

Ali Infoz 03101190027

MATHEMATICS 8

CONTENTS

Unit No	Particulars	Page No
1	APPROXIMATION AND ESTIMATION	104 - 105
2	REAL NUMBERS	106 - 118
3	FINANCIAL ARITHMETIC	119 - 132
4	SQUARE ROOTS AND CUBE ROOTS	133 - 148
5	SETS	149 - 163
6	SEQUENCES AND ALGEBRA	164 - 189
7	EXPONENTS AND LAWS OF EXPONENTS	190 - 202
8	SIMULTANEOUS LINEAR EQUATIONS	203 - 233
9	SURFACE AREA AND VOLUME	234 - 254
10	GEOMETRY	256 - 282
11	DATA MANAGEMENT AND PROBABILITY	282 - 297

Unit No. 1

APPROXIMATION AND ESTIMATION

Exercise 1.1 (T.B Page 04)

Q1. Round the following whole numbers to 3 significant figures:

(a) 67245

Sol: $67245 \approx 67200$ Ans

(b) 99244

Sol: $99244 \approx 99200$ Ans

(c) 6378

Sol: $6378 \approx 6380$ Ans

(d) 8230

Sol: $8230 \approx 8230$ Ans

(e) 53772

Sol: $53772 \approx 53800$ Ans

(f) 238793

Sol: $238793 \approx 239000$ Ans

Q2. Round the following whole numbers to 4 significant figures.

(a) 83567

Sol: $83567 \approx 83570$ Ans

(b) 178923

Sol: $178923 \approx 178900$ Ans

(c) 873572

Sol: $873572 \approx 873600$ Ans

(d) 93652

Sol: $93652 \approx 93650$ Ans

(e) 83476

Sol: $83476 \approx 83480$ Ans

(f) 45705

Sol: $45705 \approx 45710$ Ans

Q3. Round the following whole numbers to 5 significant figures.

(a) 8723451

Sol: $8723451 \approx 8723500$ Ans

(b) 5362852

Sol: $5362852 \approx 5362900$ Ans

(c) 9024691

Sol: $9024691 \approx 9024700$ Ans

(d) 8348347

Sol: $8348347 \approx 8348300$ Ans

(e) 4528409

Sol: $4528409 \approx 4528400$ Ans

(f) 5245891

Sol: $5245891 \approx 5245900$ Ans

Q4. Round the following decimal numbers to 3 significant figures.

(a) 87.256

Sol: $87.256 \approx 87.3$ Ans. Book answer is wrong

(b) 58.2672

Sol: $58.2672 \approx 58.3$ Ans.

(c) 9.24578

Sol: $9.24578 \approx 9.25$ Ans.

(d) 2.6572

Sol: $2.6572 \approx 2.66$ Ans.

(e) 4.8235

Sol: $4.8235 \approx 4.82$ Ans.

Q5. Round the following decimal numbers to 4 significant figures.

(a) 72.5623

Sol: $72.5623 \approx 72.56$ Ans.

(b) 89.0367

Sol: $89.0367 \approx 89.04$ Ans.

(c) 56.8926

Sol: $56.8926 \approx 56.89$ Ans.

(d) 6.09871

Sol: $6.09871 \approx 6.099$ Ans.

(e) 23.23232

Sol: $23.23232 \approx 23.23$ Ans.

Q6. Round the following decimal numbers to 5 significant figures.

(a) 4.10987

Sol: $4.10987 \approx 4.1099$ Ans.

(b) 65.23689

Sol: $65.23689 \approx 65.237$ Ans

(c) 872.12345

Sol: $872.12345 \approx 872.12$ Ans

(d) 0.234871

Sol: $0.234871 \approx 0.23487$ Ans

(e) 65.72045

Sol: $65.72045 \approx 65.720$ Ans

Q7. There are 87234 English language books and 63245 Art books in a library. Round off these quantities to 4 significant figures and then add to find the approximate number of total books.

Sol: English Language books: -
 $87234 \approx 87,230$ Ans

Arts books:-

$63245 \approx 63,250$ Ans

Total Books = $87,230 + 63,250$

Total Books = 150,480 Ans

Q8. Zaeem want to buy a flat costing Rs. 2,237,750. Round this amount off to 5 significant figures.

Sol: Rs. $2,237,750 \approx$ Rs. 2,237,800 Ans

Q9. The mass of a bag of cement is 23.765 gram. Round this mass off to 4 significant figures.

Sol: Rs. 23.765g $\approx$ 23.77g Ans

Q10. The volume of water in a water tank is 6723.855 litres. Round this volume off to 5 significant figures.

Sol: 6723.855l = 6723.9l Ans.

Q11. The grocery bill has an exact amount of Rs. 723.657. Round this off to 5 significant figures.

Sol: 723.657 = Rs. 723.66 Ans.

REVIEW EXERCISE

(T.B Page 06)

Q1. Encircle the correct option.

(a) How many significant figures are there in the number 3746000?

(i) 4 (ii) 5

(iii) 6 (iv) $\checkmark$ 7

(b) Which of these have 3 significant figures?

(i) 23.78 (ii) 67.07

(iii) 0.350 (iv) $\checkmark$ 680

(c) How many significant figures are there in the number 0.00589?

(i) $\checkmark$ 3 (ii) 4

(iii) 5 (iv) 6

(d) Which of these has 5 significant figures?

(i) 0.0560 (ii) $\checkmark$ 8.0560

(iii) 81.0500 (iv) 9.060

(e) How many significant figures are in 209110?

(i) 4 (ii) 5

(iii) $\checkmark$ 6 (iv) 7

Q2. Round the following to the given numbers of significant figures.

Numbers	Rounded off to 2 significant figures	Rounded off to 3 significant figures	Rounded off to 4 significant figures	Rounded off to 5 significant figures
a) 6729000	6700000	6730000	6729000	6729000
b) 7609168	7600000	7610000	7609000	7609200
c) 23.8712	24	23.9	23.87	23.871
d) 0.672451	0.67	0.672	0.6725	0.6724
e) 45.76217	46	45.8	45.76	45.762

Q3. A library has 127462 monthly visitors. Round this value to:

(a) 2 significant figures

Sol 127462 $\approx$ 130000 Ans

(b) 3 significant figures

Sol 127462 $\approx$ 127000 Ans

(c) 4 significant figures.

Sol 127462 $\approx$ 127500 Ans

(d) 5 significant figures

Sol 127462 $\approx$ 127460 Ans

Q4. The population of Town A is 872345 and that of Town B is 624509. Round off these to 4 significant figures and then add to find the approximate population.

Sol: Town A:

872345 $\approx$ 872300 Ans

Town B: -

624509 $\approx$ 624500 Ans

Total population = 872,300 + 624,500 = 1,496,800 Ans

Q5. The distance between two landmarks is 452.9872km. Round off this to:

(a) 3 Significant figures

Sol: 452.9872km $\approx$ 453 km Ans

(b) 4 Significant figures

Sol: 452.9872km $\approx$ 453.0km Ans

(c) 5 Significant figures

Sol: 452.9872km $\approx$ 452.99 km Ans

Unit No. 2

REAL NUMBERS

Exercise 2.1 (T.B Page 15)

Q1. Identify terminating and non-terminating decimal numbers.

(a) $0.4\overline{5}$

Sol: Non-terminating decimal number

(b) $2.\overline{6}$

Sol: Non-terminating decimal number

(c) 0.12

Sol: Terminating decimal number

(d) $3.\overline{67}$

Sol: Non Terminating decimal number

(e) $8.\overline{3}$

Sol: Non terminating decimal number

(f) 0.26

Sol: Terminating decimal number

(g) 1.2747

Sol: Terminating decimal number

(h) $2.\overline{63}$

Sol: Non terminating decimal number

(i) $0.\overline{123}$

Sol: Non terminating decimal number

(j) 3.12

Sol: Terminating decimal number

(k) 9.62

Sol: Terminating decimal number

(l) $8.\overline{71}$

Sol: Non terminating decimal number

Q2. Identify recurring and non-recurring decimal numbers.

(a) $0.561345\dots$

Sol: Non-recurring decimal number

(b) $0.4324567\dots$

Sol: Non-recurring decimal number

(c) $0.123123\dots$

Sol: Recurring decimal number

(d) $0.1289765\dots$

Sol: Non-recurring decimal number

(e) $0.9999999\dots$

Sol: Recurring decimal number

(f) $4.231\dots$

Sol: Non-recurring decimal number

(g) $0.781\dots$

Sol: Non-recurring decimal number

(h) $8.1454545\dots$

Sol: Recurring decimal number

Q3. Convert the following to decimals and identify which type of decimal it is.

(a) $\frac{2}{3}$

Sol: Working

$$\begin{array}{r} 0.6666\dots \\ 3 \overline{) 2.0000} \\ \underline{1 } \\ 2 \\ \underline{1 } \\ 1 \\ \underline{0 } \\ 0 \\ \underline{0 } \\ 0 \\ \underline{0 } \\ 0 \end{array}$$

As $\frac{2}{3} = 0.6666\dots$

(recurring decimal number)

(b) $\frac{15}{4}$

Sol: Working

$$\begin{array}{r} 3.75 \\ 4 \overline{) 15.00} \\ \underline{12 } \\ 3 \\ \underline{2 } \\ 1 \\ \underline{0 } \\ 0 \end{array}$$

As, $\frac{15}{4} = 3.75$ (a terminating decimal number)

(c) $\frac{1}{7}$

Sol: Working

$$\begin{array}{r} 0.1428\dots \\ 7 \overline{) 1.0000} \\ \underline{7 } \\ 3 \\ \underline{2 } \\ 1 \\ \underline{0 } \\ 0 \\ \underline{0 } \\ 0 \end{array}$$

As, $\frac{1}{7} = 0.1428\dots$

(Non-Terminating decimal number)

(d) $\frac{11}{8}$

Sol: Working

$$\begin{array}{r}
 1.375 \\
 8 \overline{) 13.750} \\
 \underline{8} \\
 5 \\
 \underline{4} \\
 1 \\
 \underline{0} \\
 0
 \end{array}$$

As, $\frac{11}{8} = 1.375$

(Terminating decimal number)

(e) $\frac{20}{21}$

Sol: working

Sol: Working

$$\begin{array}{r}
 0.95238 \dots \\
 21 \overline{) 20.95238} \\
 \underline{18} \\
 2 \\
 \underline{18} \\
 2 \\
 \underline{21} \\
 0
 \end{array}$$

As, $\frac{20}{21} = 0.95238 \dots$

(Non-terminating decimal number)

(f) $\frac{13}{8}$

Sol: working

$$\begin{array}{r}
 1.625 \\
 8 \overline{) 13.000} \\
 \underline{8} \\
 5 \\
 \underline{4} \\
 1 \\
 \underline{0} \\
 0
 \end{array}$$

As, $\frac{13}{8} = 1.625$

(Terminating decimal number)

(g) $\frac{4}{7}$

Sol: Working

$$\begin{array}{r}
 0.571428 \dots \\
 7 \overline{) 4.000000} \\
 \underline{3} \\
 1 \\
 \underline{0} \\
 0 \\
 \underline{0} \\
 0
 \end{array}$$

As, $\frac{4}{7} = 0.571428 \dots$

(Non-terminating decimal number)

(h) $\frac{23}{15}$

Sol: Working

$$\begin{array}{r}
 1.53333 \dots \\
 15 \overline{) 23.00000} \\
 \underline{15} \\
 8 \\
 \underline{7} \\
 1 \\
 \underline{0} \\
 0
 \end{array}$$

As, $\frac{23}{15} = 1.53333 \dots$

(Recurring decimal number)

Q4. Write the following in short form.

(a) $0.\overline{353535}$

Sol: $= 0.\overline{35}$ Ans

(b) $0.\overline{1272727}$

Sol: $= 0.\overline{127}$ Ans

(c) $7.\overline{44444}$

Sol: $= 7.\overline{4}$ Ans

(d) $8.\overline{123123123}$

Sol: $= 8.\overline{123}$ Ans

(e) $0.\overline{666666}$

Sol: $= 0.\overline{6}$ Ans

(f) $3.\overline{46464646}$

Sol: $= 3.\overline{46}$ Ans

(g) $12.\overline{333333}$

Sol: $= 12.\overline{3}$ Ans

(h) $9.\overline{333333}$

Sol: $= 9.\overline{3}$ Ans

Q5. Identify the rational numbers which are not in standard form and given reason. Then convert them into standard form.

(a) $\frac{-12}{16}$

Sol: Which is not in standard form, because it is not in simplest form.

$$= \frac{-\cancel{2} \times \cancel{2} \times 3}{\cancel{2} \times \cancel{2} \times 2 \times 2}$$

$$= \frac{-3}{4} \text{ (Standard form)}$$

(b) $\frac{41}{-61}$

Sol: Which is not in standard form, because denominator is not positive.

$$= \frac{41 \div (-1)}{-61 \div (-1)}$$

$$= \frac{-41}{61} \text{ (Standard form)}$$

(c) $\frac{-21}{2}$

Sol: Which is in standard form, because it is in simplest form.

(d) $\frac{3}{4}$

Sol: Which is in standard form, because it is in simplest form.

(e) $\frac{5}{15}$

Sol: Which is not in standard form, because it is not in simplest form.

$$= \frac{1 \times \cancel{5}}{3 \times \cancel{5}}$$

$$= \frac{1}{3} \text{ (Standard form)}$$

(f) $\frac{17}{4}$

Sol: Which is in simplest form, so it is in standard form. Ans

(g) $\frac{44}{-88}$

Sol: Which is not in simplest form, so it is not in standard form.

$$= \frac{\cancel{2} \times \cancel{2} \times \cancel{11}}{-2 \times \cancel{2} \times \cancel{2} \times \cancel{11}}$$

$$= \frac{1}{-2}$$

Here denominator must be positive, so dividing numerator and denominator by "-1"

$$= \frac{1 \div (-1)}{-2 \div (-1)}$$

$$= \frac{-1}{2} \text{ (Standard form)}$$

(h) $\frac{-75}{135}$

Sol: Which is not in simplest form, so it is not in standard form

$$= \frac{-\cancel{5} \times 5 \times 3}{\cancel{5} \times 3 \times 3 \times \cancel{3}}$$

$$= \frac{-5}{9} \text{ (Standard form)}$$

Q6. Find if the following are terminating decimals or not without dividing. Then verify your answer by division.

(a) $\frac{7}{9}$

$$\text{Sol} = \frac{7}{3 \times 3}$$

As in the denominator we do not have only 2 or 5, therefore it is non terminating decimal number.

Verification: -

$$\begin{array}{r}
 0.7777... \\
 9 \overline{) 7.0000} \\
 \underline{6 } \\
 1 \\
 \underline{0 } \\
 0 \\
 \underline{0 } \\
 0 \\
 \underline{0 } \\
 0
 \end{array}$$

$$\frac{7}{9} = 0.7777... \text{ (Non-terminating)}$$

$$(b) \frac{8}{13}$$

Sol: As in the denominator we do not have only 2 or 5, therefore it is non-terminating decimal number.

Verification:

$$\begin{array}{r}
 0.615... \\
 13 \overline{) 8.000} \\
 \underline{7 } \\
 1 \\
 \underline{1 } \\
 0 \\
 \underline{0 } \\
 0
 \end{array}$$

$$\frac{8}{13} = 0.615... \text{ (Non-terminating)}$$

$$(c) \frac{7}{-6}$$

$$\text{Sol: } = \frac{-7}{2 \times 3}$$

As in the denominator we do not have only 2 or 5, therefore it is non-terminating decimal number.

Verification:

$$\begin{array}{r}
 1.1666... \\
 6 \overline{) 7.0000} \\
 \underline{6 } \\
 1 \\
 \underline{0 } \\
 0 \\
 \underline{0 } \\
 0 \\
 \underline{0 } \\
 0
 \end{array}$$

$$\frac{7}{-6} = -1.1666... \text{ (Non-terminating)}$$

$$(d) \frac{10}{11}$$

Sol: As in the denominators we do not have only 2 or 5, therefore it is non terminating decimal number.

Verification: -

$$\begin{array}{r}
 0.9090... \\
 11 \overline{) 10.0000} \\
 \underline{9 } \\
 1 \\
 \underline{0 } \\
 0 \\
 \underline{0 } \\
 0 \\
 \underline{0 } \\
 0
 \end{array}$$

$$\frac{10}{11} = 0.9090... \text{ (Non-terminating)}$$

$$(e) \frac{-3}{12}$$

$$\begin{aligned}
 \text{Sol: } &= \frac{-3}{2 \times 2 \times 3} \\
 &= \frac{-1}{2 \times 2}
 \end{aligned}$$

As in the denominator we have only 2, therefore it is a terminating decimal number.

Verification: -

$$\begin{array}{r}
 0.25 \\
 12 \overline{) 3.00} \\
 \underline{2 } \\
 1 \\
 \underline{0 } \\
 0
 \end{array}$$

$$\frac{-3}{12} = -0.25 \text{ (Terminating)}$$

$$(f) \frac{7}{5}$$

Sol: As in the denominator we have only 5, therefore it is terminating decimal number.

Verification:-

$$\begin{array}{r}
 1.4 \\
 5 \overline{) 7.0} \\
 \underline{5 } \\
 2 \\
 \underline{2 } \\
 0
 \end{array}$$

$$4\frac{2}{3} \div 3$$

$$= \frac{14}{3} \div \frac{3}{1}$$

$$= \frac{14}{3} \times \frac{1}{3}$$

$$= \frac{14}{9}$$

$$= 1\frac{5}{9} \text{ km Ans}$$

WC

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

$$\begin{array}{r} 1 \\ 9 \overline{) 14} \\ \underline{9} \\ 5 \end{array}$$

$$4 \text{ km} \times 5 = 20 \text{ km}$$

Since our estimated value is closed to the actual value, so our answer is reasonable. Ans

Q6. Haadia bought 2.5 kg of honey. She used it equally to make 2 different desserts. How much honey did she use in each dessert?

Sol:

$$\text{Cost of honey} = 2.5 \text{ kg}$$

In order to find the honey which is used by Haadia equally into "2" different dessert we will use the process of division.

$$2.5 \text{ kg} \div 2 = 1.25 \text{ kg}$$

She used 1.25 kg in each dessert. Ans.

Q4. Adeela and her family travel to another town at a distance of 60.27 km. On their way back, they choose another route which is 12.3 km shorter than the previous one.

(a) How much distance did they cover on their way back?

Solution of part (a):-

$$\text{Covered distance} = 60.27 \text{ km}$$

In order to find the distance they cover on their way back, then we will use the process of subtraction.

$$60.27 - 12.3 = 47.97 \text{ km}$$

(b) Find the total distance covered by them.

Solution of part (b): -

1st route: -

$$\text{Covered distance} = 60.27 \text{ km}$$

2nd route: -

$$\text{Covered distance} = 47.97 \text{ km}$$

In order to find the total distance we will use the process of addition.

$$60.27 + 47.97 = 108.24 \text{ km}$$

So, the total distance covered by them was 108.24 km. Ans

Q5. The distance of Saafi's home to the Masjid is 2.2 km. if Saafi offers all his 5 prayers regularly, how much distance does he cover every day from the Masjid to home and home to the Masjid? Estimate the answer to check its reasonableness.

Solution: -

$$\text{Distance from home to Masjid} = 2.2 \text{ km}$$

$$\text{Distance from Masjid to home} = 2.2 \text{ km}$$

$$\text{Total distance} = 2.2 + 2.2 = 4.4 \text{ km}$$

Since Saafi offers all his 5 prayers regularly,

So we will use the process of multiplication.

$$4.4 \text{ km} \times 5 = 22 \text{ km Ans}$$

Verification:-

$$4.4 \text{ km} \approx 4 \text{ km}$$

Exercise 2.3

(T.B Page 19)

Q1. Which of the following are rational and which are irrational number? Justify your answer.

(a) 5

Sol: 5 is a rational number

Justification:-

$$5 = \frac{5}{1} = \frac{p}{q};$$

Where $P = 5 \in \mathbb{Z}$ and $q = 1 \in \mathbb{Z}$ and $q \neq 0$.

(b) $\frac{1}{2}$

Sol: $\frac{1}{2}$ is a rational number

Justification:-

$$\frac{1}{2} = \frac{p}{q}; p = 1 \in \mathbb{Z} \text{ and } q = 2 \in \mathbb{Z} \text{ and } q \neq 0.$$

(c) $-\frac{2}{7}$

Sol: $-\frac{2}{7}$ is a rational number.

Justification:-

$$-\frac{1}{2} = \frac{p}{q}; p = -1 \in \mathbb{Z} \text{ and } q = 2 \in \mathbb{Z} \text{ and } q \neq 0.$$

(d) $\frac{10}{0}$

Sol: $\frac{10}{0}$ is neither a rational and nor irrational number.

Justification: - Since $q = 0$

(e) $\frac{8}{-9}$

Sol: $\frac{8}{-9}$ is a rational number.

Justification:-

$$\frac{8}{-9} = \frac{p}{q}; p = 8 \in \mathbb{Z} \text{ and } q = -9 \in \mathbb{Z} \text{ and } q \neq 0.$$

(f) $\sqrt{2}$

Sol: $\sqrt{2}$ is an irrational number.

Justification:-

Since "2" is not a perfect square.

(g) $2.\overline{25}$

Sol: $2.\overline{25}$ is a rational number.

Justification:-

 $2.\overline{25} = 2.252525\ldots$ which is rational number.

(h) 1.75

Sol: 1.75 is a recurring decimal number.

Justification:-

As 1.75 is a decimal number.

(i) $\sqrt{11}$

Sol: $\sqrt{11}$ is an irrational number.

Justification:-

Since 11 is not a perfect square.

(j) $\sqrt{5}$

Sol: $\sqrt{5}$ is an irrational number.

Justification:-

Since "5" is not a perfect square.

(k) -23

Sol: -23 is a rational number.

Justification:-

Since -23 can be expressed as $\frac{p}{q}$; like $\frac{-23}{1}$;

(l) $\frac{5}{2}$

Sol: $\frac{5}{2}$ is a rational number.

Justification:-

$$\frac{5}{2} = \frac{p}{q}; p = 5 \in \mathbb{Z}, q = 2 \in \mathbb{Z}; q \neq 0$$

(m) $\sqrt[3]{2}$

Sol: $\sqrt[3]{2}$ is an irrational number.

Justification:-

Since "2" is not a perfect cube.

(n) $\frac{1}{4}$

Sol: $\frac{1}{4}$ is a rational number.

Justification:-

$$\frac{1}{4} = \frac{p}{q}; p = 1 \in \mathbb{Z}, q = 4 \in \mathbb{Z}, q \neq 0.$$

(o) $6.\overline{33}$

Sol: $6.\overline{33}$ is a rational number.

Justification:-

$$6.\overline{33} = 6.3333\ldots$$

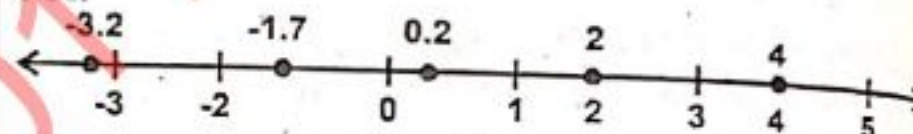
Which is recurring decimal number.

Exercise 2.4 (T.B Page 23)

Q1. Represent the following real numbers on a number line.

(a) -1.7, 0.2, 2, -3.2, 4.

Sol:



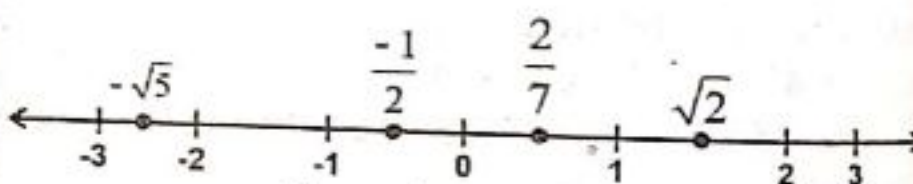
(b) $\sqrt{2}, -\sqrt{5}, \frac{2}{7}, -\frac{1}{2}$

Sol: $\sqrt{2} = 1.4142 \approx 1.41$

$$\sqrt{5} = -2.236 \approx -2.24$$

$$\frac{2}{7} = 0.28$$

$$-\frac{1}{2} = -0.5$$

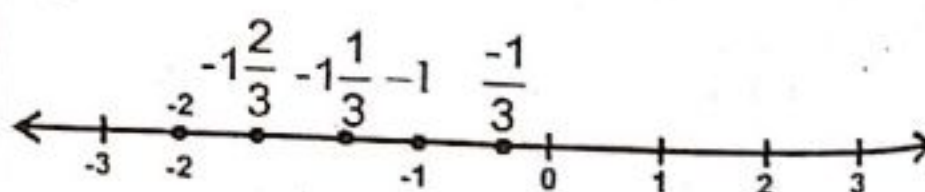


(c) $-2, -1\frac{2}{3}, -1\frac{1}{3}, -1, -\frac{1}{3}$

Sol: $-1\frac{2}{3} = -1.66$

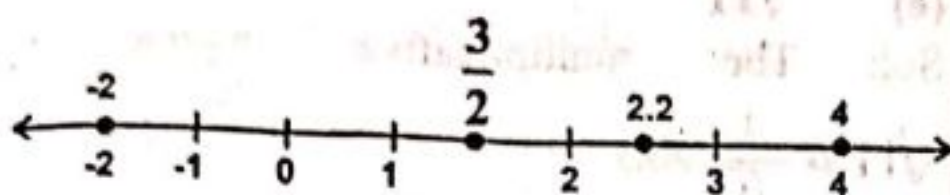
$$-1\frac{1}{3} = -1.33$$

$$-\frac{1}{3} = -0.33$$



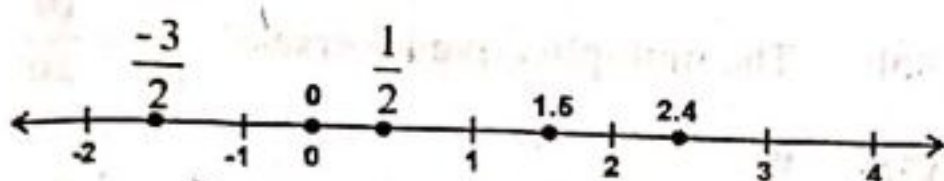
(d) $\frac{3}{2}, 2^2, 2.2, -2$

Sol: $\frac{3}{2} = 1.5$
 $2^2 = 4$



(e) $2.4, 0, 1.5, \frac{1}{2}, -\frac{3}{2}$

Sol: $\frac{1}{2} = 0.5$
 $-\frac{3}{2} = -1.5$

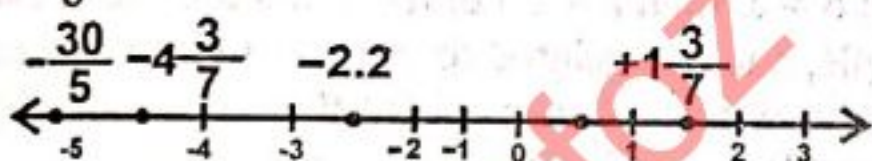


(f) $1\frac{3}{7}, 2.5, 3.5, -2.2, -4\frac{3}{7}, \frac{3}{7}, -\frac{30}{6}$

Sol: $1\frac{3}{7} = 1.42$

$-4\frac{3}{7} = -4.42$

$-\frac{30}{6} = -5$



Q2. Find the Absolute value of the following real numbers.

(a) $\sqrt{11}$ and $-\sqrt{11}$

Sol: $|\sqrt{11}| = \sqrt{11}$
 $|- \sqrt{11}| = \sqrt{11}$ Ans

(b) 3.18 and -3.18

Sol: $|3.18| = 3.18$
 $|-3.18| = 3.18$ Ans

(c) $-\frac{3}{4}$ and $\frac{3}{4}$

Sol: $|\frac{-3}{4}| = \frac{3}{4}$
 $|\frac{3}{4}| = \frac{3}{4}$ Ans

(d) -18.9 and 18.9

Sol: $|-18.9| = 18.9$
 $|18.9| = 18.9$ Ans

(e) $\sqrt{7}$ and $-\sqrt{7}$

Sol: $|\sqrt{7}| = \sqrt{7}$
 $|- \sqrt{7}| = \sqrt{7}$ Ans

(f) 1.44 and -1.44

Sol: $|1.44| = 1.44$
 $|-1.44| = 1.44$ Ans

Exercise 2.5

(TB Page 28)

Q1. Identify the properties used in the following.

(a) $17 + \sqrt{7} = \sqrt{7} + 17$

Sol: Commutative property w.r.t. addition.

(2) $12 \times 3.5 = 3.5 \times 12$

Sol: Commutative property w.r.t. multiplication.

(c) $7 \times \frac{1}{7} = 1$

Sol: Multiplicative inverse

(d) $\frac{1}{3} + 0 = \frac{1}{3}$

Sol: Additive identity.

(e) $\frac{8}{11} \times \frac{11}{8} = 1$

Sol: Multiplicative inverse
 Statement of part (e) is wrong.

(f) $-y + 4 = 4 + (-y)$

Sol: commutative property w.r.t. addition

(g) $8.9 \times 1 = 8.9$

Sol: Multiplicative Identity.

(h) $\sqrt{13} \times \frac{1}{\sqrt{13}} = 1$

Sol: Multiplicative Inverse.
 Statement of part (h) is wrong.

(i) $\frac{-1}{4} \times -4 = 1$

Sol: Multiplicative Inverse.

(j) $(8+4) + 5 = 8 + (4+5)$

Sol: Associative property w.r.t. addition

(k) $(\sqrt{2} \times 2) \times 5 = \sqrt{2} \times (2 \times 5)$

Sol: Associative property w.r.t multiplication.

Q2. Find the additive inverse of each number.

(a) 9

Sol: The additive inverse of 9 is -9. Ans

(b) -3.4

Sol: The additive inverse of -3.4 is 3.4 Ans

(c) $\frac{3}{9}$ Sol: The additive inverse of $\frac{3}{9}$ is $-\frac{3}{9}$ Ans(d) $\frac{1}{\sqrt{5}}$ Sol: The additive inverse of $\frac{1}{\sqrt{5}}$ is $-\frac{1}{\sqrt{5}}$ Ans(e) $\frac{\sqrt{2}}{\sqrt{5}}$ Sol: The additive inverse of $\frac{\sqrt{2}}{\sqrt{5}}$ is $-\frac{\sqrt{2}}{\sqrt{5}}$

(f) -6

Sol: The additive inverse of -6 is 6 Ans

(g) $-\frac{4}{9}$ Sol: The additive inverse of $-\frac{4}{9}$ is $\frac{4}{9}$ Ans

(h) 0

Sol: The additive inverse of 0 is 0. Ans

(i) 1

Sol: The additive inverse of 1 is -1. Ans

Q3. Find the multiplicative inverse of each number.

(a) -10

Sol: The multiplicative inverse of -10 is $-\frac{1}{10}$ Ans(b) $\frac{1}{2}$ Sol: The multiplicative inverse of $\frac{1}{2}$ is 2.

(c) 8.1

Sol: the multiplicative inverse of 8.1 is $\frac{1}{8.1}$ (d) $\frac{\sqrt{5}}{4}$ Sol: The multiplicative inverse of $\frac{\sqrt{5}}{4}$ is $\frac{4}{\sqrt{5}}$ Ans(e) $\sqrt{11}$ Sol: The multiplicative inverse of $\sqrt{11}$ is $\frac{1}{\sqrt{11}}$ Ans

(f) 14

Sol: The multiplicative inverse of 14 is $\frac{1}{14}$ (g) $-\frac{9}{10}$ Sol: The multiplicative inverse of $-\frac{9}{10}$ is $-\frac{10}{9}$

(h) 0

Sol: The multiplicative inverse of "0" does not exist.

(i) 1

Sol: The multiplicative inverse of 1 is 1.

Q4. State and prove the following properties for any real numbers of your own choice:

(a) The transitive property.

This property states that $\forall a, b, c \in \mathbb{R}$, if $a = b$ and $b = c$, then $a = c$ i.e. if a is related to b under a rule, and b is related to c under the same rule, then a is related to c under the same rule, for example. $3x + 5 = y$ and $y = x - 1$, then $3x + 5 = x - 1$.

(b) The reflexive property

This property states that $\forall a \in \mathbb{R}$: $a = a$ i.e. a number or value is equal to itself. This property states that for all real numbers.

For example,

$$\sqrt{2} = \sqrt{2}$$

$$-1.3 = -1.3$$

$$1.3 + \sqrt{7} = 1.3 + \sqrt{7} \text{ and so on.}$$

(c) The symmetric property

This property states that $\forall a \in \mathbb{R}$: if $a = b$ then $b = a$ i.e. interchange the sides of an equation doesn't affect the result.

For example:

$$\text{If } a + b = c, \text{ then } c = a + b$$

$$\text{If } 2 + a = b, \text{ then } b = 2 + a$$

$$8 - x = c \text{ then } c = 8 - x \text{ and so on.}$$

(d) Addition property

This property states that $\forall a, b, c \in \mathbb{R}$, if $a=b$, then $a+c=b+c$. i.e., adding the same number on both sides of equation, doesn't change the equation.

If $x=5$, then $x+1=5+1$.

(e) Subtraction property.

This property states that $\forall a, b, c \in \mathbb{R}$, if $a=b$, then $a-c=b-c$, i.e., subtracting the same number from both sides of equation, doesn't change the equation. For example:

If $x=6$, then $x-2=6-2$.

(f) Multiplication property

This property states that $\forall a, b, c \in \mathbb{R}$, if $a=b$, then $a \times c = b \times c$, i.e., multiplying the same number on both sides of equation, doesn't change the equation. For example:

If $x=8$, then $x \times 3 = 8 \times 3$.

(g) Division Property

This property states that $\forall a, b, c \in \mathbb{R}$ and $c \neq 0$,

if $a=b$, then $\frac{a}{c} = \frac{b}{c}$, i.e., dividing by the

same number on both sides of equation, doesn't change the equation.

For Example:

$$\text{If } x=10, \text{ then } \frac{x}{3} = \frac{10}{3}$$

REVIEW EXERCISE (TB Page 30)**Q1. Encircle the correct option.**

(a) Terminating decimal number are those decimal numbers that have a number of digits after the decimal point.

(i) Infinite (ii) ☒ finite

(iii) even (iv) ☐ Odd

(b) Decimal numbers that have an infinite number of digits after the decimal point.

(i) ☒ non-terminating (ii) terminating

(iii) like (iv) ☐ unlike

(c) A decimal number that has a single digit or a block of digits repeat itself an infinite number of times after the decimal point is called a/an decimal number.

(i) terminating (ii) ☐ unlike

(iii) ☒ recurring (iv) non-recurring

(d) Which of these is an irrational number?

(i) 2.5 (ii) $\frac{1}{2}$

(iii) 0.23232323... (iv) ☒ 1.01001110110111...

(e) Q+Q' makes

(i) The set of natural numbers

(ii) ☒ The set of real numbers

(iii) The set of rational numbers

(iv) The set of integers

(f) The absolute value of -3 is:

(i) -1 (b) -3 (iii) ☒ 3 (iv) -6

(g) Reflexive property of real numbers states that $\forall a \in \mathbb{R}$:

(i) $a+b=b+a$ (ii) $a=-a$

(iii) ☒ $a=a$ (iv) $a+3=a$

(h) Symmetric property is shown by:

(i) If $a+2=10$, then $-10=a-2$

(ii) ☒ If $a+2=10$, then $10=a+2$

(iii) If $a+2=10$, then $10=2-a$

(iv) If $a+2=10$, then $-10=-a+2$

Q2. Define the following with examples.

a) Terminating Decimals

b) Non-Terminating Decimals

c) Recurring Decimals

d) Non-Recurring Decimals

e) Standard form of rational numbers

f) Rational Numbers

g) Irrational numbers

h) Real Numbers

i) Absolute value of a Real Numbers

Ans: See text in the book. (Do yourself)

Q3. Identify terminating and non-terminating decimals numbers.

(a) 1.23

Sol: Terminating decimal number

(b) 6.7777---

Sol: Non-terminating decimal number

(c) 0.87676 - - -

Sol: Non-terminating decimal

(d) 2.3456

Sol: Terminating decimal number

(e) 7.7

Sol: Terminating decimal number

(f) 7.89765 - - -

Sol: Non-terminating decimal number

(g) 0.25

Sol: Terminating decimal number

(h) 16.51 - - -

Sol: Non-terminating decimal number

Q4. Identify recurring and non recurring decimal numbers.

(a) $0.1111 \dots = 0.\bar{1}$

Sol: Recurring decimal number

(b) $0.5555 \dots = 0.\bar{5}$

Sol: Recurring decimal number

(c) $0.454545 \dots = 0.\overline{45}$
Sol: Recurring decimal number

(d) $3.141645 \dots$
Sol: Non-recurring decimal

(e) $9.9999 \dots = 9.\overline{9}$
Sol: Recurring decimal number

(f) $3.434343 \dots = 3.\overline{43}$
Sol: Recurring decimal number

(g) $0.4535353 \dots = 0.4\overline{53}$
Sol: Recurring decimal number

(h) $7.6751053 \dots$
Sol: Non-recurring decimal number.

Q5. Which of the following are rational and which are irrational numbers? Justify your answer.

(a) $-3\frac{1}{2}$

Sol: $-3\frac{1}{2}$ is a rational number.

Justification:

$$-3\frac{1}{2} = \frac{-7}{2} = \frac{p}{q}$$

$$p = -7 \in \mathbb{Z}, q = 2 \in \mathbb{Z} \text{ and } q \neq 0$$

(b) $\sqrt{12}$

Sol: $\sqrt{12}$ is an irrational number.

Justification:

Since "12" is not a perfect square.

(c) 5.7

Sol: 5.7 is a rational number.

Justification

As, 5.7 is terminating decimal number.

(d) 0

Sol: "0" is a rational number

Justification:

$$0 = \frac{0}{1} = \frac{p}{q} \text{ where}$$

$$p = 0 \in \mathbb{Z}, q = 1 \in \mathbb{Z}, q \neq 0$$

(e) -8π

Sol: -8π is an irrational number.

Justification:

" π " is an irrational number.

(f) 9

Sol: 9 is a rational number.

Justification:

$$9 = \frac{9}{1} = \frac{p}{q};$$

$$p = 9 \in \mathbb{Z}, q = 1 \in \mathbb{Z}, q \neq 0$$

(g) $\sqrt{25}$

Sol: $\sqrt{25}$ is a rational number.

Justification:

Since 25 is a perfect square.

(h) $\frac{\pi}{2}$

Sol: $\frac{\pi}{2}$ is an irrational number

Justification

π is an irrational number.

(i) $\frac{12}{5}$

Sol: $\frac{12}{5}$ is a rational number

Justification

$$\frac{12}{5} = \frac{p}{q}; p = 12 \in \mathbb{Z},$$

$$q = 5 \in \mathbb{Z}, q \neq 0$$

(j) $\frac{4}{7}$

Sol: $\frac{4}{7}$ is a rational number.

Justification

$$\frac{4}{7} = \frac{p}{q}; p = 4 \in \mathbb{Z},$$

$$q = 7 \in \mathbb{Z}, q \neq 0$$

(k) $\sqrt{9}$

Sol: $\sqrt{9}$ is a rational number.

Justification:

Since "9" is a perfect square.

(l) $\frac{15}{38}$

Sol: $\frac{15}{38}$ is a rational number.

Justification

$$\frac{15}{38} = \frac{p}{q}; p = 15 \in \mathbb{Z},$$

$$q = 38 \in \mathbb{Z}, q \neq 0$$

(m) 5.2

Sol: 5.2 is a rational number

Justification:

5.2 is terminating decimal number.

(n) $\sqrt{17}$

Sol: $\sqrt{17}$ is an irrational number.

Justification:

Since "17" is not a perfect square.

(o) $-\sqrt{16}$

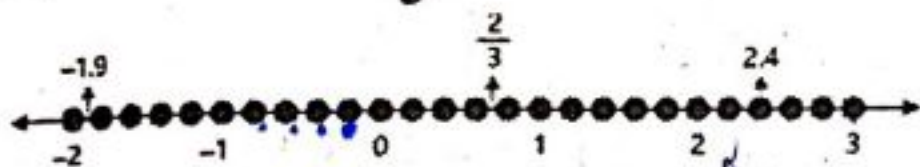
Sol: $-\sqrt{16}$ is a rational number.

Justification:

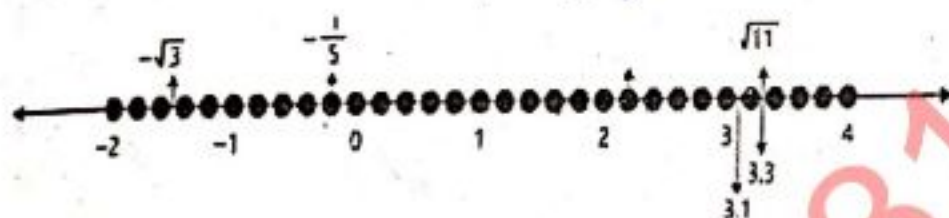
Since "16" is a perfect square.

Q6. Represent the following real numbers on a number line.

(a) 2.4, -1.9, 3, $\frac{2}{3}$



(b) $\sqrt{11}$, $-\sqrt{3}$, 3.3, $\frac{22}{7}$, $-\frac{1}{5}$



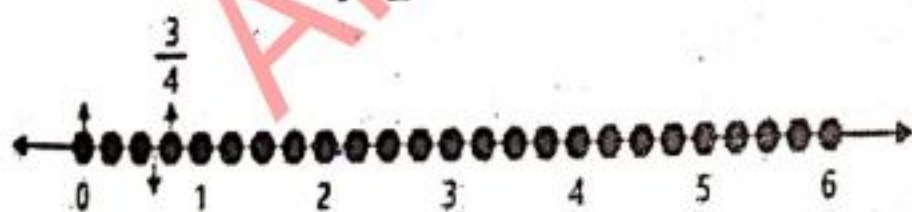
Sol: $\sqrt{11} = 3.32$

$-\sqrt{3} = -1.732$

$\frac{22}{7} = 3.14$

$-\frac{1}{5} = -0.2$

(c) 6, 0, 0.5, $\frac{3}{4}$, $\frac{1}{2}$



Sol: $\frac{3}{4} = 0.75$

$\frac{1}{2} = 0.5$

Q7. Find the absolute value of the following real numbers.

(a) $|\sqrt{17}|$ and $-\sqrt{17}$

Sol: $|\sqrt{17}| = \sqrt{17}$ Ans

$|\sqrt{17}| = \sqrt{17}$ Ans

(b) -0.06 and 0.06

Sol: $|-0.06| = 0.06$ Ans

$|0.06| = 0.06$ Ans

(c) $-\frac{4}{5}$ and $\frac{4}{5}$

Sol: $|\frac{-4}{5}| = \frac{4}{5}$ Ans

$|\frac{4}{5}| = \frac{4}{5}$ Ans

Q8. Identify and write the properties used in the following.

(a) $12 + \sqrt{2} = \sqrt{2} + 12$

Sol: Commutative property w.r.t. additions.

(b) $3 \times 5 = 5 \times 3$

Sol: commutative property w.r.t. multiplication.

(c) $-2 \times \frac{-1}{2} = 1$

Sol: Multiplicative inverse property.

(d) $2.5 \times 0 = 0$

Sol: No such property is addressed.

(e) $(1+6) + 2 = 1 + (6+2)$

Sol: Associative property w.r.t. Multiplication.

Q9. Find the additive and multiplicative inverse of each number.

(a) 10

Sol: The additive inverse of 10 is -10. Ans

The multiplicative inverse of 10 is $\frac{1}{10}$ Ans

(b) 2.5

Sol: The additive inverse of 2.5 is -2.5 Ans

The multiplicative inverse. Of 2.5 is $\frac{1}{2.5}$ Ans

(c) $\frac{1}{9}$

Sol: The additive inverse of $\frac{1}{9}$ is $-\frac{1}{9}$. Ans

The multiplicative inverse of $\frac{1}{9}$ is 9. Ans

(d) $\frac{1}{\sqrt{2}}$

Sol: The additive inverse of $\frac{1}{\sqrt{2}}$ is $-\frac{1}{\sqrt{2}}$ Ans

The multiplicative inverse of $\frac{1}{\sqrt{2}}$ is $\sqrt{2}$ is 9.

(e) $\frac{\sqrt{2}}{3}$

sol: The additive inverse of $\frac{\sqrt{2}}{3}$ is $-\frac{\sqrt{2}}{3}$.

The multiplicative inverse of $\frac{\sqrt{2}}{3}$ is $\frac{3}{\sqrt{2}}$

(f) -10

Sol: The additive inverse of -10 is +10 Ans

The multiplicative inverse of -10 is $-\frac{1}{10}$ Ans

(g) 0

Sol: The additive inverse of 0 is 0 Ans.

The multiplicative inverse of "0" does not exist. Ans

(h) 1

Sol: The additive inverse of 1 is -1. Ans

The multiplicative inverse of 1 is 1. Ans

Q10. Same as Q4 of exercise No 2.5.

(Already Done)

Unit No. 3

Financial Arithmetic

Exercise 3.1

(Tb Pg 39)

Q1. Find the value of y in the following.

(a) $\frac{y}{32} = \frac{3}{8}$

Sol $y = \frac{3}{8} \times 32$

$y = 3 \times 4 \quad y = 12 \text{ Ans}$

(b) $\frac{2}{y} = \frac{4}{6}$

Sol by cross multiplication
 $4 \times y = 2 \times 6$

$y = \frac{2 \times 6}{4} \quad y = 3 \text{ Ans}$

(c) $\frac{5}{15} = \frac{y}{30}$

Sol by cross multiplication
 $15 \times y = 5 \times 30$

$y = \frac{5 \times 30}{15} \quad y = 5 \times 2$
 $y = 10 \text{ Ans}$

(d) $\frac{5}{20} = \frac{4}{y}$

Sol by cross multiplication
 $5 \times y = 4 \times 20$

$y = \frac{4 \times 20}{5}$
 $y = 4 \times 4 \quad y = 16 \text{ Ans}$

(e) $\frac{y}{24} = \frac{8}{16}$

Sol By cross multiplication
 $16 \times y = 8 \times 24$

$y = \frac{192}{16} \quad y = 12 \text{ Ans}$

(f) $\frac{3}{21} = \frac{7}{y}$

Sol By cross Multiplication
 $3 \times y = 7 \times 21$

$y = \frac{7 \times 21}{3} \quad y = 7 \times 7$
 $y = 49 \text{ Ans}$

(g) $125 : 15 :: y : 60$

Sol Product of means = Product of extremes
 $15 \times y = 125 \times 60$

$y = \frac{125 \times 60}{15}$

$y = 125 \times 4 \quad y = 500 \text{ Ans}$

(h) $70 : 14 :: 40 : y$

Sol Product of extremes = product of means
 $70 \times y = 14 \times 40$

$y = \frac{14 \times 40}{70}$

$y = 8 \text{ Ans}$

(i) $y : 32 :: 8 : 16$

Sol Product of extremes = Product of means
 $16 \times y = 8 \times 32$

$y = \frac{8 \times 32}{16}$

$y = 8 \times 2 \quad y = 16 \text{ Ans}$

(j) $25 : y :: 100 : 200$

Sol Product of means = Product of extremes
 $100 \times y = 25 \times 200$

$y = \frac{25 \times 200}{100}$

$y = 25 \times 2$

$y = 50 \text{ Ans}$

Q2. Missing

Q3. In 21:28, If we change the first term of the ratio to 70, what will be the second term?

Sol: Second term = ?

Give ratio: 21 : 28

Divided by "21"

$= \frac{21}{21} : \frac{28}{21}$
 $= 1 : \frac{4}{3}$

Multiplying by 70

$= 70 \times 1 : 70 \times \frac{4}{3} \quad = 70 : \frac{280}{3} \text{ Ans}$

Thus, the 2nd term is $\frac{280}{3}$

Q4. What is the missing term in the proportional 8:11::16:x?

Sol $x = ?$

$8 : 11 :: 16 : x$

Product of extremes = product of means

$$8 \times x = 11 \times 16$$

$$x = \frac{11 \times 16}{8}$$

$$x = 11 \times 2 \quad x = 22 \text{ Ans}$$

Q5. 5 men complete a task in 2 days. How many days are required to complete the same task by 1 man?

Sol We know that number of men is inversely proportional to time, So

↑	days :	Men	↓
	2 :	5	
	x :	1	
	$\frac{x}{2} = \frac{5}{1}$		
	$x = 5 \times 2$		
	$x = 10$		

1 man completes a same task in 10 days. Ans

Q6. Ijaz reads 20 pages of the Holy Quran in 55 minutes. How many pages will he read in 120 minutes?

Sol As we know that time is directly proportional to the task (reading the pages)

↑	Reading pages :	Time	↑
	20 :	55	
	x :	120	

$$\frac{x}{20} = \frac{120}{55}$$

$$x = \frac{120}{55} \times 20$$

$$x = \frac{480}{11}$$

Ijaz reads $\frac{480}{11}$ pages of the Holy Quran in 120 minutes. Ans

Q7. 9 Footballs cost Rs 3500. How much will 4 footballs cost?

Sol: As we know that number of footballs is directly proportional to the cost, so

↑	football:	cost	↑
	9 :	3500	
	4 :	X	

$$\frac{x}{3500} = \frac{4}{9}$$

$$x = \frac{4}{9} \times 3500$$

$$x = \frac{14,000}{9} \quad x = 1555 \frac{5}{9}$$

4 footballs cost Rs. $1555 \frac{5}{9}$. Ans

Q8. The cost of 145kg of rice is Rs 6743. How many kg of rice can be purchased for Rs 9876?

Sol As we know that the cost is directly proportional to mass of rice.

↑	Cost :	Mass	↑
	6743 :	145	
	9876 :	x	

$$\frac{x}{145} = \frac{9876}{6743}$$

$$x = \frac{9876}{6743} \times 145$$

$$x = \frac{1432020}{6743}$$

$$x = 212.37 \text{ kg Ans}$$

Q9. If 5 boxes occupy a space of 750 cm³, how much space will be required for 180 such boxes?

Sol As we know that number of boxes is directly proportional to capacity.

↑	Number of boxes :	capacity	↑
	5 :	750	
	180 :	x	

$$\frac{x}{750} = \frac{180}{5}$$

$$x = \frac{180}{5} \times 750$$

$$x = \frac{135,000}{5}$$

$$x = 27,000 \text{ cm}^3. \text{ Ans}$$

Book answer is wrong.

Q10. If 8 workers can do a job in 16 days, how many workers will it take to do the job in 32 days?

Sol As we know that the number of worker is directly proportional to time, so

↓	Days :	number of worker	↑
	16 :	8	
	32 :	x	

$$\frac{x}{8} = \frac{16}{32}$$

By cross multiplication

$$32 \times x = 8 \times 16$$

$$x = \frac{8 \times 16}{32}$$

$$x = \frac{16}{4} \Rightarrow x = 4$$

4 workers can do a job in 32 days.

Book answer is wrong.

Q11. A man cleans 1450 cloths in 90 minutes. How many clothes will be wash in 18 more minutes?

Sol: As we know that the number of clothes is directly proportional to time, so

Clothes :	Time
1450 :	90
x :	108

$$\frac{x}{1450} = \frac{108}{90}$$

$$\text{WC} \\ 90 + 18 = 108 \text{ min}$$

By cross multiplication

$$90 \times x = 108 \times 1450$$

$$x = \frac{156,600}{90} \quad x = \frac{15,660}{9}$$

$$x = 1740$$

$$1740 - 1450 = 290$$

He will was 290 clothes in 18 more minutes.

Q12. Rabia irons 7 scarves in 12 minutes. How long will she take to iron 45 scarves?

Sol: in this case will use the directly properties, so

Scarves :	Minutes
7 :	12
45 :	X

$$\frac{x}{45} = \frac{12}{7}$$

By cross multiplication

$$7 \times x = 45 \times 12$$

$$x = \frac{540}{7} \quad x = 77 \frac{1}{7} \text{ minutes}$$

Rabia irons 45 scarves in $77 \frac{1}{7}$ minutes. Ans

Q13. 14 tube wells can a fill a water tank in 45 minutes. If 4 tube wells are out of order, how long will the remaining tube wells take to fill the tank?

Sol: Here we will use the inversely proportion, so

Tube wells :	Time(in minutes)
--------------	------------------

14 :	45
10 :	x

$$\frac{x}{45} = \frac{14}{10}$$

$$10 \times x = 14 \times 45$$

$$x = \frac{630}{10}$$

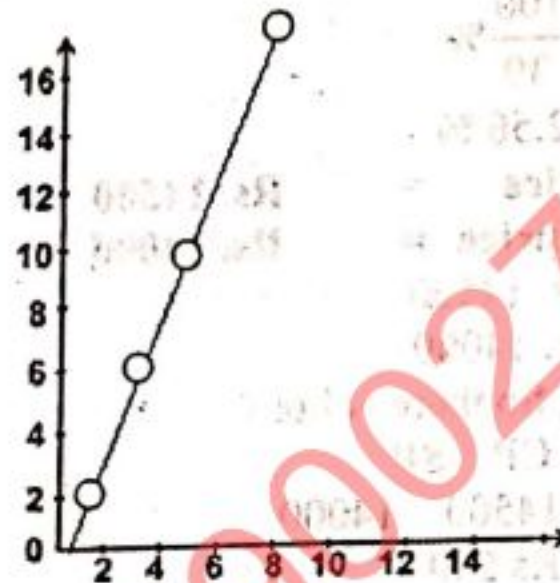
$$x = 63 \text{ minutes}$$

The remaining tube wells fill a water tank in 63 minutes.

Q14. Identify the proportion from the given table and then plot the graphs.

x	1	3	9	5
y	2	6	18	10

Sol: from the table; when we increase the value of x then also the values of y increases.

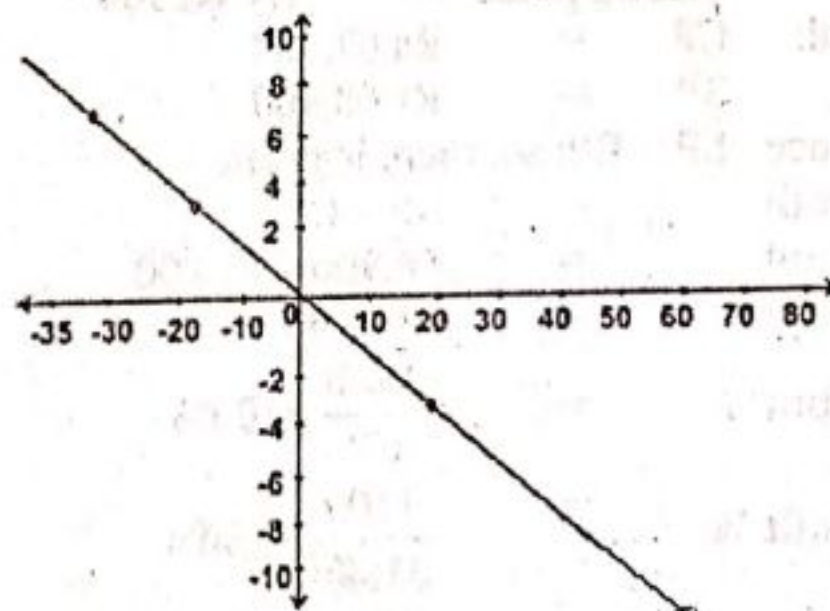


x	-35	-15	20	55	-15
y	7	3	-4	-11	3

Sol: The above table can be written as :-

X	-35	-15	20	55
y	7	3	-4	-11

When x increases the y decreases, so it inversely proportion.



Exercise 3.2

(TB Pg 43)

Q1. Find percentage profit or percentage loss if:

(a) Cost price = Rs 3900

Selling price = Rs 3800

Sol CP = Rs 3900

SP = Rs 3800

Since $SP < CP$, so there is loss

$$\text{Loss} = CP - SP$$

$$\text{Loss} = 3900 - 3800$$

$$\text{Loss} = \text{Rs } 100$$

$$\text{Loss \%} = \frac{\text{Loss}}{CP} \times 100\%$$

$$\text{Loss \%} = \frac{100}{3900} \times 100\%$$

$$\text{Loss \%} = \frac{100}{39} \%$$

$$\text{Loss \%} = 2.56 \%$$

(b) Cost Price = Rs. 14500

Selling price = Rs. 14000

Sol CP = Rs. 14500

SP = Rs. 14000

Since $SP < CP$, So there is Loss

$$\text{Loss} = CP - SP$$

$$\text{Loss} = 14500 - 14000$$

$$\text{Loss} = \text{Rs } 500$$

$$\text{Loss \%} = \frac{\text{Loss}}{CP} \times 100\%$$

$$\text{Loss \%} = \frac{500}{14500} \times 100\%$$

$$\text{Loss \%} = \frac{500}{145} \%$$

$$\text{Loss \%} = 3.45\% \text{ Ans}$$

(c) Cost price = Rs. 67,800

Selling price = Rs 68,900

Sol: CP = Rs 67,800

SP = Rs 68,900

Since $SP > CP$: so, there is profit

$$\text{Profit} = SP - CP$$

$$\text{Profit} = 68,900 - 67,800$$

$$\text{Profit} = \text{Rs } 1100$$

$$\text{Profit \%} = \frac{\text{Profit}}{CP} \times 100\%$$

$$\text{Profit \%} = \frac{1100}{67800} \times 100\%$$

$$\text{Profit \%} = \frac{1100}{678} \%$$

$$\text{Profit \%} = 1.622\% \text{ Ans}$$

(d) Cost price = Rs 1500

Selling Price = Rs. 2550

Sol CP = Rs. 1500

SP = Rs. 2550

Since $SP > CP$; so there is profit

$$\text{Profit} = SP - CP$$

$$\text{Profit} = 2550 - 1500$$

$$\text{Profit} = \text{Rs. } 1050$$

$$\text{Profit \%} = \frac{\text{Profit}}{CP} \times 100\%$$

$$\text{Profit \%} = \frac{1050}{1500} \times 100\%$$

$$\text{Profit \%} = \frac{1050}{15} \%$$

$$\text{Profit \%} = 70\% \text{ Ans}$$

Q2. Jamil purchased a house for Rs. 9250000. After sometime, he sold it at 8% profit. Find the selling price of the house.

Sol SP = ?

CP = Rs 9250000

$$\text{Profit \%} = 8\%$$

$$\text{Profit \%} = \frac{\text{Profit}}{CP} \times 100\%$$

$$8\% = \frac{\text{Profit}}{9250000} \times 100\%$$

$$8 = \frac{\text{Profit}}{92500}$$

$$8 \times 92500 = \text{Profit}$$

$$\text{Profit} = \text{Rs } 740,000$$

$$\text{Profit} = SP - CP$$

$$740,000 = SP - 9,250,000$$

$$740,000 + 9,250,000 = SP$$

$$SP = \text{Rs. } 9,990,000 \text{ Ans}$$

Q3. An electric fan is sold for Rs 19516 after giving a discount of 14%. Find the marked price of the fan.

Sol: MP = ?

SP = Rs. 19,516 (Actual Price)

Discount % = 14%

Suppose marked price = Rs. x

14% discount means that if marked price is Rs. 100, then discount is Rs. 14 and therefore;

$$\text{Actual SP} = \text{Rs } 100 - \text{Rs } 14 = \text{Rs } 86.$$

If actual SP is Rs 86, then marked price = Rs 100 of actual SP is Rs 1, then marked price

$$= \frac{100}{86}. \text{ If actual SP is Rs } 19,516, \text{ then marked}$$

$$\text{price} = \frac{100}{86} \times 19,516 = \text{Rs } 22,693 \text{ Ans}$$

Q4. The marked price of a photo copier machine is Rs. 72000. The machine was sold at 5% discount. The shopkeeper still earned a profit of 14%. Find its cost price.

Sol: MP = Rs. 72000

Discount % = 5%

CP = ?

$$\% \text{ Discount} = \frac{\text{Discount}}{\text{MP}} \times 100\%$$

$$5\% = \frac{\text{Discount}}{72000} \times 100\%$$

$$5 = \frac{\text{Discount}}{720}$$

$$5 \times 720 = \text{Discount} = \text{Dis} = \text{Rs. } 3600$$

$$\text{SP} = \text{MP} - \text{Discount}$$

$$\text{SP} = 72000 - 3600$$

$$\text{SP} = \text{Rs } 68,400$$

$$\text{Profit} = 14\% \text{ of Rs } 68,400$$

$$\text{Profit} = \frac{14}{100} \times \text{Rs } 68,400$$

$$\text{Profit} = 14 \times \text{Rs } 684$$

$$\text{Profit} = \text{Rs. } 9,576$$

$$\text{Profit} = \text{SP} - \text{CP}$$

$$9,576 = 68,400 - \text{CP}$$

$$\text{CP} = 68,400 - 9,576$$

$$\text{CP} = \text{Rs. } 58,824 \text{ Ans}$$

Book answer is wrong.

Q5. The marked price of a mobile phone is Rs. 24500. The shopkeeper offers his customer two successive discount of 10% and 6%. Find the final S.P of the mobile phone.

$$\text{Sol: MP} = \text{Rs } 24,500$$

$$1^{\text{st}} \text{ Discount} = \frac{10}{100} \times \text{Rs. } 24,500$$

$$1^{\text{st}} \text{ Discount} = \text{Rs. } 2450$$

$$\text{SP after } 1^{\text{st}} \text{ discount} = 24,500 - 2450$$

$$= \text{Rs } 22,050$$

$$2^{\text{nd}} \text{ discount} = 6\% \text{ of Rs } 22,050$$

$$= \frac{6}{100} \times \text{Rs } 22,050$$

$$= \frac{\text{Rs } 132,300}{100}$$

$$= \text{Rs } 1323$$

$$2^{\text{nd}} \text{ Discount} = \text{Rs } 1323$$

$$\text{Final SP} = 22,050 - 1323$$

$$= \text{Rs. } 20727 \text{ Ans}$$

Q6. The factory price of a T.V set is Rs. 42000. A wholesaler buys 20 TV sets at a discount of 5% and sells them at 10% profit on each TV set. Find the SP of each TV set.

$$\text{Sol: Marked price of a TV set} = \text{Rs } 42000$$

$$\text{Total amount for 20 TV sets} = 20 \times 42000$$

$$= \text{Rs } 840,000$$

$$\text{Discount} = 5\% \text{ of } 840,000 = \frac{5}{100} \times \text{Rs } 840,000$$

$$\text{Discount} = \text{Rs } 5 \times \text{Rs } 8,400 = \text{Rs } 42,000$$

$$\text{Rs } 840,000 - \text{Rs } 42,000 = \text{Rs } 79,800$$

$$\text{Cost Price for 20 TV set} = \text{Rs } 798,000$$

$$\text{Cost Price for a TV set} = \frac{\text{Rs } 798,000}{20}$$

$$\text{Cost Price for a TV set} = \text{Rs } 39,900$$

$$\text{Profit} = 10\% \text{ of Rs } 39,900$$

$$\text{Profit} = \frac{10}{100} \times \text{Rs } 39,900$$

$$\text{Profit} = \text{Rs } 3,990$$

$$\text{SP} = \text{CP} + \text{Profit} = 39,900 + 3,990 = \text{Rs } 43,890$$

Q7. Zain sold a can of oil for Rs. 7780 at a loss of 15% calculate his cost price.

$$\text{Sol: SP} = \text{Rs } 7780$$

$$\text{Loss}\% = 15\%$$

$$\text{CP} = ?$$

$$\text{Loss}\% = 15\%$$

$$\text{SP} = \text{Rs } 7780$$

Formula:

$$\text{CP} = \frac{100\%}{(100 - L)\%}$$

$$\text{C.P} = \frac{100\%}{(100 - 15)\%} \times 7780$$

$$\text{C.P} = \frac{100\%}{85\%} \times 7780$$

$$\text{C.P} = \frac{778000}{85}$$

$$\text{C.P.} = \text{Rs } 9152.94 \text{ Ans}$$

Q8. A merchant bought some good for Rs, 650,000. He spent Rs. 12,000 on overheads charges including labor and transportation. He sold the goods for Rs 770,000. Find his profit or loss percentage.

$$\text{Sol: CP} = \text{Rs. } 650,000$$

$$\text{Overhead charges (transportation)} = \text{Rs. } 12,000$$

$$\text{Total amount paid} = \text{cost price} + \text{overhead}$$

$$\text{charges} = \text{Rs } 650,000 + \text{Rs. } 12,000$$

$$= \text{Rs. } 662,000$$

Since the selling price is more than the cost price, so the merchant earned a profit.

$$\text{Profit} = \text{S.P} - \text{CP}$$

$$\text{Profit} = 770,000 - 662,000$$

$$\text{Profit} = 108,000$$

$$\text{Profit}\% = \frac{\text{Profit}}{\text{CP}} \times 100\%$$

$$\text{Profit \%} = \frac{108000}{662000} \times 100\%$$

$$\text{Profit \%} = \frac{10800}{662}\%$$

$$\text{Profit \%} = 16.3\% \text{ Ans}$$

Q9. Mr Qadeer sold a car for Rs 840,000 and suffered a loss of 18%. How much should he have sold it for to achieve a profit of 10.5%?

$$\text{Sol: SP} = \text{Rs } 840,000$$

$$\text{Loss\%} = 18\% \text{ of Rs } 840,000$$

$$= \frac{18}{100} \times \text{Rs } 840,000$$

$$= 18 \times \text{Rs } 8400$$

$$\text{Loss\%} = \text{Rs } 151,200$$

$$\text{Loss} = \text{CP} - \text{SP}$$

$$\text{Rs } 151,200 = \text{CP} - \text{Rs } 840,000$$

$$\text{CP} = \text{Rs } 151,000 + \text{Rs } 840,000$$

$$\text{CP} = \text{Rs } 991,200$$

$$\text{Profit} = 10.5\% \text{ of CP}$$

$$= \frac{10.5}{100} \times \text{Rs } 991,200$$

$$= 10.5 \times \text{Rs } 9912$$

$$\text{Profit} = \text{Rs } 104,076$$

$$\text{Profit} = \text{SP} - \text{CP}$$

$$\text{Rs } 104,076 = \text{SP} - \text{Rs } 991,200$$

$$\text{SP} = \text{Rs } 104,076 + \text{Rs } 991,200$$

$$\text{SP} = \text{Rs } 1,095,276$$

Q10. A shopkeeper sold a table for Rs 8400, he loses 6% of its cost price. Find the cost price of the table.

$$\text{Sol: C.P} = ?$$

$$\text{Loss \%} = 6\%$$

$$\text{S.P} = \text{Rs } 8400$$

Formula: -

$$\boxed{C.P = \frac{100\%}{(100 - L)\%} \times SP}$$

$$C.P = \frac{100\%}{(100 - 6)\%} \times \text{Rs } 8400$$

$$C.P = \frac{100}{94} \times \text{Rs } 8400$$

$$C.P = \frac{\text{Rs } 840000}{94}$$

$$\boxed{CP = \text{Rs } 8936.17} \text{ Ans}$$

Q11. A buyer buys rice at Rs 120 per kg. what price per kg must he sell the rice to gain 20%.

$$\text{Sol: CP} = \text{Rs } 120 \text{ (Per kg)}$$

$$\text{Gain (profit) \%} = 20\% \text{ of CP}$$

$$= \frac{20}{100} \times 120$$

$$= 2 \times 12$$

$$\text{Gain (Profit) \%} = \text{Rs } 24$$

$$120 + 24 = 144$$

The price per kg he sell the rice is Rs. 144. Ans

Q12. A man gets a profit of Rs 370 by selling a cycle at Rs 10,500. Find its cost price and profit percentage.

$$\text{Sol Profit} = \text{Rs } 370$$

$$\text{SP} = \text{Rs } 10,500$$

$$\text{CP} = ?$$

$$\text{Profit \%} = ?$$

$$\text{Profit} = \text{SP} - \text{CP}$$

$$370 = 10,500 - \text{CP}$$

$$\text{CP} = 10,500 - 370$$

$$\text{CP} = \text{Rs } 10,130 \text{ Ans}$$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100\%$$

$$\text{Profit \%} = \frac{370}{10130} \times 100\%$$

$$\text{Profit\%} = \frac{3700}{1013}\%$$

$$\text{Profit \%} = 3.65\% \text{ Ans}$$

Q13. A Watch is bought for Rs 16780 and sold for Rs 17300. Find the profit and profit percentage.

$$\text{Sol CP} = \text{Rs } 16,780$$

$$\text{SP} = \text{Rs } 17,300$$

$$\text{Profit} = ?$$

$$\text{Profit\%} = ?$$

$$\text{Profit} = \text{SP} - \text{CP}$$

$$\text{Profit} = 17,300 - 16,780$$

$$\text{Profit} = \text{Rs } 520 \text{ Ans}$$

$$\text{Profit\%} = \frac{\text{Profit}}{\text{CP}} \times 100\%$$

$$\text{Profit\%} = \frac{520}{16780} \times 100\%$$

$$\text{Profit \%} = \frac{5200}{1678}\%$$

$$\text{Profit\%} = 3.1\% \text{ Ans}$$

Q14. A shopkeeper sold a television and makes a profit of 8%. The buyer sold it for Rs 52500 and suffered a loss of 10%. What was the original price of the television?

Sol: First let us calculate CP of the buyer or sale price of shopkeeper.

Sale Price of buyer = Rs 52,500

On selling the buyer suffered a loss of 10%, so

$$\text{CP of the buyer} = \frac{52500}{0.9}$$

This is the sale price of the shopkeeper.

Shopkeeper makes a profit of 8% while selling to buyer.

So, CP of shopkeeper or original price of the

$$\text{TV} = \left(\frac{52500}{0.9} \right) \times \left(\frac{1}{1.08} \right)$$

$$= \frac{52500}{0.972}$$

$$= \text{Rs } 54012.35$$

Exercise 3.3

(TB Pg 47)

Q1. Find the missing quantities by using the formula.

(a) If P = Rs 400, T = 2 years
R = 8%, Markup = ?

$$\text{Sol Markup} = \frac{P \times R \times T}{100}$$

$$\text{Markup} = \frac{400 \times 8 \times 2}{100}$$

$$\text{Markup} = 4 \times 8 \times 2$$

$$\text{Markup} = \text{Rs. } 64 \text{ Ans}$$

(b) If markup = Rs 1900, T = 3 years,
R = 4%, P = ?

$$\text{Sol Markup} = \frac{P \times R \times T}{100}$$

$$1900 = \frac{P \times 4 \times 3}{100}$$

$$1900 \times 100 = P \times 4 \times 3$$

$$190000 = P \times 12$$

$$\frac{190000}{12} = P$$

$$P = \text{Rs. } 15833.34 \text{ Ans}$$

(c) If P = Rs 4000, R = 10%,
Markup = Rs 12500, T = ?

$$\text{Sol Markup} = \frac{P \times R \times T}{100}$$

$$12500 = \frac{4000 \times 10 \times T}{100}$$

$$12500 = 40 \times 10 \times T$$

$$12500 = 400 \times T$$

$$\frac{12500}{400} = T$$

$$T = \frac{125}{4}$$

$$T = 31.25 \text{ years}$$

(d) If P = Rs 700, T = 3.5 years, R = 12%,
markup = ?

$$\text{Sol Markup} = \frac{P \times R \times T}{100}$$

$$\text{Markup} = \frac{700 \times 12 \times 3.5}{100}$$

$$\text{Markup} = 7 \times 12 \times 3.5$$

$$\text{Markup} = \text{Rs. } 294 \text{ Ans}$$

Q2. The cash price of a washing machine is Rs 19500. Iqra buys it on installments by paying Rs 4500 as down payment and the rest by 9 monthly installments of Rs 2000 each. If she buys it using cash payment, how much money will she save?

Sol: Cash price of washing machine

$$= \text{Rs } 19,500$$

$$\text{Down payment} = \text{Rs } 4500$$

$$\text{Monthly Installments} = \text{Rs } 2000$$

$$9 \text{ Months installment} = 9 \times \text{Rs } 2000$$

$$= 18,000$$

$$18,000 + 4,500 = \text{Rs } 22,500$$

$$\text{Amount paid by installments} = \text{Rs } 22,500$$

$$\text{Rs } 22,500 - \text{Rs } 19,500 = \text{Rs } 3,000$$

$$\text{She will save Rs } 3,000$$

Q3. A microwave oven is available for Rs 17000 in cash or Rs 2000 down payment followed by 7 equal monthly installments of Rs 2500 each. Compute the total payment.

Sol:

$$\text{Cash price of microwave} = \text{Rs } 17,000$$

$$\text{Down payment} = \text{Rs } 2000$$

$$\text{Monthly installments} = \text{Rs } 2500$$

$$7 \text{ Monthly Installment} = 2,500 \times 7$$

$$= \text{Rs } 17,500$$

$$\text{Total Payment} = \text{Rs } 17,500 + \text{Rs } 2000$$

$$= \text{Rs } 19,500 \text{ Ans}$$

Q4. Mr Amir paid a markup of Rs 520 on an item that costs Rs 5800. If the time period is 2 years, calculate the rate of the markup.

Sol: Markup = Rs 520

$$P = \text{Rs } 5800$$

$$T = 2 \text{ Years}$$

$$\text{Rate} = R = ?$$

Formula

$$\text{Markup} = \frac{P \times R \times T}{100}$$

$$520 = \frac{5800 \times R \times 2}{100}$$

$$520 = 58 \times R \times 2$$

$$520 = 116 \times R$$

$$\frac{520}{116} = R$$

$$R = 4.48\% \text{ Ans}$$

Q5. Find the markup on a principal amount of Rs 95,400 at the rate of 13% per annum for 5 years.

Sol: Markup = ?

P = Rs 95,400, R = 13%, T = 5 years

Formula

$$\text{Markup} = \frac{P \times R \times T}{100}$$

$$\text{Markup} = \frac{95400 \times 13 \times 5}{100}$$

$$\text{Markup} = 954 \times 13 \times 5$$

$$\text{Markup} = \text{Rs } 62,010 \text{ Ans}$$

Q6. The price of a mobile including markup is Rs 15610. If the markup rate is 7% per annum, find the amount of markup for 2 years?

Sol: Markup = ?

P = Rs 15,610

R = 7%, T = 2 yrs

Formula

$$\text{Markup} = \frac{P \times R \times T}{100}$$

$$\text{Markup} = \frac{15610 \times 7 \times 2}{100}$$

$$\text{Markup} = \frac{1561 \times 7 \times 2}{10}$$

$$\text{Markup} = \frac{\text{Rs } 21854}{10}$$

$$\text{Markup} = \text{Rs } 2185.4 \text{ Ans}$$

Q7. Qasir bought a motorbike for Rs 125,000 and paid a markup of Rs 25,000 for 2 years. What markup rate did he pay?

Sol: R = ?

P = Rs 125,000, Markup = Rs 25,000

T = 2 yrs.

$$\text{Markup} = \frac{P \times R \times T}{100}$$

$$25000 = \frac{125000 \times R \times 2}{100}$$

$$25000 = 1250 \times R \times 2$$

$$25000 = 2500 \times R$$

$$\frac{25000}{2500} = R \quad \frac{250}{25} = R$$

$$R = 10\% \text{ Ans}$$

Exercise 3.4

(TB Pg 50)

Q1. For a family of 4 members, Rs. 40,000 is sufficient for 25 days. For how many days Rs. 40000 will be sufficient for a family of 6 members?

Sol: let the number of days = x

Members	days	Amount
4	25	Rs 40,000
6	x	Rs 40,000

$$\frac{x}{25} = \frac{4}{6} \times \frac{40000}{40000}$$

$$x = \frac{4}{6} \times 25 \quad x = \frac{100}{6}$$

$$x = 16\frac{2}{3} \text{ days Ans}$$

Q2. An inheritance of Rs. 500,000 is to be divided among two brothers and one sister such that ratio among their share is 2:2:1 respectively. Find their share.

Sol: Total Amount = Rs. 500,000

1st brother: 2nd brother: 3rd brother

= 2 : 2 : 1

Sum of ratio = 2+2+1 = 5

$$1^{\text{st}} \text{ brother's share} = \frac{2}{5} \times \frac{100,000}{500,000}$$

$$1^{\text{st}} \text{ brother's share} = \text{Rs. } 200,000 \text{ Ans.}$$

$$2^{\text{nd}} \text{ brother's share} = \frac{2}{5} \times \frac{100,000}{500,000}$$

$$2^{\text{nd}} \text{ brother's share} = \text{Rs. } 200,000 \text{ Ans}$$

$$3^{\text{rd}} \text{ brother's share} = \frac{1}{5} \times \frac{100,000}{500,000}$$

$$3^{\text{rd}} \text{ brother's share} = \text{Rs. } 100,000 \text{ Ans}$$

Q3 Salman, Ahmad and Akram invested an amount in a business in the ratio 2:4:3 respectively. if the profit at the end of year is Rs. 45000, find their share in profit.

Sol: Profit = Rs. 45,000

Salman : Ahmad : Akram

2 : 4 : 3

Sum of ratio = 2+4+3 = 9

$$\text{Salman's share} = \frac{2}{9} \times \frac{5,000}{45,000}$$

Salman share's = Rs. 10,000 Ans

Ahmad's share = $\frac{4}{9} \times \text{Rs. } 45,000$

Ahmad's Share = Rs. 20,000 Ans

Akram's share = $\frac{3}{9} \times \text{Rs. } 45,000$

Akram's Share = Rs. 15,000 Ans

Q4. If 140 men working 10 hours a day can build a house in 16 days, find out how many men will build same kind of house in 12 days by working 13 hours a day?

Men	hrs	days
140	10	16
x	13	12

Sol:

$$\Rightarrow \frac{16}{12} = \frac{x}{140} \times \frac{13}{10}$$

$$\Rightarrow \frac{16}{12} = \frac{13x}{1400} \text{ (CM)}$$

$$\Rightarrow (12)(13x) = (16)(1400)$$

$$\Rightarrow (156x) = 22400$$

$$\Rightarrow x = \frac{22400}{156}$$

$$\Rightarrow x = 143$$

143 men will be required.

Q5. Saleem left a property of value Rs.

150,000. If his widow gets $\frac{1}{8}$ of the total

value and son gets twice than a daughter, find the share of his widow, a son and a daughter.

Sol: Total value = Rs. 150,000

Widow gets = $\frac{1}{8}$ of the total value

$$= \frac{1}{8} \times \text{Rs. } 150,000$$

Widow gets = Rs. 18750 Ans

Remaining Amount = $150,000 - 18,750 = \text{Rs. } 131,250$

Son : daughter = 2:1

Sum of ratio = $2+1 = 3$

Son's gets = $\frac{2}{3} \times \text{Rs. } 131,250$

Son's gets = Rs 87,500

Daughters gets = $\frac{1}{3} \times \text{Rs. } 131,250$

= Rs 43,750 Ans

Q6. Aleem and Riaz started a business together. Aleem invests Rs. 41,000 and Riaz invests Rs 82,000. If they earned a profit of Rs. 21,000 after a year, find their shares?

Sol Shares of Aleem = ?

Shares of Riaz = ?

Profit = Rs. 21,000

Invest amount of Aleem = Rs 41,000.

Invest amount of Riaz = Rs. 82,000

$$\begin{array}{lcl} \text{Aleem} & : & \text{Riaz} \\ = 41,000 & : & 82,000 \\ = 41 & : & 82 \end{array}$$

$$= \frac{41^1}{41} : \frac{82^2}{41}$$

$$= 1:2$$

Sum of ratio = $1+2 = 3$

Aleem's Profit = $\frac{1}{3} \times \text{Rs. } 21,000$

= Rs 7000 Ans

Riaz's Profit = $\frac{2}{3} \times \text{Rs. } 21,000$

= Rs 14000 Ans

Q7. If 10 men can construct a 75 km long road in 5 days. How many days will needed for 15 men to construct a 45 km long road.

Sol

Sol: let the number of days = x

Persons	days	Distance
10	5	75
15	x	45

$$\frac{x}{5} = \frac{10^2}{15} \times \frac{45^3}{75^{15}}$$

$$\frac{x}{5} = \frac{6}{15}$$

$$x = \frac{6}{15} \times 5$$

$$x = \frac{30}{15} \Rightarrow \boxed{x = 2}$$

Required days are 2 Ans.

Exercise 3.5

(Tb Pg 54)

Q1. Najma insured her life for Rs. 650,000. Find the amount of premium at rate of 5%.

Sol: Total amount = Rs. 650,000

Rate of premium = 5%

Amount of premium = $\frac{\text{rate}}{100} \times \text{total amount}$

$$= \frac{5}{100} \times 650000$$

$$= 5 \times 6500$$

$$= \text{Rs. } 32,500 \text{ Ans}$$

Q2. Find the rate of premium if a person insured his life for Rs. 500,000 and he pays annual premium Rs. 25000.

Sol: Total amount of insurance = Rs. 500,000

amount of premium = Rs. 25,000

Rate of premium = ?

Amount of premium = $\frac{\text{rate}}{100} \times \text{total amount of insurance.}$

$$25,000 = \frac{\text{rate}}{100} \times 500,000$$

$$25,000 = \text{rate} \times 5000$$

$$\frac{25,000}{5000} = \text{rate}$$

$$\text{Rate} = \frac{25}{5}$$

$$\text{Rate} = 5\% \text{ Ans}$$

Q3. Anwar insured his rickshaw at a rate of 4.2%. he paid an annual premium Rs. 6500. Find the actual price of the rickshaw.

Sol: Actual Price = ?

Rate = 4.2 %

Amount of premium = Rs. 6500

Amount of premium = $\frac{\text{rate}}{100} \times \text{Actual price}$

$$6500 = \frac{4.2}{100} \times \text{Actual price}$$

$$6500 = 0.042 \times \text{Actual Price}$$

$$\frac{6500}{0.042} = \text{Actual Price}$$

$$\text{Actual price} = \text{Rs. } 154,761.9 \text{ Ans}$$

Q4. Hamid brought a car for Rs. 700,000. He insured it at a rate of 3.5% for 3 years. Find the total amount paid as premiums while the rate of depreciation is 5% yearly.

Sol:

Value of car = Rs. 700,000

Rate of premium = 3.5%

Tenure = 3 years

Depreciation rate = 5%

$$1^{\text{st}} \text{ Premium} = \frac{\text{rate}}{100} \times \text{total value}$$

$$= \frac{3.5}{100} \times 700,000$$

$$= 3.5 \times 7000$$

$$1^{\text{st}} \text{ Premium} = \text{Rs } 24,500$$

$$\text{Depreciation} = \frac{5}{100} \times 700,000$$

$$\text{Depreciation} = \text{Rs } 35000$$

$$\text{Depreciated Price after } 1^{\text{st}} \text{ year}$$

$$= 700,000 - 35,000$$

$$= \text{Rs } 665,000$$

$$2^{\text{nd}} \text{ Premium} = \frac{3.5}{100} \times 665,000$$

$$= 3.5 \times 6650$$

$$2^{\text{nd}} \text{ premium} = \text{Rs } 23,275$$

$$\text{Depreciation} = \frac{5}{100} \times 665,000$$

$$= 5 \times 6650$$

$$\text{Depreciation} = \text{Rs } 33,250$$

$$\text{Depreciated Price after } 2^{\text{nd}} \text{ year}$$

$$= 665,000 - 33,250 = \text{Rs } 631,750$$

$$3^{\text{rd}} \text{ Premium} = \frac{3.5}{100} \times 631,750$$

$$= \frac{3.5 \times 63175}{10}$$

$$3^{\text{rd}} \text{ Premium} = \text{Rs } 22,111.25$$

$$\text{The total amount paid as premium} = \text{Rs. } 24500 + \text{Rs } 23275 + \text{Rs } 22111.25 = \text{Rs } 69886.25 \text{ Ans.}$$

Q5. A person insured his vehicle worth Rs. 450,000 at a rate of 2.5% for 4 years. After 3 years he got a claim of damages worth Rs. 750,000. How much loss had he recovered through insurance?

Total worth = Rs. 450,000

$$2.5\% \text{ of } 450,000 = \frac{2.5}{100} \times 450,000$$

$$= 2.5 \times 4500 = \text{Rs } 11250$$

$$\frac{3}{4} \times 11250 = \text{Rs } 8437.5$$

$$750,000 - 8437.5 = \text{Rs } 741562.5$$

So he recovered Rs 741562.5

Note: Book answer is wrong.

CONVERTING CURRENCIES

PKR to USD (United States Dollar)
 1 Pakistan Rupee = 0.0055809287 USD
 1 USD = 179.181648 Pakistani Rupee

PKR to GBP (British Pound Sterling)
 1 PKR = 0.0042 GBP
 1 GBP = 239.66 PKR

PKR to Euro
 1 PKR = 0.0050 EUR
 1 EUR = 199.64 PKR

PKR to CAD (Canadian Dollar)
 1 PKR = 0.0069 CAD
 1 CAD = 144.45 PKR

EXERCISE 3.6 (TB pg 56)

Q1. Convert the following currencies to PKR. (Use updated currency rates from the internet)

(a) **340 USD**
 Sol: 1 USD = 179.181648 Rupees
 $= 340 \times 179.181648$ Rupees
 $= 60,921,76$ Rupees. Ans

(b) **120 CAD**
 Sol: 1 CAD = 144.45 PKR
 $= 120 \times 144.45$ PKR
 $= 17,334$ PKR

(c) **98 EUR**
 Sol: 1 EUR = 199.64 PKR
 $= 98 \times 199.64$ PKR
 $= 19,564.72$ PKR

(d) **250 GBP**
 Sol: 1 GBP = 239.6635 PKR
 $= 250 \times 239.6635$ PKR
 $= 59,915.875$ PKR

(e) **29 USD**
 Sol: 1 USD = 179.181648 PKR
 $= 29 \times 179.181648$ PKR
 $= 5196.27$ PKR

(f) **45 CAD**
 Sol: 1 CAD = 144.45 PKR
 $= 45 \times 144.45$ PKR
 $= 6500.25$ PKR

(g) **444 EUR**
 Sol: 1 EUR = 199.64 PKR
 $= 444 \times 199.64$ PKR
 $= 88,640.16$ PKR

(h) **654 GBP**
 Sol: 1 GBP = 239.6635 PKR

$= 654 \times 239.6635$ PKR
 $= 156739.929$ PKR

Q2: Convert the following amounts given in PKR to the mentioned currencies. (Use updated currency rates from the internet).

(a) **600 PKR to USD**
 Sol: 1 PKR = 0.0055809287 USD
 $= 600 \times 0.0055809287$ USD
 $= 3.3486$ USD

(b) **35 PKR to CAD**
 Sol: 1 PKR = 0.0069 CAD
 $= 35 \times 0.0069$ CAD
 $= 0.2415$ CAD

(c) **897 PKR to EUR**
 Sol: 1 PKR = 0.0050 EUR
 $= 897 \times 0.0050$ EUR
 $= 4.485$ EUR

(d) **600 PKR to GBP**
 Sol: 1 PKR = 0.0042 GBP
 $= 600 \times 0.0042$ GBP
 $= 2.52$ GBP

(e) **425 PKR to USD**
 Sol: 1 PKR = 0.0055809287 USD
 $= 425 \times 0.0055809287$ USD
 $= 2.3719$ USD

(f) **98 PKR to CAD**
 Sol: 1 PKR = 0.0069 CAD
 $= 98 \times 0.0069$ CAD
 $= 0.6762$ CAD

(g) **326 PKR to EUR**
 Sol: 1 PKR = 0.0050 EUR
 $= 326 \times 0.0050$ EUR
 $= 1.63$ EUR

(h) **562 PKR to GBP**
 Sol: 1 PKR = 0.0042 GBP
 $= 562 \times 0.0042$ GBP
 $= 2.3604$ GBP

REVIEW EXERCISE (TB PG 58)

Q1. Encircle the correct option.

(a) If the ratio $a:b$ is the same as the ratio of $c:d$, then:

- (i) $a:c::b:d$ ii. $a:b::c:d$ ✓
 (iii) $a:d::c:b$ (iv) $a:b::a:d$

(b) A method in which we calculate the value of a number of things by finding the value of one thing is called.

- (i) Direct Method
 (ii) Inverse method
 (iii) Unitary Method ✓
 (iv) Indirect Method

(c) If the two quantities x and y are directly proportional to each other i.e. $y \propto x$, then:

- (i) $y = kx$ (ii) $y = k/x$
 (iii) $y = x$ (iv) $y = kx^2$

(d) If the selling price (SP) of the things or goods are more than its cost price (CP), we can say that there is a:

- (i) Loss (ii) profit✓
 (iii) Discount (iv) Tax

(e) An amount that is added to the cost price to calculate the sale price is called:

- (i) Loss (ii) Profit✓
 (iii) Markup (iv) Principal

(f) Markup =

- (i) Discount - Cash Price
 (ii) Total Payment - Discount ✓
 (iii) Cash Price - Total Payment
 (iv) Total Payment - Cash price

Q2. If 42 men working together can construct a road in 13 days, how long will it take 39 men to construct the same road?

Sol: We know that number of men is inversely proportional to time, so

$$\begin{array}{ccc} \text{Days} & : & \text{men} \\ \uparrow & & \downarrow \\ 13 & : & 42 \\ x & : & 39 \\ \frac{x}{13} & = & \frac{42}{39} \end{array}$$

By cross multiplication $(39)(x) = (13)(42)$

$$x = \frac{(13)(42)}{39} \quad x = \frac{42}{3}$$

$$x = 14$$

Hence, 39 men will construct the same road in 14 days. Ans

Q3. A bus runs at an average speed of 35 km per hour and completes a journey in 4 hours 12 minutes. How long will it take to cover the same distance at a speed of 45 km per hour?

Sol: $S = 35 \text{ km/h}$
 $T = 4 \text{ hr } 12 \text{ min}$
 $T = 4 \text{ hr} + \frac{12}{60} \text{ hr}$
 $T = 4 \text{ hr} + 0.2 \text{ hr}$
 $T = 4.2 \text{ hr}$

$$S = \frac{D}{T} \Rightarrow 35 = \frac{D}{4.2} \Rightarrow D = 4.2 \times 35$$

$$D = 147 \text{ km}$$

To find the time,

$$S = \frac{D}{T} \Rightarrow 45 = \frac{147}{T} \Rightarrow 45T = 147$$

$$T = \frac{147}{45}$$

$$T = 3.27 \text{ hr}$$

$$T = 3 \text{ hr} + 0.27 \text{ hr}$$

$$T = 3 \text{ hr} + 0.26 \times 60 \text{ min}$$

$$T = 3 \text{ hr} + 16.2 \text{ min}$$

$$T = 3 \text{ hr} + 16 \text{ min} + 0.2 \text{ min}$$

$$T = 3 \text{ hr} + 16 \text{ min} + 0.2 \times 60 \text{ sec}$$

$$T = 3 \text{ hr} + 16 \text{ min} + 12 \text{ sec}$$

$$T = 3 \text{ hr } 16 \text{ min } 12 \text{ sec}$$

A bus will take 3 hr 16 min 12 sec to cover the same distance at a speed of 45 km/h

Q4. 2.6 carpenters can make 8 chairs in 10 days, how many days will be required for 10 carpenters to make 16 chairs?

Sol: Let required days = x

Carpenter	Days	Chairs
2.6	10	8
10	X	16

$$\frac{x}{10} \times \frac{10}{2.6} = \frac{16}{8}$$

$$\frac{x}{2.6} = 2$$

$$x = 2 \times 2.6$$

$$x = 5.2$$

Required days are 5.2 days.

Q5. Find the profit or loss (percent) if Saima bought a house for Rs. 7,540,000 and sold it for Rs. 9,200,000.

Sol: Required:

$$\text{Profit \%} = ?$$

$$\text{CP} = \text{Rs. } 7,540,000$$

$$\text{SP} = 9,200,000$$

Since $\text{SP} > \text{CP}$: there is a profit.

$$\text{Profit} = \text{SP} - \text{CP}$$

$$\text{Profit} = 9,200,000 - 7,540,000$$

$$\text{Profit} = 1,660,000$$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100\%$$

$$\text{Profit \%} = \frac{166000}{754000} \times 100\%$$

$$\text{Profit \%} = \frac{1600}{754} \%$$

$$\text{Profit \%} = 2.12\% \text{ Ans}$$

Q6. Ahmad and Haroon started business by sharing Rs. 400,000 and Rs 300,000. Ahsan joined after 6 months with a capital of Rs. 390,000. They made a profit of Rs. 40,000 at the end of the year. Find the share of each in the profit.

Sol: Ahmad : Haroon : Ahsan
2 : 2 : 1

$$\text{Sum of ratios} = 2 + 2 + 1 = 5$$

$$\text{Profit amount} = \text{Rs } 40,000$$

$$\text{Ahmad's profit} = \frac{2}{5} \times \text{Rs } 40,000 = \text{Rs } 16,000$$

$$\text{Haroon's profit} = \frac{2}{5} \times \text{Rs } 40,000 = \text{Rs } 16,000$$

$$\text{Ahsan's profit} = \frac{1}{5} \times \text{Rs } 40,000 = \text{Rs } 8,000$$

Ahmad's profit will be Rs 16,000

Haroon's profit will be Rs 16,000

Ahsan's profit will be Rs 8,000

Q7. Zubair passed away after leaving property worth Rs. 962,000. Distribute property among his heirs; a wife, a daughter and two sons.

Sol: Total Amount = Rs. 962,000.

Wife : daughter : son : son

8 : 1 : 2 : 2

$$\text{Sum of ratio} = 8 + 1 + 2 + 2 = 13$$

$$\text{Wife's share} = \frac{8}{13} \times \text{Rs } 962,000 = \text{Rs } 592,000$$

$$\text{Daughter's share} = \frac{1}{13} \times 962,000$$

$$= \text{Rs. } 74,000 \text{ Ans}$$

$$1^{\text{st}} \text{ son's share} = \frac{2}{13} \times \text{Rs } 962,000$$

$$1^{\text{st}} \text{ Son's Share} = \text{Rs. } 148,000 \text{ Ans}$$

$$2^{\text{nd}} \text{ Son's Share} = \frac{2}{13} \times \text{Rs } 962,000$$

$$2^{\text{nd}} \text{ son's Share} = \text{Rs } 148,000 \text{ Ans}$$

Q8. A person bought 35 books for Rs. 7,000. He gained 10% profit by selling them. Find out the selling price?

Sol C.P = Rs. 7,000

% Profit = 10%

Profit Amount = 10% of C.P

$$= \frac{10}{100} \times 7000$$

$$= 10 \times 70$$

Profit Amount = Rs. 700

$$\text{S.P} = \text{C.P} + \text{Profit}$$

$$\text{S.P} = \text{C.P} + \text{Profit}$$

$$\text{S.P} = 7,000 + 700$$

$$\text{S.P} = \text{Rs } 7,700 \text{ Ans}$$

Q9. Convert the following currencies to PKR. (Use updated currency rates form the internet)

(a) 23 USD

$$\text{Sol } 1 \text{ USD} = \text{Rs } 179.181648$$

$$= 23 \times \text{Rs } 179.181648$$

$$= \text{Rs. } 4,121.18 \text{ Ans}$$

(b) 556 CAD

$$\text{Sol } 1 \text{ CAD} = 144.45 \text{ PKR}$$

$$= 556 \times \text{Rs } 144.45 \text{ PKR}$$

$$= \text{Rs. } 80,314.2 \text{ PKR. Ans}$$

(c) 67 EUR

$$\text{Sol } 1 \text{ EUR} = 199.64 \text{ PKR}$$

$$= 67 \times \text{Rs } 199.64$$

$$= \text{Rs. } 13,375.88 \text{ Ans}$$

(d) 85 GBP

$$\text{Sol } 1 \text{ GBP} = 239.6635 \text{ PKR}$$

$$= 85 \times 239.6635 \text{ PKR}$$

$$= \text{Rs. } 20,371.39 \text{ Ans}$$

(e) 445 USD

$$\text{Sol } 1 \text{ USD} = \text{Rs. } 179.181648$$

$$= 445 \times \text{Rs } 179.181648$$

$$= \text{Rs. } 79,735.83 \text{ Ans}$$

(f) 890 CAD

$$\text{Sol } 1 \text{ CAD} = 144.45 \text{ PKR}$$

$$= 144.45 \times 890 \text{ PKR}$$

$$= 128,560.5 \text{ PKR. Ans}$$

(g) 23 EUR

$$\text{Sol } 1 \text{ EUR} = 199.64 \text{ PKR}$$

$$= 23 \times 199.64 \text{ PKR}$$

$$= 4,591.72 \text{ PKR}$$

(h) 456 GBP

$$\text{Sol } 1 \text{ GBP} = 239.66 \text{ PKR}$$

$$= 239.66 \times \text{PKR} \times 456$$

$$= 109,284.95 \text{ Ans}$$

Q10. Convert the following amounts given in PKR to the mentioned currencies. (Use updated currency rates form the internet)

(a) 456 PKR to USD

$$\text{Sol } 1 \text{ PKR} = 0.0055809287 \text{ USD}$$

$$= 456 \times 0.0055809287 \text{ USD}$$

$$= 2.544 \text{ USD Ans}$$

(b) 777 PKR to CAD

Sol $1 \text{ PKR} = 0.0069 \text{ CAD}$

$= 777 \times 0.0069 \text{ CAD}$

$= 5.3613 \text{ CAD Ans}$

(c) 89 PKR to EUR

Sol $1 \text{ PKR} = 0.0050 \text{ EUR}$

$= 89 \times 0.0050 \text{ EUR}$

$= 0.445 \text{ EUR Ans}$

(d) 128 PKR to GBP

Sol $1 \text{ PKR} = 0.0042 \text{ GBP}$

$= 128 \times 0.0042 \text{ GBP}$

$= 0.5376 \text{ GBP Ans}$

(e) 778 PKR to USD

Sol $1 \text{ PKR} = 0.0055809287 \text{ USD}$

$= 778 \times 0.0055809287 \text{ USD}$

$= \text{Rs. } 4.341962529 \text{ USD. Ans}$

(f) 765 PKR to CAD

Sol $1 \text{ PKR} = 0.0069 \text{ CAD}$

$= 765 \times 0.0069 \text{ CAD}$

$= 5.2785 \text{ CAD. Ans}$

(g) 220 PKR to EUR

Sol $1 \text{ PKR} = 0.0050 \text{ EUR}$

$= 220 \times 0.0050 \text{ EUR}$

$= 1.1 \text{ EUR Ans}$

(h) 989 PKR to GBP

Sol $1 \text{ PKR} = 0.0042 \text{ GBP}$

$= 989 \times 0.0042 \text{ GBP}$

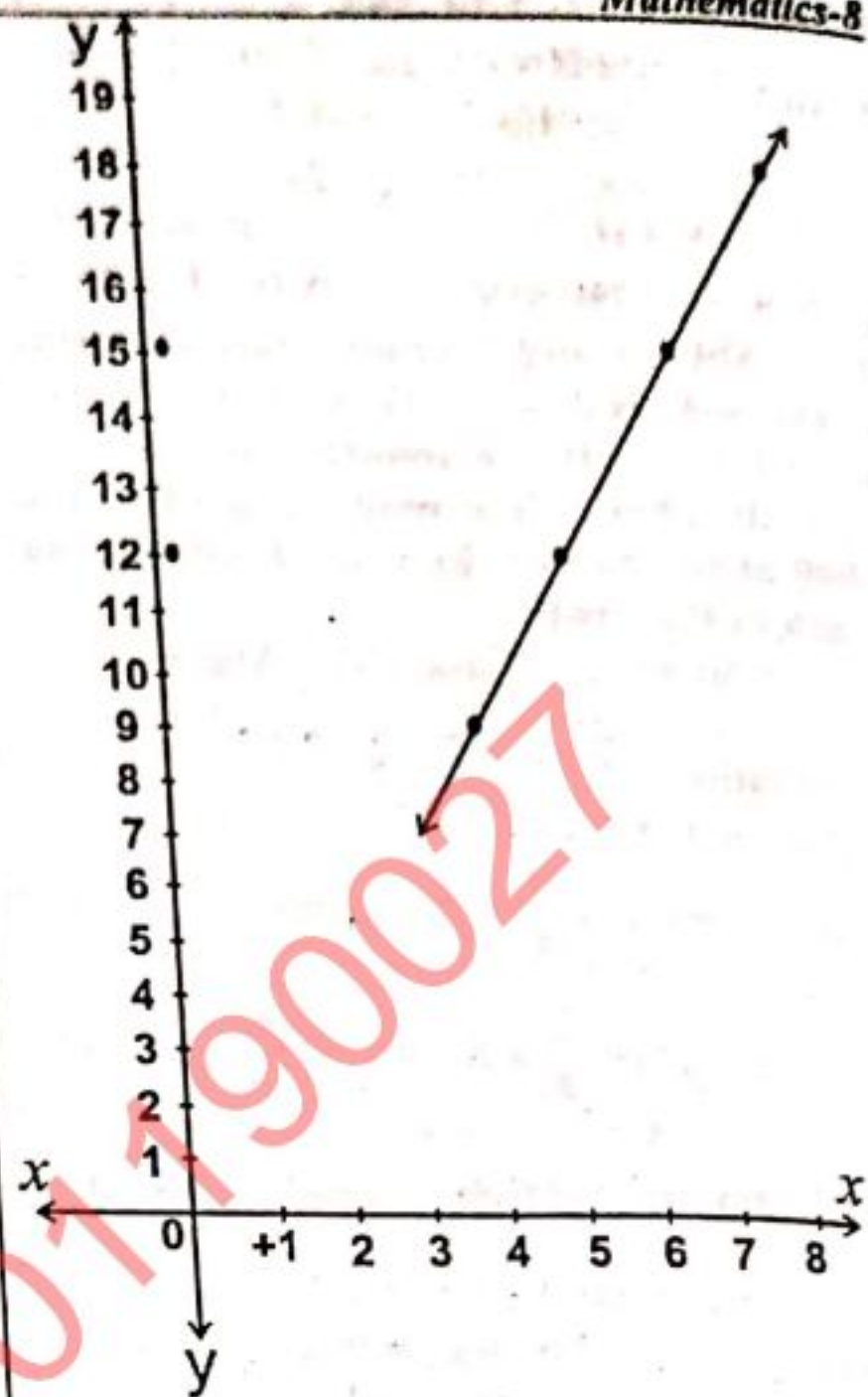
$= 4.1538 \text{ GBP. Ans}$

Q11. Identify the proportion form the given table and then plot the graphs.

(a)

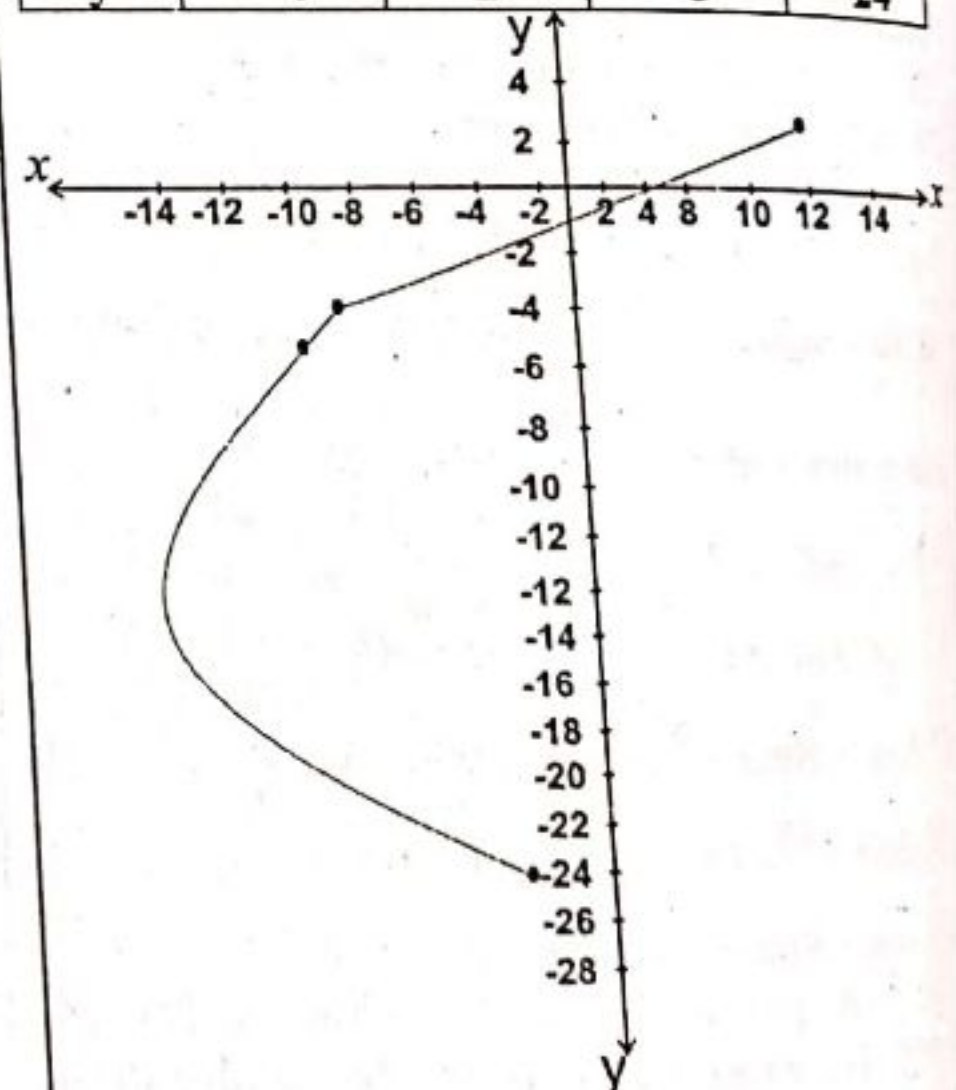
x	3	4	5	6
y	9	12	15	18

Sol there is direct proportion



(a)

x	-6	12	-8	-1
y	-4	2	-3	-24



Unit No. 4
Square Roots and Cube Roots
Exercise 4.1
(Tb Pg 72)

Q1. Find the square root of the following numbers by factorization method.

(i) $\sqrt{36} = ?$
 Sol: $\sqrt{36} = ?$

2	36
2	18
3	9
3	3
	1

$$\sqrt{36} = \sqrt{2 \times 2 \times 3 \times 3}$$

$$\sqrt{36} = \sqrt{2^2 \times 3^2}$$

$$\sqrt{36} = \sqrt{2^2} \times \sqrt{3^2}$$

$$\sqrt{36} = 2 \times 3$$

$$\sqrt{36} = 6 \text{ Ans}$$

(ii) $\sqrt{100} = ?$
 Sol: $\sqrt{100} = ?$

2	100
2	50
5	25
5	5
	1

$$\sqrt{100} = \sqrt{2 \times 2 \times 5 \times 5}$$

$$\sqrt{100} = \sqrt{2^2 \times 5^2}$$

$$\sqrt{100} = 2 \times 5$$

$$\sqrt{100} = 10 \text{ Ans}$$

(iii) $\sqrt{2401} = ?$
 Sol: $\sqrt{2401} = ?$

7	2401
7	343
7	49
7	7
	1

$$\sqrt{2401} = \sqrt{7 \times 7 \times 7 \times 7}$$

$$\sqrt{2401} = \sqrt{7^2 \times 7^2}$$

$$\sqrt{2401} = \sqrt{7^2} \times \sqrt{7^2}$$

$$\sqrt{2401} = 7 \times 7$$

$$\sqrt{2401} = 49 \text{ Ans}$$

(iv) $\sqrt{409600} = ?$
 Sol: $\sqrt{409600} = ?$

5	409600
5	81920
2	16384
2	8192
2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$$\sqrt{409600} = \sqrt{5^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2}$$

$$\sqrt{409600} = 5 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

$$\sqrt{409600} = 640 \text{ Ans}$$

(v) $\sqrt{\frac{25}{49}} = ?$
 Sol: $\sqrt{\frac{25}{49}} = ?$

5	25
5	5
	1

7	49
7	7
	1

$$\sqrt{\frac{25}{49}} = \sqrt{\frac{5 \times 5}{7 \times 7}}$$

$$\sqrt{\frac{25}{49}} = \sqrt{\frac{5^2}{7^2}}$$

$$\sqrt{\frac{25}{49}} = \frac{\sqrt{5^2}}{7^2}$$

$$\frac{25}{49} = \frac{5}{7} \text{ Ans}$$

(vi) $\frac{961}{10201}$
Sol: $\sqrt{\frac{961}{10201}} = ?$

$$\begin{array}{r} 31 \quad 961 \\ 31 \quad 31 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 101 \quad 10201 \\ 101 \quad 101 \\ \hline 1 \end{array}$$

$$\sqrt{\frac{961}{10201}} = \sqrt{\frac{31 \times 31}{101 \times 101}}$$

$$\sqrt{\frac{961}{10201}} = \sqrt{\frac{31^2}{101^2}}$$

$$\sqrt{\frac{961}{10201}} = \frac{\sqrt{31^2}}{\sqrt{101^2}}$$

$$\sqrt{\frac{961}{10201}} = \frac{31}{101} \text{ Ans}$$

(vii) $\frac{1444}{1764}$

Sol: $\sqrt{\frac{1444}{1764}} = ?$

$$\begin{array}{r} 2 \quad 1444 \\ 2 \quad 722 \\ 19 \quad 361 \\ 19 \quad 19 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 2 \quad 1764 \\ 2 \quad 882 \\ 3 \quad 441 \\ 3 \quad 147 \\ 7 \quad 49 \\ 7 \quad 7 \\ \hline 1 \end{array}$$

$$\sqrt{\frac{1444}{1764}} = \sqrt{\frac{2 \times 2 \times 19 \times 19}{2 \times 2 \times 3 \times 3 \times 7 \times 7}}$$

$$\sqrt{\frac{1444}{1764}} = \sqrt{\frac{19^2}{3^2 \times 7^2}}$$

$$\sqrt{\frac{1444}{1764}} = \frac{\sqrt{19^2}}{\sqrt{3^2 \times 7^2}}$$

$$\sqrt{\frac{1444}{1764}} = \frac{19}{3 \times 7}$$

$$\sqrt{\frac{1444}{1764}} = \frac{19}{21} \text{ Ans}$$

(viii) $29\frac{30}{49}$

Sol: $\sqrt{29\frac{30}{49}} = ?$

$$\sqrt{29\frac{30}{49}} = \sqrt{\frac{1451}{49}} = \sqrt{29.61} = 5.44$$

We can't solve it by prime factorization method

(ix) 0.0081

Sol: $\sqrt{0.0081} = ?$

$$\sqrt{0.0081} = \sqrt{\frac{81}{10000}}$$

$$\begin{array}{r} 3 \quad 81 \\ 3 \quad 27 \\ 3 \quad 9 \\ 3 \quad 3 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 2 \quad 10000 \\ 2 \quad 5000 \\ 2 \quad 2500 \\ 2 \quad 1250 \\ 5 \quad 625 \\ 5 \quad 125 \\ 5 \quad 25 \\ 5 \quad 5 \\ \hline 1 \end{array}$$

$$\sqrt{0.0081} = \sqrt{\frac{3^2 \times 3^2}{2^2 \times 2^2 \times 5^2 \times 5^2}}$$

$$\sqrt{0.0081} = \frac{\sqrt{3^2} \times \sqrt{3^2}}{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{5^2} \times \sqrt{5^2}}$$

$$\sqrt{0.0081} = \frac{3 \times 3}{2 \times 2 \times 5 \times 5}$$

$$\sqrt{0.0081} = \frac{9}{100} \text{ Ans}$$

or

$$\sqrt{0.0081} = 0.09 \text{ Ans}$$

(x) 11.56

Sol: $\sqrt{11.56} = ?$

$$\sqrt{11.56} = \sqrt{\frac{1156}{100}}$$

$$\begin{array}{r} 2 \quad 1156 \\ 2 \quad 578 \\ 17 \quad 289 \\ 17 \quad 17 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 2 \quad 100 \\ 2 \quad 50 \\ 5 \quad 25 \\ 5 \quad 5 \\ \hline 1 \end{array}$$

$$\sqrt{11.56} = \sqrt{\frac{2 \times 2 \times 17 \times 17}{2 \times 2 \times 5 \times 5}}$$

$$\sqrt{11.56} = \sqrt{\frac{17^2}{5^2}}$$

$$\sqrt{11.56} = \frac{\sqrt{17^2}}{5^2}$$

$$\sqrt{11.56} = \frac{17}{5} \text{ Ans}$$

or

$$\sqrt{11.56} = 3.4 \text{ Ans}$$

(xi) 8036.355

Sol: Not possible

Q2. Find the square root of the following natural numbers by division method.

(a) 4489

Sol: $\sqrt{4489} = ?$

	67
6	4489
	36
127	889
	889
	000

$$\sqrt{4489} = 67 \text{ Ans}$$

(b) 9604

Sol: $\sqrt{9604} = ?$

	98
9	9604
	81
188	1504
	1504
	0000

$$\sqrt{9604} = 98 \text{ Ans}$$

(c) 7569

Sol: $\sqrt{7569} = ?$

	87
8	7569
	64
167	1169
	1169
	000

$$\sqrt{7569} = 87 \text{ Ans}$$

(d) 28224

Sol: $\sqrt{28224} = ?$

	168
1	28224
	1
26	182
	156
328	2624
	2624
	0000

$$\sqrt{28224} = 168 \text{ Ans}$$

(e) 1225

Sol: $\sqrt{1225} = ?$

	35
3	1225
	9
65	325
	325
	000

$$\sqrt{1225} = 35 \text{ Ans}$$

(f) 72900

Sol: $\sqrt{72900} = ?$

	270
2	72900
	4
47	329
	329
540	00
	00
	0

$$\sqrt{72900} = 270 \text{ Ans}$$

Q3. Find the square root of the following fraction by division method.

(a) $11\frac{14}{25}$

Sol: $\sqrt{11\frac{14}{25}} = ?$

$$\sqrt{11\frac{14}{25}} = \sqrt{\frac{289}{25}} = \frac{\sqrt{289}}{\sqrt{25}}$$

	17
1	289
	1
27	189
	189
	000

	5
5	25
	25
	00

$$\sqrt{11\frac{14}{25}} = \frac{17}{5} \text{ Ans}$$

(b) $\frac{1600}{169}$

Sol: $\sqrt{\frac{1600}{169}} = ? \quad \sqrt{\frac{1600}{169}} = \frac{\sqrt{1600}}{\sqrt{169}}$

$$\begin{array}{r} 40 \\ 4 \overline{) 16 \ 00} \\ \underline{16} \\ 00 \\ 80 \overline{) 00 \ 00} \\ \underline{00} \\ 0 \end{array}$$

$$\begin{array}{r} 13 \\ 1 \overline{) 1 \ 69} \\ \underline{1} \\ 69 \\ 23 \overline{) 69 \ 69} \\ \underline{69} \\ 00 \end{array}$$

$$\sqrt{\frac{1600}{169}} = \frac{40}{13} \text{ Ans}$$

(c) $\frac{2916}{1444}$

Sol: $\sqrt{\frac{2916}{1444}} = ? \quad \sqrt{\frac{2916}{1444}} = \frac{\sqrt{2916}}{\sqrt{169}}$

$$\begin{array}{r} 54 \\ 5 \overline{) 29 \ 16} \\ \underline{25} \\ 416 \\ 104 \overline{) 416 \ 416} \\ \underline{416} \\ 000 \end{array}$$

$$\begin{array}{r} 38 \\ 3 \overline{) 14 \ 44} \\ \underline{9} \\ 544 \\ 68 \overline{) 544 \ 544} \\ \underline{544} \\ 000 \end{array}$$

$$\sqrt{\frac{2916}{1444}} = \frac{54^{27}}{38^{19}} = \frac{27}{19}$$

(d) $\frac{196}{484}$

Sol: $\sqrt{\frac{196}{484}} = ?$

$$\sqrt{\frac{196}{484}} = \frac{\sqrt{196}}{\sqrt{484}}$$

$$\begin{array}{r} 14 \\ 1 \overline{) 1 \ 96} \\ \underline{1} \\ 96 \\ 24 \overline{) 96 \ 96} \\ \underline{96} \\ 00 \end{array}$$

$$\begin{array}{r} 22 \\ 2 \overline{) 4 \ 84} \\ \underline{4} \\ 84 \\ 42 \overline{) 84 \ 84} \\ \underline{84} \\ 00 \end{array}$$

$$\sqrt{\frac{196}{484}} = \frac{14^7}{22^{11}} = \frac{7}{11} \text{ Ans}$$

(e) $\frac{4225}{5476}$

Sol: $\sqrt{\frac{4225}{5476}} = ? \quad \sqrt{\frac{4225}{5476}} = \frac{\sqrt{4225}}{\sqrt{5476}}$

$$\begin{array}{r} 65 \\ 6 \overline{) 42 \ 25} \\ \underline{36} \\ 625 \\ 125 \overline{) 625 \ 625} \\ \underline{625} \\ 000 \end{array}$$

$$\begin{array}{r} 74 \\ 7 \overline{) 54 \ 76} \\ \underline{49} \\ 576 \\ 144 \overline{) 576 \ 576} \\ \underline{576} \\ 000 \end{array}$$

$$\sqrt{\frac{4225}{5476}} = \frac{65}{74} \text{ Ans}$$

Q4. Find the square root of the following decimal numbers by division method.

(a) 0.1089

Sol: $\sqrt{0.1089} = ?$

$$\begin{array}{r} 0.33 \\ 1 \overline{) 0.1089} \\ \underline{0} \\ 10 \\ 3 \overline{) 9} \\ \underline{9} \\ 189 \\ 63 \overline{) 189 \ 189} \\ \underline{189} \\ 000 \end{array}$$

$$\sqrt{0.1089} = 0.33 \text{ Ans}$$

(b) 0.0025

Sol: $\sqrt{0.0025} = ?$

$$\begin{array}{r} 0.05 \\ 0 \overline{) 0.0025} \\ \underline{0} \\ 00 \\ 0 \overline{) 00} \\ \underline{00} \\ 25 \\ 5 \overline{) 25} \\ \underline{25} \\ 00 \end{array}$$

$$\sqrt{0.0025} = 0.05 \text{ Ans}$$

c) 92.16

Sol: $\sqrt{92.16} = ?$

$$\begin{array}{r} 9.6 \\ 9 \overline{) 92.16} \\ \underline{18} \\ 11 \ 16 \\ 186 \overline{) 11 \ 16 \ 11 \ 16} \\ \underline{11 \ 16} \\ 0000 \end{array}$$

$$\sqrt{92.16} = 9.6 \text{ Ans}$$

d) 112.36
Sol: $\sqrt{112.36} = ?$

	10.6
1	112.36
	1
206	1236
	1236
	0000

$\sqrt{112.36} = 10.6$ Ans

Q5. Find the square root of the following non-perfect square upto three decimal places.

(a) 5
 $\sqrt{5} = ?$

	2.236
2	5.000000
	4
42	100
	84
443	1600
	1329
4466	27100
	26796
	304

$\sqrt{5} = 2.236$ Ans

(b) 2
Sol: $\sqrt{2} = ?$

	1.414
1	2. 0 0 0 0 0 0 0
	1
24	1 0 0
	9 6
281	4 0 0
	2 8 1
2824	1 1 9 0 0
	1 1 2 9 6
	6 0 4

$\sqrt{2} = 1.414$ Ans

(c) 7
Sol: $\sqrt{7} = ?$

	2.645
2	7. 0 0 0 0 0 0 0
	4
46	3 0 0
	2 7 6

524	2 4 0 0
	2 0 9 6
5285	3 0 4 0 0
	2 6 4 2 5
	3 9 7 5

$\sqrt{7} = 2.645$ Ans

(d) 11
Sol: $\sqrt{11} = ?$

	3.316
3	11. 0 0 0 0 0 0 0
	9
63	2 0 0
	1 8 9
661	1 1 0 0
	6 6 1
6626	4 3 9 0 0
	3 9 7 5 6
	4 1 4 4

$\sqrt{11} = 3.316$ Ans

(e) 3.1
Sol: $\sqrt{3.1} = ?$

	1.760
1	3. 1 0 0 0 0 0 0 0 0
	1
27	2 1 0
	1 8 9
346	2 1 0 0
	2 0 7 6
352	2 4 0 0 0 0

$\sqrt{3.1} = 1.760$ Ans

Q6. Find the square root of the following decimal fractions upto 2 decimal places.

(a) 3.21
Sol: $\sqrt{3.21} = ?$

	1.79
1	3.2100
	1
27	221
	189
349	3200
	3141
	59

$\sqrt{3.21} = 1.79$ Ans

(b) 56.56

Sol: $\sqrt{56.56} = ?$

7	56.5600
	49
145	756
	725
1502	3100
	3004
	96

$\sqrt{56.56} = 7.52$ Ans

(c) 46.5

Sol: $\sqrt{46.5} = ?$

6	46.5000
	36
128	1050
	1024
1361	2600
	1361
	1239

$\sqrt{46.5} = 6.81$ Ans

(d) 11.3

Sol: $\sqrt{11.3} = ?$

3	11.3000
	9
63	230
	189
666	4100
	3996
	104

$\sqrt{11.3} = 3.36$ Ans

(e) 5.776

Sol: $\sqrt{5.776} = ?$

2	5.776000
	4
44	177
	176
48	16000

$\sqrt{5.776} = 2.40$ Ans

Note it down (Tb pg 74)

Q1. The area of the squared shaped ground of the Masjid is 1156m^2 . Find the length of the ground.

Sol: length of the ground = ?

Area of squared shaped ground = 1156m^2

we know that

$$\text{Length} = \sqrt{\text{Area}}$$

Length = $\sqrt{1156}$

Length = 34m Ans

34	11.56
	9
64	256
	256
	000

Q2. Area of the squared shaped room is 98.01m^2 . Find the perimeter of the room.

Sol: Perimeter of the room = ?

Area of the squared shaped room = 98.01m^2

$$\text{Length} = \sqrt{\text{Area}}$$

Length = $\sqrt{98.01}$

Length = 9.9m Ans

Perimeter = $4 \times l$

= $4 \times 9.9\text{m}$

Perimeter = 39.6m A

WC	9.9
	98.01
9	81
	1701
189	1701
	0000

Exercise 4.2

(Tb Pg 75)

Q1. There are 102400 chairs in a hall arranged in such a way that the chairs in each row are equal to the total number of rows. Find the number of rows?

Sol: Total chairs = 102400

Number of rows = ?

Since in such a way that the chairs in each row are equal to the total number of rows, so we will use the process of square root by division method.

320	102400
	9
62	124
	124
640	00
	00

The required number of rows is 320. Ans

Q2. The area of a rectangular field is equal to the area of another squared shaped field. Find the length of the squared shaped field if the length and width of the rectangular are 675m and 147m respectively.

Sol: Area of rectangular = $l \times w$
 Area of rectangular = 675×147
 Area of rectangular = $99,225 \text{ m}^2$
 Length of the square shaped field = ?
 But, given that

	315
3	99225
	9
61	92
	61
625	3125
	3125
	0000
	0000

Area of square shaped field = Area of rectangular shaped field
 Area of square shaped field = $99,225 \text{ m}^2$

$$\text{Length} = \sqrt{\text{Area}}$$

Length of square shaped field = $\sqrt{99,225}$

Length of square shaped field = 315m Ans

Q3. Find the length of the square shaped Masjid of its area is 722,500 square meter.

Sol: Length of square shaped masjid = ?
 Area = $722,500 \text{ m}^2$

$$\text{Length} = \sqrt{\text{Area}}$$

Length = $\sqrt{722,500}$

Length = 850m Ans

	85.0
8	72.2500
	64
165	825
	825
1700	00
	00
	0
	0

Q4. The length and width of a rectangular plot is 500m and 125m respectively. If a square shaped plot has the same area as the rectangular plot, find the cost of fencing the square plot at the rate of Rs 150 per meter.

Sol: Cost of fencing the square plot = ?

Length of rectangular plot = 500m

Width of rectangular plot = 125m

Area of rectangular plot = $l \times w$

$$= 500 \times 125$$

$$= 62500$$

But, given that

Area of square shaped plot = Area of rectangular plot

Area of square shaped plot = 62500

$$\text{Length} = \sqrt{\text{Area}}$$

Length = $\sqrt{62,500}$

Length = 250m Ans

$250 \times \text{Rs } 150$

= Rs 37,500

The cost of fencing the square plot at the rate of Rs 150 per meter is Rs 37,500 Ans.

Q5. The length of the base and altitude of a triangle is 220 cm and 55cm respectively. if the area of a square is double the area of this triangle, find the length of the square.

Sol: Length of the square = ?

Base of triangle = 220 cm

Height of triangle = 55 cm

We know that

$$\text{Length of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$A = \frac{1}{2} \times 220 \times 55$$

$$A = 110 \times 55$$

$$A = 6050 \text{ cm}^2$$

Area of square = $2 \times (\text{Area of triangle})$

Area of square = 2×6050

Area of square = 12100 cm^2

$$\text{length of square} = \sqrt{\text{area of square}}$$

Length = $\sqrt{12100}$

Length = 110 cm Ans

Q6. The square shaped parking area is 10404 m^2 . Find the cost of constructing a tiled path around it at the rate of Rs 435 per meter.

Sol: Cost of constructing a tiled = ?

Area of square shaped = 10404 m^2

$$\text{Length} = \sqrt{\text{Area}}$$

Length = $\sqrt{10404}$

Length = 102m

	102
1	104 04
	1
202	0404
	404
	00
	00

So, the cost of constructing a tiled path around it at the rate of Rs 435 per meter is Rs 44370 Ans.

Q7. The area of square shaped garden is 9801 square meter. Find the perimeter of the garden.

Sol: Perimeter of the garden = ?
Area of square shaped = 9801m^2

$$\text{Length} = \sqrt{\text{Area}}$$

$$\text{Length} = \sqrt{9801}$$

$$\text{Length} = 99\text{m}$$

9	99
	98 01
	81
189	1701
	1701
	0000

$$\text{Perimeter of the garden} = 4 \times l = 4 \times 99$$

$$\text{Perimeter of the garden} = 396\text{m Ans}$$

Table of cubes: -

x	x^3	x	x^3
1	1	11	1331
2	8	12	1728
3	27	13	2197
4	64	14	2744
5	125	15	3375
6	216	16	4096
7	343	17	4913
8	512	18	5832
9	729	19	6859
10	1000	20	8000

The perfect cubes are: -

1, 8, 27, 64, 125, 216, 343, 512, 729, 1000, 1331, 1728, 2197, 2744, 3375, 4096, 4913, 5832, 6859, 8000

Properties of Cubes of Numbers:

- The cube of an even number is even.
- The cube of an odd number is odd.
- The cube of a positive number is positive.
- The cube of a negative number is negative.

- For any rational number a and b

$$\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$$

- For any rational number a and b ,

$$\sqrt[3]{a \times b} = \sqrt[3]{a} \times \sqrt[3]{b}$$

Exercise 4.3

(Tb page 81)

Q1. Find the cube root of the following if possible.

(a) 512

$$\text{Sol: } \sqrt[3]{512} = ?$$

Working:-

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

(b) 1728

$$\text{Sol: } \sqrt[3]{1728} = ?$$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

(c) 6859

$$\text{Sol: } \sqrt[3]{6859} = ?$$

19	6859
19	361
19	19
	1

(d) 15625

$$\text{Sol: } \sqrt[3]{15625} = ?$$

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

(e) 21952

$$\text{Sol: } \sqrt[3]{21952} = ?$$

2	21952
2	10976
2	5488
2	2744
2	1372
2	686
7	343
7	49

$$512 = 2^3 \times 2^3 \times 2^3$$

$$\sqrt[3]{512} = \sqrt[3]{2^3 \times 2^3 \times 2^3}$$

$$\sqrt[3]{512} = 2 \times 2 \times 2$$

$$\sqrt[3]{512} = 8 \text{ Ans}$$

$$1728 = 2^3 \times 2^3 \times 3^3$$

$$\sqrt[3]{1728} = \sqrt[3]{2^3 \times 2^3 \times 3^3}$$

$$\sqrt[3]{1728} = 2 \times 2 \times 3$$

$$\sqrt[3]{1728} = 12 \text{ Ans}$$

$$6859 = 19 \times 19 \times 19$$

$$6859 = 19^3$$

$$\sqrt[3]{6859} = \sqrt[3]{19^3}$$

$$\sqrt[3]{6859} = 19 \text{ Ans}$$

$$15625 = 5^3 \times 5^3$$

$$\sqrt[3]{15625} = \sqrt[3]{5^3 \times 5^3}$$

$$\sqrt[3]{15625} = 5 \times 5$$

$$\sqrt[3]{15625} = 25 \text{ Ans}$$

$$21952 = 2^3 \times 2^3 \times 7^3$$

$$\sqrt[3]{21952} = \sqrt[3]{2^3 \times 2^3 \times 7^3}$$

$$\sqrt[3]{21952} = 2 \times 2 \times 7$$

$$\sqrt[3]{21952} = 28 \text{ Ans}$$

7	7
	1

(i) 32768

Sol: $\sqrt[3]{32768} = ?$

2	32768	$32768 = 2^3 \times 2^3 \times 2^3 \times 2^3 \times 2^3$
2	16384	$\sqrt[3]{32768} = \sqrt[3]{2^3 \times 2^3 \times 2^3 \times 2^3 \times 2^3}$
2	8192	$\sqrt[3]{32768} = 2 \times 2 \times 2 \times 2 \times 2$
2	4096	$\sqrt[3]{32768} = 32 \text{ Ans}$
2	2048	
2	1024	
2	512	
2	256	
2	128	
2	64	
2	32	
2	16	
2	8	
2	4	
2	2	
	1	

(ii) 46656

Sol: $\sqrt[3]{46656} = ?$

2	46656	$46656 = 2^3 \times 2^3 \times 3^3 \times 3^3$
2	23328	$\sqrt[3]{46656} = \sqrt[3]{2^3 \times 2^3 \times 3^3 \times 3^3}$
2	11664	$\sqrt[3]{46656} = 2 \times 2 \times 3 \times 3$
2	5832	$\sqrt[3]{46656} = 4 \times 9$
2	2916	$\sqrt[3]{46656} = 36 \text{ Ans}$
2	1458	
3	729	
3	243	
3	81	
3	27	
3	9	
3	3	
	1	

(iii) 59319

Sol: $\sqrt[3]{59319} = ?$

3	59319	$59319 = 3^3 \times 13^3$
3	19773	$\sqrt[3]{59319} = \sqrt[3]{3^3 \times 13^3}$
3	6591	$\sqrt[3]{59319} = 3 \times 13$
13	2197	$\sqrt[3]{59319} = 39 \text{ Ans}$
13	169	
13	13	
	1	

(iv) 85184

Sol: $\sqrt[3]{85184} = ?$

2	85184	$85184 = 2^3 \times 2^3 \times 11^3$
2	42592	
2	21296	

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

$$\sqrt[3]{85184} = \sqrt[3]{2^3 \times 2^3 \times 11^3}$$

$$\sqrt[3]{85184} = 2 \times 2 \times 11$$

$$\sqrt[3]{85184} = 44 \text{ Ans}$$

(v) 125
4096Sol: $\sqrt[3]{\frac{125}{4096}} = ?$

2	4096	5	125
2	2048	5	25
2	1024	5	5
2	512		
2	256		
2	128		
2	64		
2	32		
2	16		
2	8		
2	4		
2	2		
	1		

$$\sqrt[3]{\frac{125}{4096}} = \sqrt[3]{\frac{5^3}{2^3 \times 2^3 \times 2^3 \times 2^3}}$$

$$\sqrt[3]{\frac{125}{4096}} = \frac{\sqrt[3]{5^3}}{\sqrt[3]{2^3 \times 2^3 \times 2^3 \times 2^3}}$$

$$\sqrt[3]{\frac{125}{4096}} = \frac{5}{2 \times 2 \times 2 \times 2} = \frac{5}{16} \text{ Ans}$$

(vi) 2197
6859Sol: $\sqrt[3]{\frac{2197}{6859}} = ?$

13	2197	19	6859
13	169	19	361
13	13	19	19
	1		1

$$\sqrt[3]{\frac{2197}{6859}} = \frac{\sqrt[3]{13^3}}{\sqrt[3]{19^3}} \Rightarrow \sqrt[3]{\frac{2197}{6859}} = \frac{13}{19} \text{ Ans}$$

(vii) 1331
8000

Sol: $\sqrt[3]{\frac{1331}{8000}} = ?$

2	8000	11	1331
2	4000	11	121
2	2000	11	11
2	1000		1
2	500		
2	250		
5	125		
5	25		
5	5		
	1		

$$\sqrt[3]{\frac{1331}{8000}} = \sqrt[3]{\frac{11^3}{2^3 \times 2^3 \times 5^3}}$$

$$\sqrt[3]{\frac{1331}{8000}} = \frac{\sqrt[3]{11^3}}{\sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{5^3}}$$

$$\sqrt[3]{\frac{1331}{8000}} = \frac{11}{2 \times 2 \times 5}$$

$$\sqrt[3]{\frac{1331}{8000}} = \frac{11}{20} \text{ Ans}$$

(m) $\frac{64}{729}$

Sol: $\sqrt[3]{\frac{64}{729}} = ?$

2	64	3	729
2	32	3	243
2	16	3	81
2	8	3	27
2	4	3	9
2	2	3	3
	1		1

$$\sqrt[3]{\frac{64}{729}} = \sqrt[3]{\frac{2^3 \times 2^3}{3^3 \times 3^3}}$$

$$\sqrt[3]{\frac{64}{729}} = \frac{\sqrt[3]{2^3} \times \sqrt[3]{2^3}}{\sqrt[3]{3^3} \times \sqrt[3]{3^3}}$$

$$\sqrt[3]{\frac{64}{729}} = \frac{2 \times 2}{2 \times 3} = \frac{4}{9} \text{ Ans}$$

(n) $\frac{27}{512}$

Sol: $\sqrt[3]{\frac{27}{512}} = ?$

3	27	2	512
3	9	2	256
3	3	2	128
	1	2	64
		2	32
		2	16
		2	8
		2	4
		2	2
			1

$$\sqrt[3]{\frac{27}{512}} = \sqrt[3]{\frac{3^3}{2^3 \times 2^3 \times 2^3}}$$

$$\sqrt[3]{\frac{27}{512}} = \frac{\sqrt[3]{3^3}}{\sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{2^3}}$$

$$\sqrt[3]{\frac{27}{512}} = \frac{3}{2 \times 2 \times 2} = \frac{3}{8} \text{ Ans}$$

(o) 64×1728

Sol: $\sqrt[3]{64 \times 1728} = ?$

2	64	2	1728
2	32	2	864
2	16	2	432
2	8	2	216
2	4	2	108
2	2	2	54
	1	3	27
		3	9
		3	3
			1

$$\sqrt[3]{64 \times 1728} = \sqrt[3]{2^3 \times 2^3 \times 2^3 \times 2^3 \times 3^3}$$

$$= \sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{3^3}$$

$$= 2 \times 2 \times 2 \times 2 \times 3$$

$$\sqrt[3]{64 \times 1728} = 48 \text{ Ans}$$

(p) 12167

Sol: $\sqrt[3]{12167} = ?$

23	12167
23	529
23	23
	1

$$\sqrt[3]{12167} = \sqrt[3]{23^3}$$

$$\sqrt[3]{12167} = 23 \text{ Ans}$$

(q) 42875

Sol: $\sqrt[3]{42875} = ?$

5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

$$\begin{aligned}\sqrt[3]{42875} &= \sqrt[3]{5^3 \times 7^3} \\ &= \sqrt[3]{5^3} \times \sqrt[3]{7^3} \\ &= 5 \times 7 \\ \sqrt[3]{42875} &= 35 \text{ Ans}\end{aligned}$$

(r) 1331

Sol: $\sqrt[3]{1331} = ?$

11	1331
11	121
11	11
	1

$$\begin{aligned}1331 &= 11^3 \\ \sqrt[3]{1331} &= \sqrt[3]{11^3} \\ \sqrt[3]{1331} &= 11 \text{ Ans}\end{aligned}$$

(r) 3375

Sol: $\sqrt[3]{3375} = ?$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$$\begin{aligned}3375 &= 3^3 \times 5^3 \\ \sqrt[3]{3375} &= \sqrt[3]{3^3} \times \sqrt[3]{5^3} \\ \sqrt[3]{3375} &= 3 \times 5 \\ \sqrt[3]{3375} &= 15 \text{ Ans}\end{aligned}$$

(t) 1000

Sol: $\sqrt[3]{1000} = ?$

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$\begin{aligned}1000 &= 2^3 \times 5^3 \\ \sqrt[3]{1000} &= \sqrt[3]{2^3} \times \sqrt[3]{5^3} \\ &= 2 \times 5 \\ \sqrt[3]{1000} &= 10 \text{ Ans}\end{aligned}$$

Q2. A cube shaped iron container has a volume of 6859 meter cube. Find the dimensions of the container.

Sol: let dimension of the Cube = "l"

$$\text{Volume} = 6859 \text{ m}^3$$

$$l = \sqrt[3]{\text{Volume}}$$

$$l = \sqrt[3]{6859}$$

$$l = \sqrt[3]{19^3}$$

$$l = 19 \text{ m Ans}$$

19	6859
19	361
19	19
	1

Q3. The volume of a cube shaped hall is 74088 m³.

Find the length of the hall.

Sol: $l = ?$

$$\text{Volume} = 74088 \text{ m}^3$$

$$l = \sqrt[3]{\text{Volume}}$$

$$l = \sqrt[3]{74088}$$

$$l = \sqrt[3]{2^3 \times 2^3 \times 7^3}$$

$$l = \sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{7^3}$$

$$l = 2 \times 2 \times 7$$

$$l = 6 \times 7$$

$$l = 42 \text{ m Ans}$$

2	74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

Q4. The volume of a cubic room is 9261 m³. Find the area of the roof of this room.

Sol: Area of the roof = ?

$$\text{Volume} = 9261 \text{ m}^3$$

$$l = \sqrt[3]{\text{Volume}}$$

$$l = \sqrt[3]{9261}$$

$$l = \sqrt[3]{3^3 \times 7^3}$$

$$l = \sqrt[3]{3^3} \times \sqrt[3]{7^3}$$

$$l = 3 \times 7$$

$$l = 21 \text{ m}$$

$$\text{area of roof} = l \times l$$

$$= 21 \times 21$$

$$\text{area of roof} = 441 \text{ m}^2 \text{ Ans}$$

Note: Book answer is wrong.

Q5. Find the cubes of the following numbers.

(a) 67

Sol: $67^3 = ?$

$$67^3 = 67 \times 67 \times 67$$

$$67^3 = 300,763 \text{ Ans}$$

(b) 12

Sol: $12^3 = ?$

$$12^3 = 12 \times 12 \times 12$$

$$12^3 = 1,728 \text{ Ans}$$

(c) 98

Sol: $98^3 = ?$

$$98^3 = 98 \times 98 \times 98$$

$$98^3 = 941,192 \text{ Ans}$$

(d) 50

Sol: $50^3 = ?$

$$50^3 = 50 \times 50 \times 50$$

$$= 125,000 \text{ Ans}$$

(e) 44

Sol: $44^3 = ?$

$$44^3 = 44 \times 44 \times 44$$

$$44^3 = 85,184 \text{ Ans}$$

(f) 73
 Sol: $73^3 = ?$
 $73^3 = 73 \times 73 \times 73$
 $73^3 = 389,017$ Ans

$$\begin{array}{r} 29 \overline{) 841} \\ 29 \overline{) 29} \\ \hline 1 \end{array}$$

$841 = 29^2$
 $\sqrt{841} = \sqrt{29^2}$
 $\sqrt{841} = 29$ Ans

Review Exercise (TB Page 83)

Q1. Encircle the correction option.
 (a) If the prime factors of the given number cannot be written in pairs, the given number is:

- (i) a perfect square
 (ii) ☒ not a perfect square
 (iii) a perfect cube
 (iv) not a perfect cube

(b) Finding square root is the inverse process of:

- (i) adding a number
 (ii) perfect cube of a number
 (iii) ☒ squaring the number
 (iv) division of a number

(c) The square root of 4096 is:

- (i) 54 (ii) ☒ 64
 (iii) 74 (iv) 84

(d) 104 is the square root of:

- (i) ☒ 10806 (ii) 10836
 (iii) 10826 (iv) ☒ 84

(e) Square root of 21609 is:

- (i) 1047 (ii) 247
 (iii) 107 (iv) ☒ 147

(f) The cube of a number is that number raised to the power:

- (i) 1 (ii) ☒ 2
 (iii) 3 (iv) 9

(g) $(17)^3 =$

- (i) 4195 (ii) 4133
 (iii) ☒ 4913 (iv) 4193

(h) 40 is the cube root of:

- (i) ☒ 64000 (ii) 6400
 (iii) 16000 (iv) 80000

(i) Cube root of 729 is:

- (i) 6 (ii) 7
 (iii) 8 (iv) ☒ 9

Q2. Find the square root of the following numbers by factorization method.

(a) 841

Sol: $\sqrt{841} = ?$

(b) 1225

Sol: $\sqrt{1225} = ? = ?$

$$\begin{array}{r} 5 \overline{) 1225} \\ 5 \overline{) 245} \\ 7 \overline{) 49} \\ 7 \overline{) 7} \\ \hline 1 \end{array}$$

$1225 = 5^2 \times 7^2$
 $\sqrt{1225} = \sqrt{5^2} \times \sqrt{7^2}$
 $\sqrt{1225} = 5 \times 7$
 $\sqrt{1225} = 35$ Ans

(c) 1764

Sol: $\sqrt{1764} = ? = ?$

$$\begin{array}{r} 2 \overline{) 1764} \\ 2 \overline{) 882} \\ 3 \overline{) 441} \\ 3 \overline{) 147} \\ 7 \overline{) 49} \\ 7 \overline{) 7} \\ \hline 1 \end{array}$$

$1764 = 2^2 \times 3^2 \times 7^2$
 $\sqrt{1764} = \sqrt{2^2} \times \sqrt{3^2} \times \sqrt{7^2}$
 $\sqrt{1764} = 2 \times 3 \times 7$
 $\sqrt{1764} = 42$ Ans

(d) 2500
 961

Sol: $\sqrt{\frac{2500}{961}} = ? = ?$

$$\begin{array}{r} 5 \overline{) 2500} \\ 5 \overline{) 500} \\ 5 \overline{) 100} \\ 5 \overline{) 20} \\ 2 \overline{) 4} \\ 2 \overline{) 2} \\ \hline 1 \end{array}$$

$$\begin{array}{r} 31 \overline{) 961} \\ 31 \overline{) 31} \\ \hline 1 \end{array}$$

$\sqrt{\frac{2500}{961}} = \sqrt{\frac{5^2 \times 5^2 \times 2^2}{31^2}}$

$\sqrt{\frac{2500}{961}} = \frac{\sqrt{5^2} \times \sqrt{5^2} \times \sqrt{2^2}}{\sqrt{31^2}} = \frac{5 \times 5 \times 2}{31} = \frac{50}{31}$

$\sqrt{\frac{2500}{961}} = \frac{50}{31}$ Ans

(e) 900
 9025

Sol: $\sqrt{\frac{900}{9025}} = ? = ?$

2	900
2	450
5	225
5	45
3	9
3	3
	1

5	9025
5	1805
19	361
19	19
	1

$$\sqrt{\frac{900}{9025}} = \sqrt{\frac{2^2 \times \cancel{5^2} \times 3^2}{\cancel{5^2} \times 19^2}}$$

$$\sqrt{\frac{2500}{961}} = \frac{\sqrt{2^2} \times \sqrt{3^2}}{\sqrt{19^2}} = \frac{2 \times 3}{19} = \frac{6}{19}$$

$$\sqrt{\frac{900}{9025}} = \frac{6}{19} \text{ Ans}$$

(f) $\frac{3366}{2401}$

Sol The square root is not possible by factorization method.

(g) 1.2321

Sol: $\sqrt{1.2321} = ?$

$$\sqrt{1.2321} = \sqrt{\frac{12321}{10000}}$$

$$= \sqrt{\frac{12321}{10000}}$$

3	12321
3	4107
37	1369
37	37
	1

2	10000
2	5000
2	2500
2	1250
5	625
5	125
5	25
5	5
	1

$$\sqrt{1.2321} = \sqrt{\frac{3^2 \times 37^2}{2^2 \times 2^2 \times 5^2 \times 5^2}}$$

$$= \frac{\sqrt{3^2} \times \sqrt{37^2}}{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{5^2} \times \sqrt{5^2}}$$

$$= \frac{3 \times 37}{2 \times 2 \times 5 \times 5}$$

$$= \frac{111}{100}$$

$$\sqrt{1.2321} = 1.11 \text{ Ans}$$

(h) $\sqrt{0.0676}$

Sol: $\sqrt{0.0676} = ?$

$$\sqrt{0.0676} = \sqrt{\frac{676}{10000}}$$

$$0.0676 = \sqrt{\frac{676}{10000}}$$

2	676
2	338
13	169
13	13
	1

2	10000
2	5000
2	2500
2	1250
5	625
5	125
5	25
5	5
	1

$$\sqrt{0.0676} = \sqrt{\frac{2^2 \times 13^2}{2^2 \times 2^2 \times 5^2 \times 5^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{13^2}}{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{5^2} \times \sqrt{5^2}}$$

$$= \frac{2 \times 13}{2 \times 2 \times 5 \times 5}$$

$$= \frac{13}{50}$$

$$\sqrt{0.0676} = 0.26 \text{ Ans}$$

(i) $\sqrt{6.4009}$

Sol: $\sqrt{6.4009} = ?$

$$\sqrt{6.4009} = \sqrt{\frac{64009}{10000}}$$

$$= \sqrt{\frac{64009}{10000}}$$

11	64009
11	5819
23	529
23	23
	1

2	10000
2	5000
2	2500
2	1250
5	625
5	125
5	25
5	5
	1

$$\sqrt{6.4009} = \sqrt{\frac{11^2 \times 23^2}{2^2 \times 2^2 \times 5^2 \times 5^2}}$$

$$\sqrt{6.4009} = \frac{11 \times 23}{2 \times 2 \times 5 \times 5}$$

$$\sqrt{6.4009} = \frac{253}{100}$$

$$\sqrt{6.4009} = 2.53 \text{ Ans}$$

Q3. Find the square root of the following numbers by division method.

(a) 5929

Sol: $\sqrt{5929} = ?$

$$\begin{array}{r} 77 \\ 7 \overline{) 5929} \\ \underline{49} \\ 147 \\ \underline{147} \\ 0000 \end{array}$$

$$\sqrt{5929} = 77 \text{ Ans}$$

(b) 4096

Sol: $\sqrt{4096} = ?$

$$\begin{array}{r} 64 \\ 6 \overline{) 4096} \\ \underline{36} \\ 124 \\ \underline{124} \\ 000 \end{array}$$

$$\sqrt{4096} = 64 \text{ Ans}$$

(c) 2704

Sol: $\sqrt{2704} = ?$

$$\begin{array}{r} 52 \\ 5 \overline{) 2704} \\ \underline{25} \\ 102 \\ \underline{102} \\ 000 \end{array}$$

$$\sqrt{2704} = 52 \text{ Ans}$$

(d) 1764

676

Sol: $\sqrt{\frac{1764}{676}} = ?$

$$\sqrt{\frac{1764}{676}} = \sqrt{\frac{1764}{676}}$$

$$\begin{array}{r} 42 \\ 4 \overline{) 1764} \\ \underline{16} \\ 82 \\ \underline{82} \\ 000 \end{array}$$

$$\begin{array}{r} 24 \\ 2 \overline{) 676} \\ \underline{4} \\ 44 \\ \underline{44} \\ 000 \end{array}$$

$$\sqrt{\frac{1764}{676}} = \frac{42^2}{24^2}$$

$$\sqrt{\frac{1764}{676}} = \frac{7}{4} \text{ Ans}$$

(e) $\frac{1444}{81}$

Sol: $\sqrt{\frac{1444}{81}} = ? \Rightarrow \sqrt{\frac{1444}{81}} = \frac{\sqrt{1444}}{\sqrt{81}}$

$$\begin{array}{r} 38 \\ 3 \overline{) 1444} \\ \underline{9} \\ 68 \\ \underline{68} \\ 000 \end{array}$$

$$\begin{array}{r} 9 \\ 9 \overline{) 81} \\ \underline{81} \\ 0 \end{array}$$

$$\sqrt{\frac{1444}{81}} = \frac{38}{9} \text{ Ans}$$

(f) 47.61

Sol: $\sqrt{47.61} = ?$

$$\begin{array}{r} 6.9 \\ 6 \overline{) 47.61} \\ \underline{36} \\ 129 \\ \underline{129} \\ 000 \end{array}$$

$$\sqrt{47.61} = 6.9 \text{ Ans}$$

(g) 146.41

Sol: $\sqrt{146.41} = ?$

$$\begin{array}{r} 12.1 \\ 1 \overline{) 146.41} \\ \underline{1} \\ 22 \\ \underline{22} \\ 241 \\ \underline{241} \\ 000 \end{array}$$

$$\sqrt{146.41} = 12.1 \text{ Ans}$$

Q4. Find the cube of the following numbers.

(a) 65

Sol: $65^3 = ?$

$$65^3 = 65 \times 65 \times 65$$

$$65^3 = 274,625 \text{ Ans}$$

(b) 77

Sol: $77^3 = ?$

$$77^3 = 77 \times 77 \times 77$$

$$77^3 = 456,533 \text{ Ans}$$

(c) 30

Sol: $30^3 = ?$
 $30^3 = 30 \times 30 \times 30$
 $30^3 = 27,000$ Ans

(d) $18^3 = ?$
 Sol: $18^3 = 18 \times 18 \times 18$
 $18^3 = 5832$ Ans

(e) $22^3 = ?$
 Sol: $22^3 = 22 \times 22 \times 22$
 $22^3 = 10,648$ Ans

(f) $99^3 = ?$
 Sol: $99^3 = 99 \times 99 \times 99$
 $99^3 = 970,299$ Ans

Q5. Find the Cube root of the following numbers by factorization method.

(a) 64
 Sol: $\sqrt[3]{64} = ?$

2	64
2	32
2	16
2	8
2	4
2	2
1	

 $64 = 2^3 \times 2^3$
 $\sqrt[3]{64} = \sqrt[3]{2^3 \times 2^3}$
 $\sqrt[3]{64} = 2 \times 2$
 $\sqrt[3]{64} = 4$ Ans

(b) 125
 Sol: $\sqrt[3]{125} = ?$

5	125
5	25
5	5
1	

 $125 = 5 \times 5 \times 5$
 $125 = 5^3$
 $\sqrt[3]{125} = \sqrt[3]{5^3}$
 $\sqrt[3]{125} = 5$ Ans

(c) 512
 Sol: $\sqrt[3]{512} = ?$

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
1	

 $512 = 2^3 \times 2^3 \times 2^3$
 $\sqrt[3]{512} = \sqrt[3]{2^3 \times 2^3 \times 2^3}$
 $= 2 \times 2 \times 2$
 $\sqrt[3]{512} = 8$ Ans

(d) 1331
 Sol: $\sqrt[3]{1331} = ?$

11	1331
11	121
11	11
	1

 $1331 = 11 \times 11 \times 11$
 $1331 = 11^3$
 $\sqrt[3]{1331} = \sqrt[3]{11^3}$
 $\sqrt[3]{1331} = 11$ Ans

(e) 74088
 Sol: $\sqrt[3]{74088} = ?$

2	74088
2	37044
2	18522
3	3087
3	1029
7	343
7	49
7	7
	1

 $74088 = 2^3 \times 3^3 \times 7^3$
 $\sqrt[3]{74088} = \sqrt[3]{2^3 \times 3^3 \times 7^3}$
 $= 2 \times 3 \times 7$
 $\sqrt[3]{74088} = 42$ Ans

Q6. Find the cube root of the following numbers by division method.

- (a) 27 (b) 216
 (c) 729 (d) 2744 (e) 13824

The solution of Q6 is not possible.

Q7. 1681 blocks have been arranged in such a way that the number of rows and the number of blocks in each row is equal. Find the number of blocks in each row.

Sol: Total blocks = 1681

To find the number of blocks; we will use the process of square root by division method.

	41
4	1681
	16
81	81
	81
	00

So, the number of blocks in each row is 41.
 Ans

Q8. Area of a square field is 50625 m^2 . Find the total length of a fencing wire is required to cover its boundary.

Sol: Area of square field = 50625 m^2
 total length of a fencing wire (perimeter) = ?

$\text{Length} = \sqrt{\text{Area}}$

$\text{Length} = \sqrt{50625}$

$\text{Length} = 225 \text{ m}$

$P = 4 \times l$

$P = 4 \times 225$

$P = 900 \text{ m}$

	225
2	50625
	4
42	106
	84
445	2225
	2225
	0000

The total length of a fencing wire is 900m to cover its boundary. Ans

Q9. A positive number when multiplied by itself is 13225. Find the number.

Sol: Required number = $\sqrt{13225}$

Working

	115
1	$\overline{1\ 32\ 25}$
	1
21	$\overline{32}$
	21
225	$\overline{1125}$
	1125
	0000

So, the required number is 115 Ans

Verification:

$$115 \times 115 = 13,225 \text{ Ans}$$

Q10. Area of the floor of a square hall is 97344 m^2 . Find the dimensions of the floor.

Sol: dimension of the floor = ?

$$\text{Length} = \sqrt{\text{Area}}$$

$$\text{Length} = \sqrt{97344}$$

$$\text{Length} = 312\text{m}$$

So, the dimension of the floor is 312m.

Ans

	312
3	$\overline{9\ 73\ 44}$
	9
61	$\overline{73}$
	61
622	$\overline{1244}$
	1244
	0000

Q11. A cube shaped plastic container has a volume of 8000 meter cube. Find the dimensions of the container.

Sol: dimension of the container = ?

$$\text{Volume of container} = 8000 \text{ m}^3$$

$$l = \sqrt[3]{\text{volume}}$$

$$l = \sqrt[3]{8000}$$

$$l = \sqrt[3]{2^3 \times 2^3 \times 5^3}$$

$$l = \sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{5^3}$$

$$l = 2 \times 2 \times 5$$

$$l = 20\text{m}$$

So, the dimension of the container is 20m. Ans

Q12. The capacity of a cube shaped swimming pool is 85184 m^3 . What is the cost of tilling its base floor at the rate of Rs 850 per square meter?

Sol: capacity of cube shaped swimming pool = 85184 m^3 .

$$l = \sqrt[3]{\text{Capacity}}$$

$$l = \sqrt[3]{85184}$$

$$l = \sqrt[3]{2^3 \times 2^3 \times 11^3}$$

$$l = \sqrt[3]{2^3} \times \sqrt[3]{2^3} \times \sqrt[3]{11^3}$$

$$l = 2 \times 2 \times 11$$

$$l = 44\text{m}$$

$$\text{Rs } 850 \times 44 = \text{Rs } 37,400$$

WC	
2	85144
2	42572
2	21286
2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

The cost of tilling floor is Rs 37,400 Ans.

Unit No. 5

SETS

Exercise 5.1

(Tb Page 89)

Q1. Write five sets of your own choice in the following three ways.

(i) Descriptive form

Sol: W = The set of whole numbers.

Z^+ = The set of +ve integers.

E = The set of non - negative even numbers.

O = The set of +ve odd numbers

P = The set of prime numbers.

(ii) Tabular form

Sol: $w = \{0, 1, 2, 3, \dots\}$

$Z^+ = \{1, 2, 3, 4, \dots\}$

$E = \{0, 2, 4, 6, \dots\}$

$O = \{1, 3, 5, 7, \dots\}$

$P = \{2, 3, 5, 7, 11, \dots\}$

(iii) Set builder notation

Sol: $w = \{x | x \in W\}$

$Z^+ = \{x | x \in Z^+\}$

$E = \{x | x \in E^+\}$

$O = \{x | x \in O^+\}$

$P = \{x | x \in P^+\}$

Q2. Express the following sets in tabular form and descriptive form:

(i) $A = \{x | x \in N \wedge x \leq 9\}$

Sol: Tabular form:

$A = \{1, 2, 3, \dots, 9\}$

Descriptive form:

A is a set of first nine natural numbers.

(ii) $B = \{x | x \in P \wedge x < 20\}$

Tabular form:

$B = \{2, 3, 5, 7, 11, 13, 17, 19\}$

Descriptive form

B the set of prime numbers less than 20

(iii) $C = \{x | x \in E \wedge 2 < x < 15\}$

Tabular form:

$C = \{4, 6, 8, \dots, 14\}$

Descriptive form

C the set of Even numbers between 2 and 15.

(iv) $D = \{x | x \in C \wedge 1 < x < 15\}$

Tabular form:

$D = \{4, 6, 8, 9, 10, 12, 14\}$

Descriptive form: D is a set of composite numbers between 1 and 15.

(v) $E = \{x | x \in W \wedge x \leq 10\}$

Tabular form:

$E = \{0, 1, 2, 3, \dots, 10\}$

Descriptive form

E is a set of whole numbers less than or equal to 10.

(vi) $F = \{x | x \in Z \wedge -10 \leq x < 10\}$

Tabular form:

$F = \{-10, -9, -8, \dots, -1, 0, 1, 2, \dots, 9\}$

Descriptive form

F is a set of integers between -11 and 10, Ans

Q3. Write the following in set builder form.

(a) E = set of even numbers

Sol: $E = \{x | x \in E\}$ Ans

(b) $R = \{101, 103, 105, 107, 109\}$

Sol: $E = \{x | x \in O^+ \wedge 101 \leq x \leq 109\}$ Ans

(c) $A = \{0, 1, 2, 3, 4, 5, \dots\}$

Sol: $A = \{x | x \in W\}$ Ans

(d) $C = \{a, e, i, o, u\}$

Sol: $C = \{x | x \text{ is a set of vowels}\}$

(e) $D = \{1, 4, 9, 16, 25\}$

Sol: $D = \{x | x = n^2, n = 1, 2, 3, 4, 5\}$

(f) F = Set of natural numbers greater than or equal to 11.

Sol: $F = \{x | x \in N \wedge x \geq 11\}$ Ans

(g) $O = \{1, 3, 5, 7, 9\}$

Sol: $O = \{x | x \in O \wedge 1 \leq x \leq 9\}$ Ans

(h) $B = \{22, 33, 44, 55\}$

Sol: $B = \{x | x = 11n, n = 2, 3, 4, 5\}$ Ans

(i) $E = \{\text{April, June, September, November}\}$

Sol: $E = \{x | x \text{ is a 30 days month}\}$

(j) The set of common factors of 18, 30, 42

Sol: $\{x | x \text{ is a common factor of } 18, 30, 42\}$

(k) The set of numbers which are divisible by both 3 and 4.

Sol: $K = \{x | x \text{ is a common divisor of } 3, 4\}$

(l) The set of factors of 81 between 5 and 30.

Sol: $L = \{x | x \text{ is a factor of } 81 \text{ between } 5 \text{ and } 30\}$

(m) The set of prime numbers between 11 and 13.

Sol: $M = \{x | x \in P \wedge 11 < x < 13\}$

(n) The set of even numbers less than or equal to 100.

Sol: $G = \{x | x \in E \wedge x \leq 100\}$

(o) The set of consonants in English alphabets.

Sol: $O = \{x | x \text{ is a consonant}\}$

(P) The set of whole numbers between 20 and 50.

Sol $H = H = \{x | x \in W \wedge 20 < x < 50\}$

(q) The set factor of 24.

Sol $\{x | x \text{ is a factor of } 24\}$

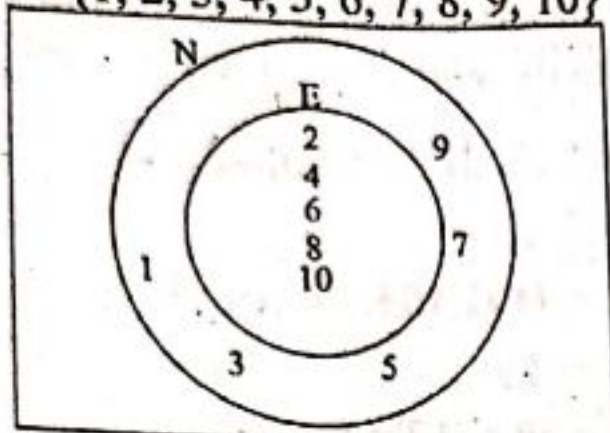
Q4. Represent the following pairs of sets using venn diagram.

(a) $E = \{x | x \in E \wedge 1 \leq x \leq 10\}$

$N = \{x | x \in N \wedge 1 \leq x \leq 10\}$

Sol $E = \{2, 4, 6, 8, 10\}$

$N = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

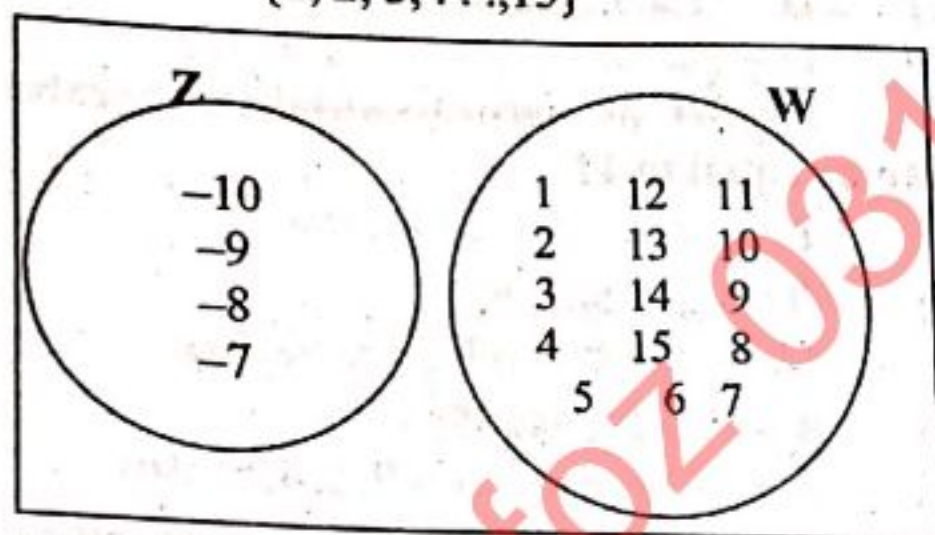


(b) $E = \{x | x \in Z \wedge -10 \leq x \leq -5\}$

$W = \{x | x \in W \wedge 1 \leq x \leq 15\}$

Sol: $Z = \{-10, -9, -8, -7, -6, -5\}$

$W = \{1, 2, 3, \dots, 15\}$

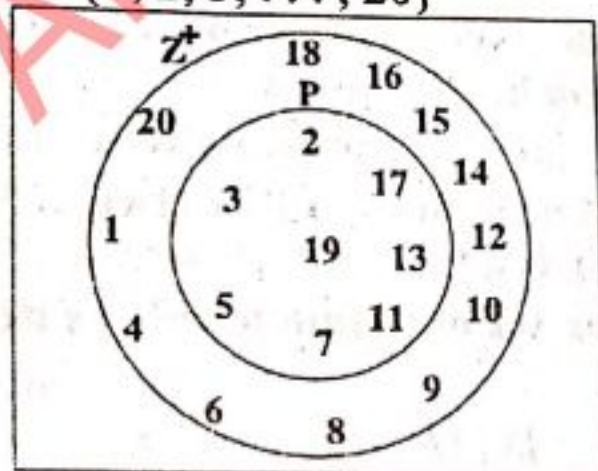


(c) $P = \{x | x \in P \wedge 1 \leq x \leq 20\}$

$Z^+ = \{x | x \in Z^+ \wedge 1 \leq x \leq 20\}$

Sol: $P = \{2, 3, 5, 7, 11, 13, 17, 19\}$

$Z^+ = \{1, 2, 3, \dots, 20\}$



Some common sets: -

Sets	Description
i. $N = \{1, 2, 3, 4, 5, \dots\}$	Set of natural numbers
ii. $W = \{0, 1, 2, 3, 4, 5, \dots\}$	Set of whole numbers
iii. $Z = \{0, \pm 1, \pm 2, \pm 3, \dots\}$	Set of integers
iv. $Z^+ = \{+1, +2, +3, +4, +5, \dots\}$	Set of positive integers
v. $Z^- = \{-1, -2, -3, -4, -5, \dots\}$	Set of negative integers
vi. $E = \{0, 2, 4, 6, 8, 10, \dots\}$	Set of even numbers
vii. $O = \{1, 3, 5, 7, 9, \dots\}$	Set of odd numbers
viii. $P = \{2, 3, 5, 7, 11, \dots\}$	Set of prime numbers
ix. $C = \{4, 6, 8, 9, 10, \dots\}$	Set of composite numbers

Subset of a Set: -

A set A is called a subset of B if every element of A is also an element of B.

We write $A \subseteq B$. If A is not a subset of a set B, we write $A \not\subseteq B$.

Exercise 5.2

(TB page 93)

Q1. Write T for true statement and F or false statement.

- (i) ϕ is the subset of every set. (T)
- (ii) if a set A has n elements then $P(A)$ has 2^{n-1} elements. (F)
- (iii) If $x \in X$ then $x \in P(X)$. (T)
- (iv) If $A \subseteq B$, then $P(A) \subseteq P(B)$. (T)
- (v) The Set $X = \{-1, 0, 1, 2\}$ has 12 possible subsets. (F)

Q2. How many subsets can be made out of the following sets? Find all the subsets of each of the following sets.

(i) $C = \{2\}$

Sol: No. of subsets $= 2^n = 2^1 = (2)$ Ans
All the possible subsets of C are:
 $\phi, \{2\}$ Ans.

(ii) $F = \{4, 8\}$

Sol No. of subsets $= 2^n = 2^2 = (4)$ Ans
All the possible subsets of "F" are: -
 $\phi, \{4\}, \{8\}, \{4, 8\}$

(iii) $M = \{-1, 0, 1, 2\}$

Sol No. of subsets $= 2^n = 2^4 = (16)$ Ans
All the possible subsets of "M" are: -
 $\phi, \{-1\}, \{0\}, \{1\}, \{2\}, \{-1, 0\}, \{-1, 1\}, \{-1, 2\},$
 $\{0, 1\}, \{0, 2\}, \{1, 2\}, \{-1, 0, 1\}, \{-1, 0, 2\}, \{-1, 1, 2\},$
 $\{0, 1, 2\}, \{-1, 0, 1, 2\}$ Ans

(iv) $S = \{ \}$

Sol: No of subsets $= 2^n = 2^0 = (1)$ Ans
All the possible subsets of S are ϕ .

(v) $R = \{5, 10, 15\}$

Sol: No of subsets $= 2^n = 2^3 = (8)$ Ans
All the possible subsets of "R" are
 $\phi, \{5\}, \{10\}, \{15\}, \{5, 10\}, \{5, 15\}, \{10, 15\},$
 $\{5, 10, 15\}$.

(vi) $Z = \{2, 3, 5, 7, 11\}$

Sol: No of subsets $= 2^n = 2^5 = (32)$ Ans

All the possible subsets of "Z" are:

$\Phi, \{2\}, \{3\}, \{5\}, \{7\}, \{11\}, \{2, 3\}, \{2, 5\}, \{2, 7\}, \{2, 11\}, \{3, 5\}, \{3, 7\}, \{3, 11\}, \{5, 7\}, \{5, 11\}, \{7, 11\}, \{2, 3, 5\}, \{2, 3, 7\}, \{2, 3, 11\}, \{2, 5, 7\}, \{2, 5, 11\}, \{2, 7, 11\}, \{3, 5, 7\}, \{3, 5, 11\}, \{3, 7, 11\}, \{5, 7, 11\}, \{2, 3, 5, 7\}, \{2, 3, 5, 11\}, \{2, 3, 7, 11\}, \{2, 5, 7, 11\}, \{3, 5, 7, 11\}$ and $\{2, 3, 5, 7, 11\}$

(vii) $K = \{x | x \in P \wedge 5 \leq x \leq 13\}$

Sol: $K = \{5, 7, 11, 13\}$ No of subsets $= 2^n = 2^4 = (16)$ Ans.

All the subsets of "K" are: -

$\Phi, \{5\}, \{7\}, \{11\}, \{13\}, \{5, 7\}, \{5, 11\}, \{5, 13\}, \{7, 11\}, \{7, 13\}, \{11, 13\}, \{5, 7, 11\}, \{5, 7, 13\}, \{5, 11, 13\}, \{7, 11, 13\}, \{5, 7, 11, 13\}$

(viii) $L = \{x | x \in Z \wedge -2 < x < 2\}$

Sol: $L = \{-1, 0, 1\}$

No. of subsets $= 2^n = 2^3 = (8)$ Ans

All the subsets of "L" are:

$\Phi, \{-1\}, \{0\}, \{1\}, \{-1, 0\}, \{-1, 1\}, \{0, 1\}, \{-1, 0, 1\}$

Q3. Find the power sets of the following sets:

(i) $X = \{x, y, z\}$

Sol: $P(X) = \{\Phi, \{x\}, \{y\}, \{z\}, \{x, y\}, \{x, z\}, \{y, z\}, \{x, y, z\}\}$ Ans

(ii) $A = \{+, -, \times, \div\}$

Sol: $P(A) = \{\Phi, \{+\}, \{-\}, \{\times\}, \{\div\}, \{+, -\}, \{+, \times\}, \{+, \div\}, \{-, \times\}, \{-, \div\}, \{\times, \div\}, \{+, -, \times\}, \{+, -, \div\}, \{+, \times, \div\}, \{-, \times, \div\}, \{+, -, \times, \div\}\}$ Ans.

(iii) $I = \{i, s, l, a, m\}$

Sol: $P(I) = \{\Phi, \{i\}, \{s\}, \{l\}, \{a\}, \{m\}, \{i, s\}, \{i, l\}, \{i, a\}, \{i, m\}, \{s, l\}, \{s, a\}, \{s, m\}, \{l, a\}, \{l, m\}, \{a, m\}, \{i, s, a\}, \{i, s, l\}, \{i, s, m\}, \{i, a, l\}, \{i, a, m\}, \{i, l, m\}, \{s, a, l\}, \{s, l, m\}, \{s, a, m\}, \{a, l, m\}, \{i, s, l, a\}, \{i, s, l, m\}, \{i, s, a, m\}, \{i, l, a, m\}, \{s, l, a, m\}, \{i, s, a, l, m\}\}$

(iv) $B = \{0\}$

Sol: $P(B) = \{\Phi, \{0\}\}$ Ans

(v) $T = \{-3, -2\}$

Sol: $P(T) = \{\Phi, \{-3\}, \{-2\}, \{-3, -2\}\}$ Ans

Operation on sets: -

(1) Commutative property of sets: -

(a) $A \cup B = B \cup A$ (w.r.t. union)

(b) $A \cap B = B \cap A$ (w.r.t. intersection)

(2) Associative property of sets:

(a) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ (w.r.t. Union)

(b) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ (w.r.t. intersection)

(3) Distributive property of Union of sets

over intersection:

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

(4) Distributive property of intersection of sets over union:

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Note it down: - (TB page 96)

Complement of a set. A with respect to a universal set U is the difference of the set A from the set U i.e. $A^c = U - A$.

De-Morgan's Law:

(a) $(A \cup B)^c = A^c \cap B^c$

(b) $(A \cap B)^c = A^c \cup B^c$

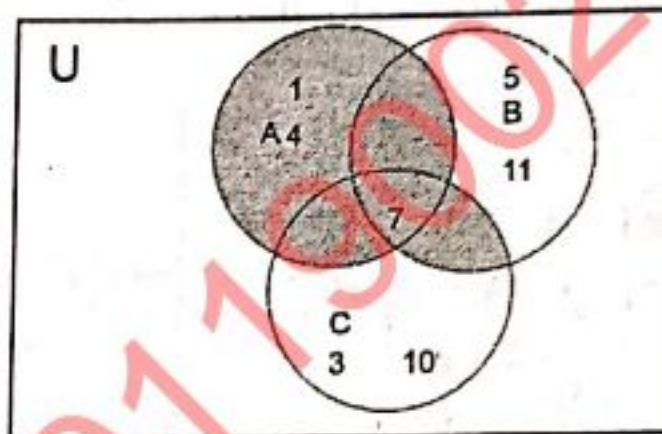
Exercise 5.3 (TB pg 199)

Q1. Given $A = \{1, 4, 7\}$,

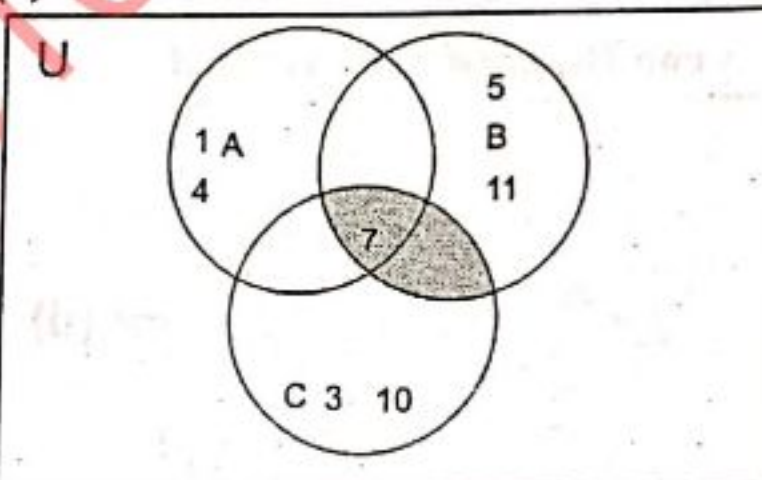
$B = \{5, 7, 11\}$, $C = \{3, 7, 10\}$

Use Venn diagrams to represent

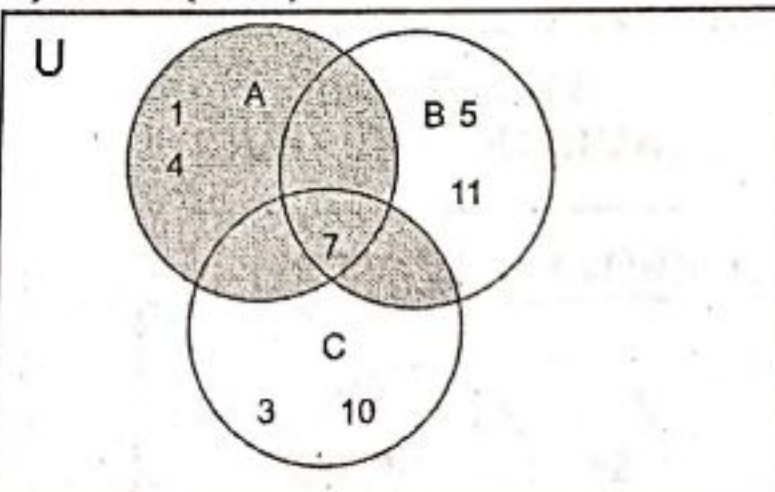
(i) $A \cup B \cap C$

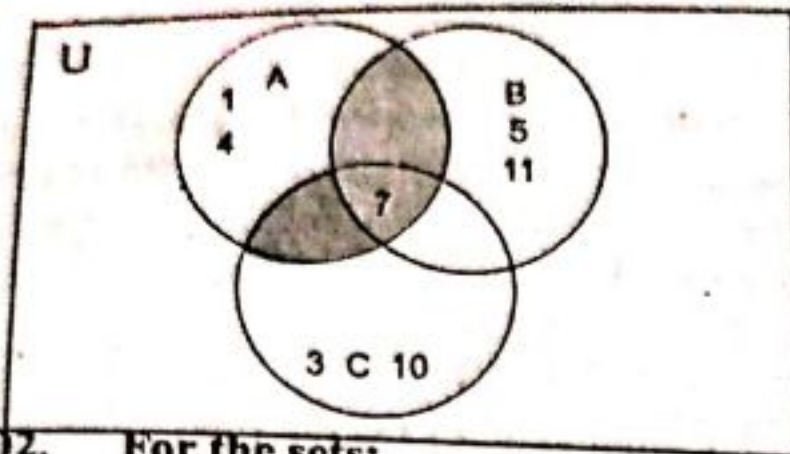


(ii) $A \cap B \cap C$



(iii) $A \cup (B \cap C)$

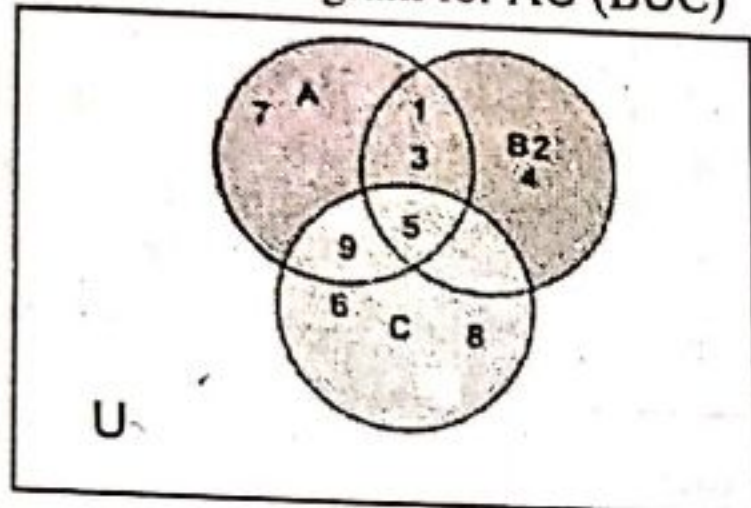


(iv) $A \cap (B \cup C)$ 

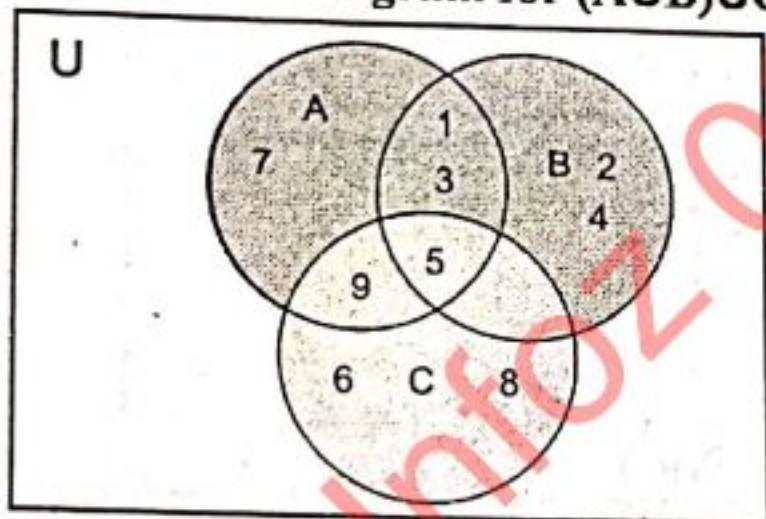
Q2. For the sets:

 $A = \{1, 3, 5, 7, 9\}$, $B = \{1, 2, 3, 4, 5\}$ And $C = \{5, 6, 7, 8, 9\}$

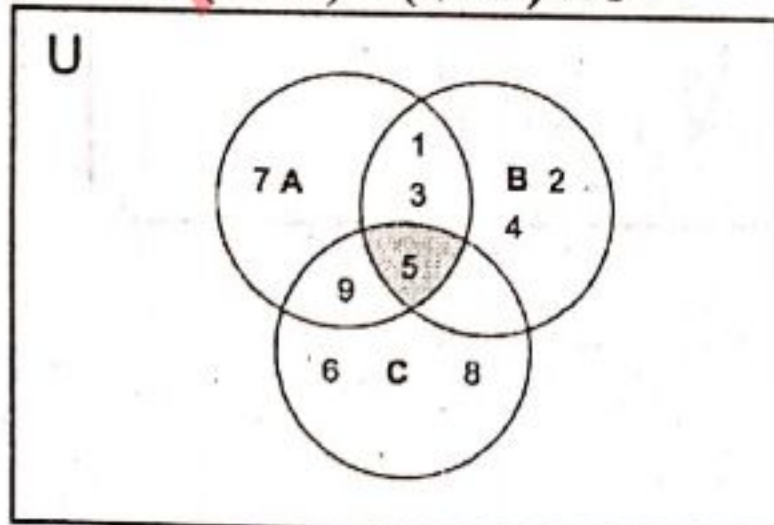
Use Venn diagrams to verify.

(i) $A \cup (B \cap C) = (A \cup B) \cap C$ Sol Venn diagram for $A \cup (B \cap C)$ 

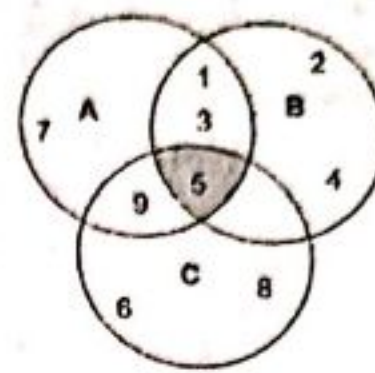
→ (i)

Venn Diagram for $(A \cup B) \cap C$ 

→ (ii)

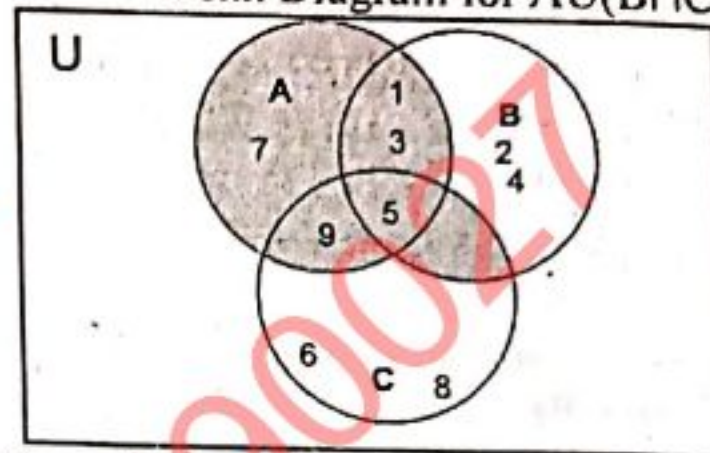
From (i) & (ii)
 $(A \cup B) \cap C = A \cup (B \cap C)$ (ii) $A \cap (B \cap C) = (A \cap B) \cap C$ 

→ (i)

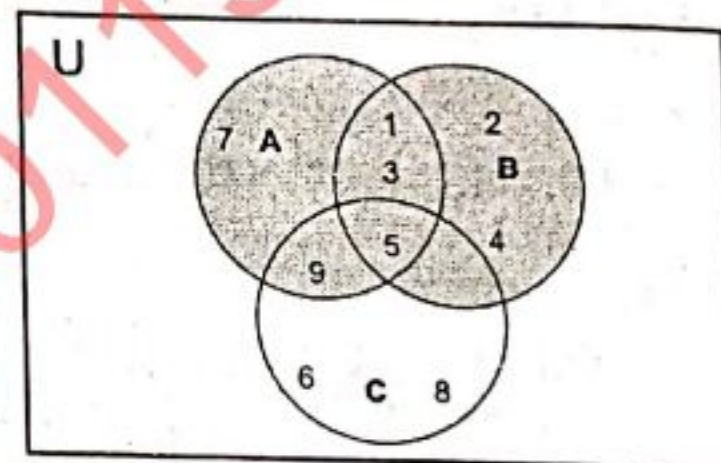
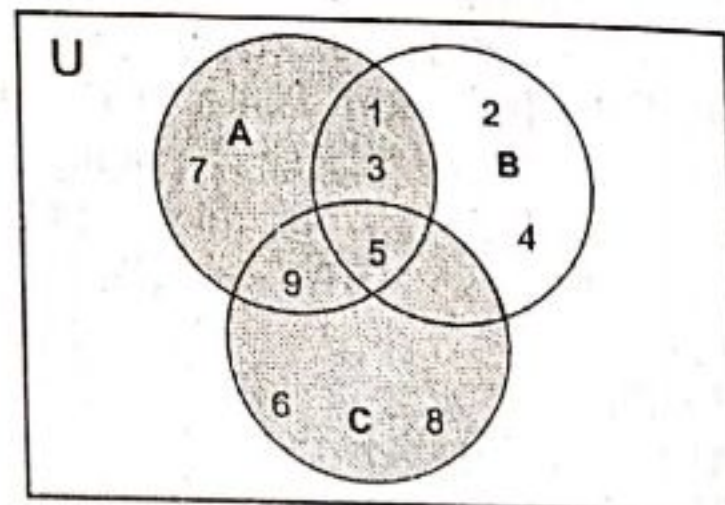
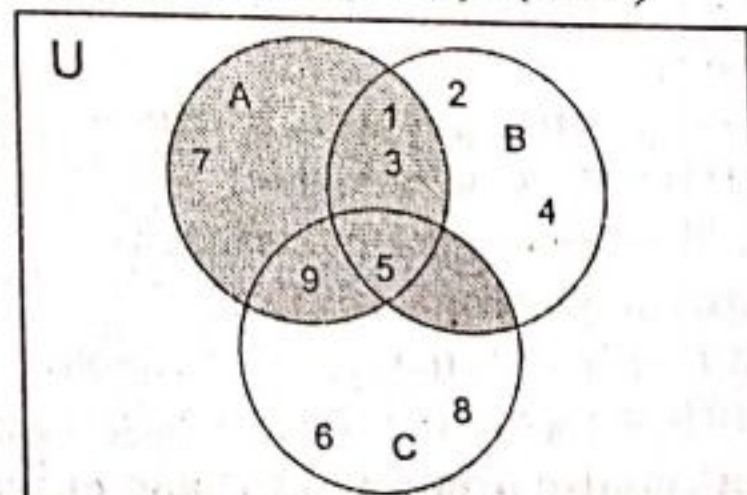
Venn diagram for $(A \cap B) \cap C$ 

→ (ii)

From (i) & (ii)

 $A \cap (B \cap C) = (A \cap B) \cap C$ (iii) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ Venn Diagram for $A \cup (B \cap C)$ 

⇒ (i)

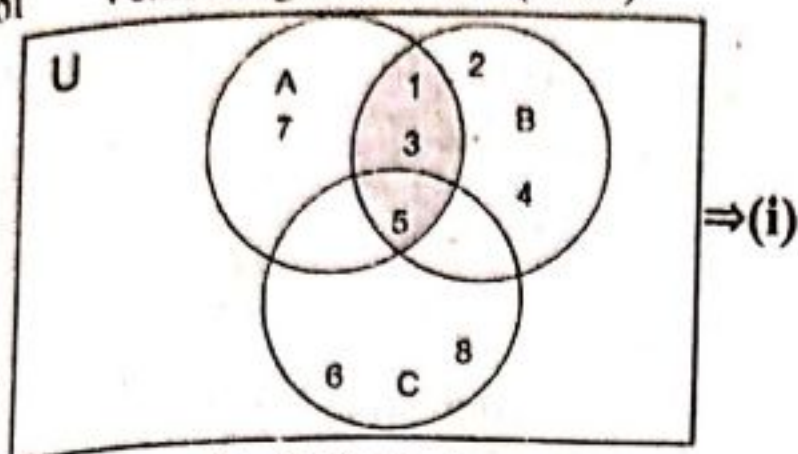
Venn diagram for $A \cup B$ Venn Diagram for $A \cup C$ Venn diagram for $(A \cup B) \cap (A \cup C)$ 

⇒ (ii)

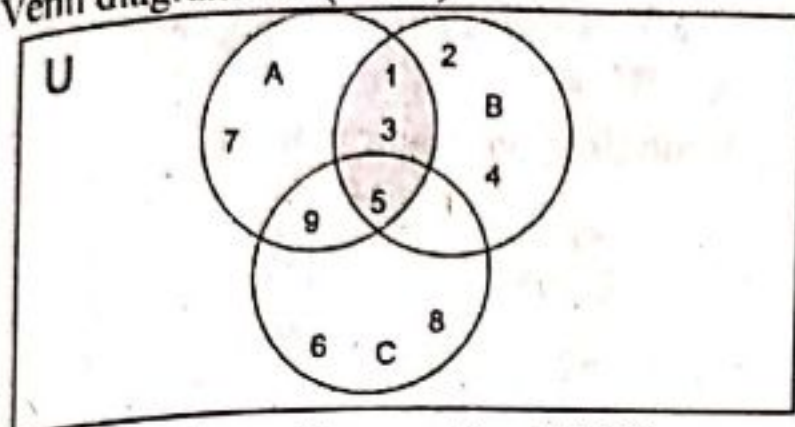
From (i) & (ii)

 $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

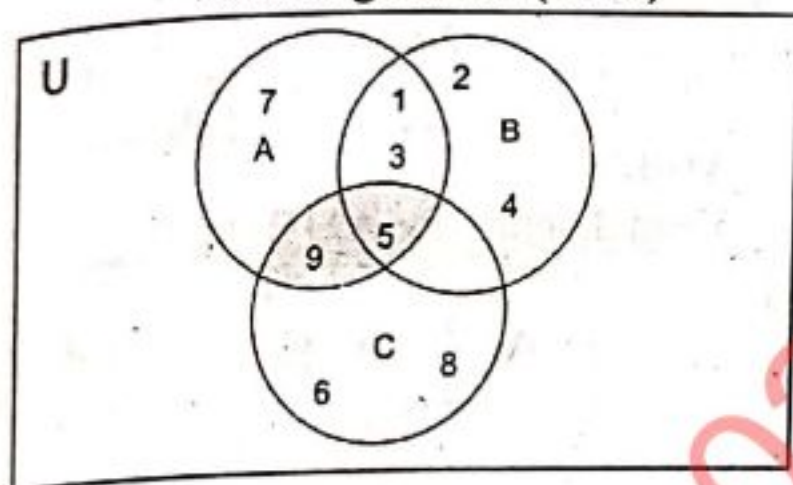
(iv) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
Sol Venn Diagram for $A \cap (B \cup C)$



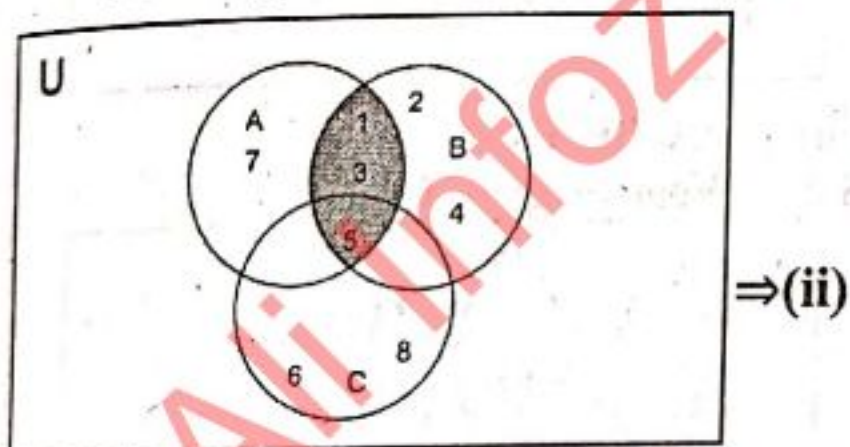
Venn diagram for $(A \cap B)$



Venn diagram for $(A \cap C)$



Venn diagram for $(A \cap B) \cup (A \cap C)$

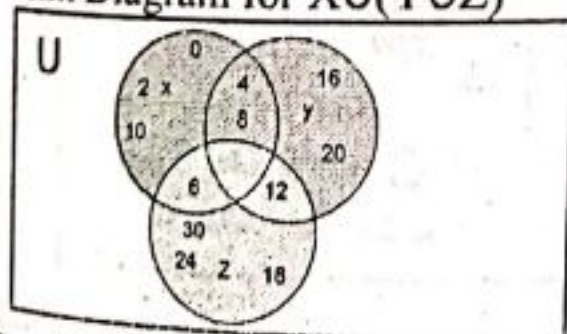


From (i) and (ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
Q3. For the following sets verify the above mentioned properties with the help of Venn diagrams.

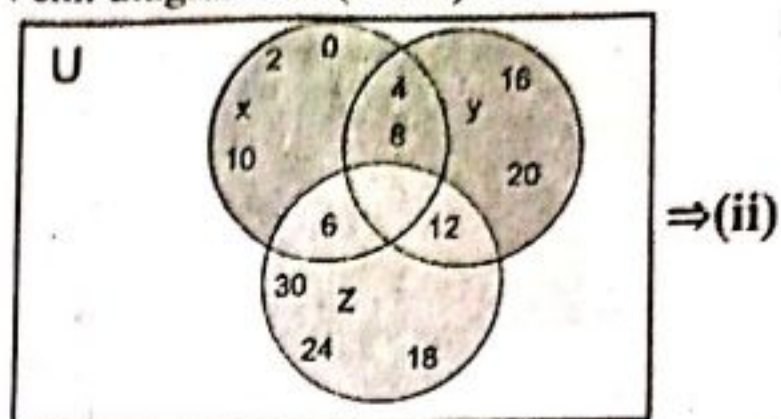
$X = \{0, 2, 4, 6, 8, 10\}$, $Y = \{4, 8, 12, 16, 20\}$,
 $Z = \{6, 12, 18, 24, 30\}$

(i) $X \cup (Y \cap Z) = (X \cup Y) \cap Z$

Venn Diagram for $X \cup (Y \cap Z)$



Venn diagram for $(X \cup Y) \cap Z$

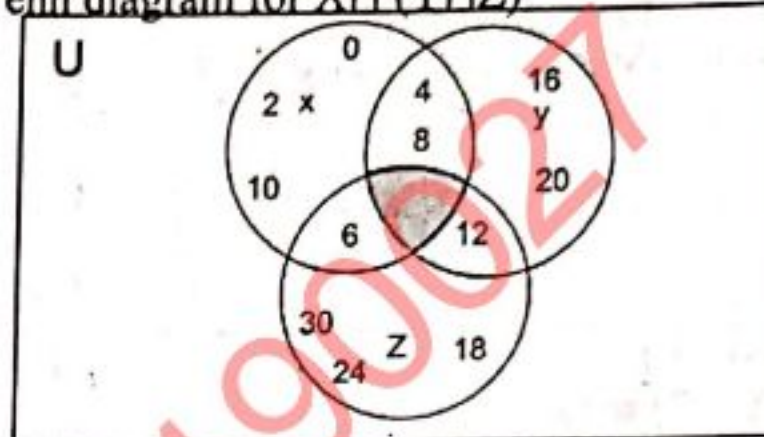


From (i) & (ii)

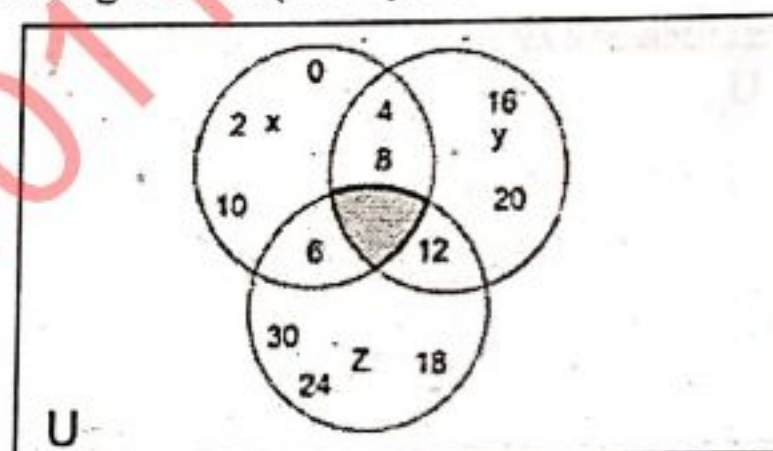
$$X \cup (Y \cap Z) = (X \cup Y) \cap Z$$

(ii) $X \cap (Y \cap Z) = (X \cap Y) \cap Z$

Venn diagram for $X \cap (Y \cap Z)$



Venn diagram for $(X \cap Y) \cap Z$

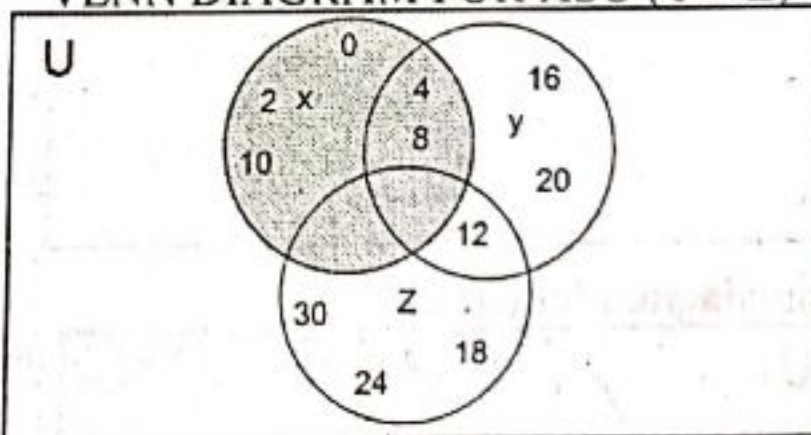


From (i) & (ii)

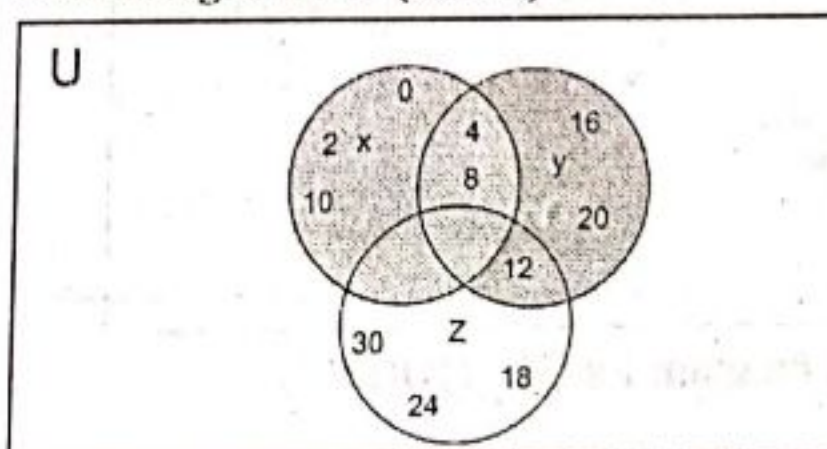
$$X \cap (Y \cap Z) = (X \cap Y) \cap Z$$

(iii) $X \cup (Y \cap Z) = (X \cup Y) \cap (X \cup Z)$

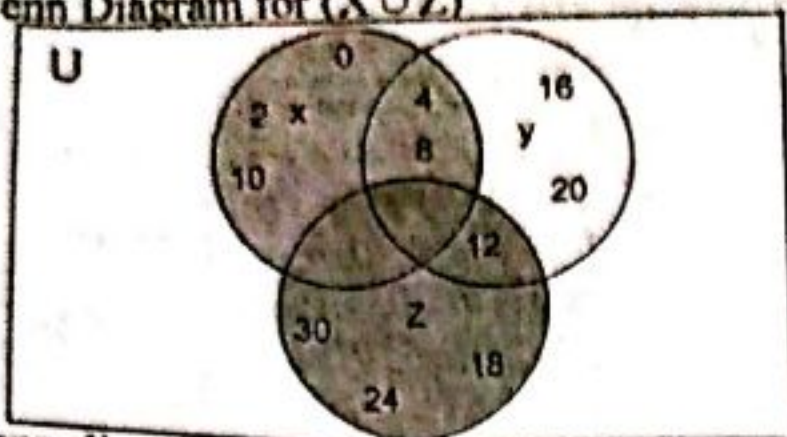
VENN DIAGRAM FOR $X \cup (Y \cap Z)$



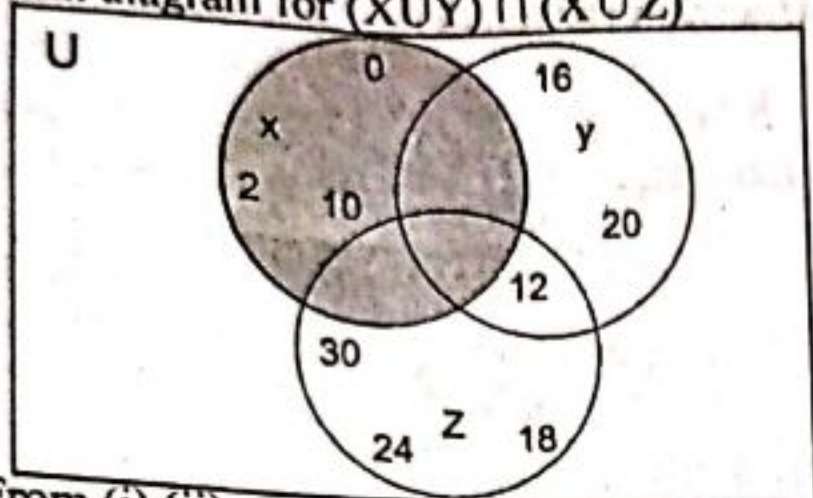
Venn Diagram for $(X \cup Y) \cap (X \cup Z)$



Venn Diagram for $(X \cup Z)$



Venn diagram for $(X \cup Y) \cap (X \cup Z)$

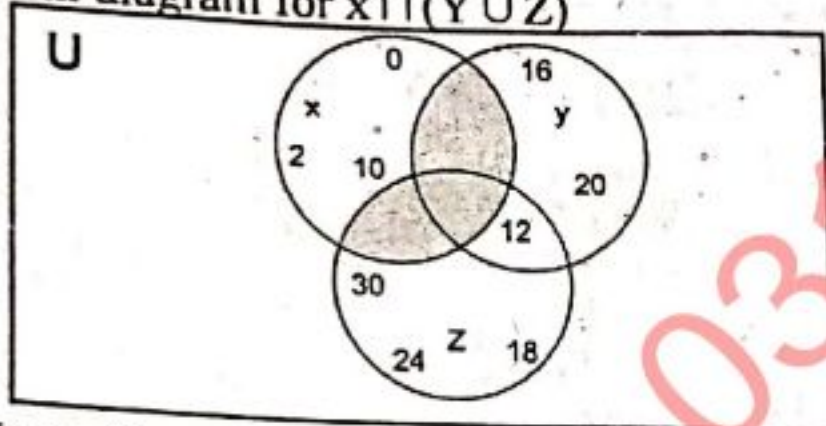


From (i) (ii)

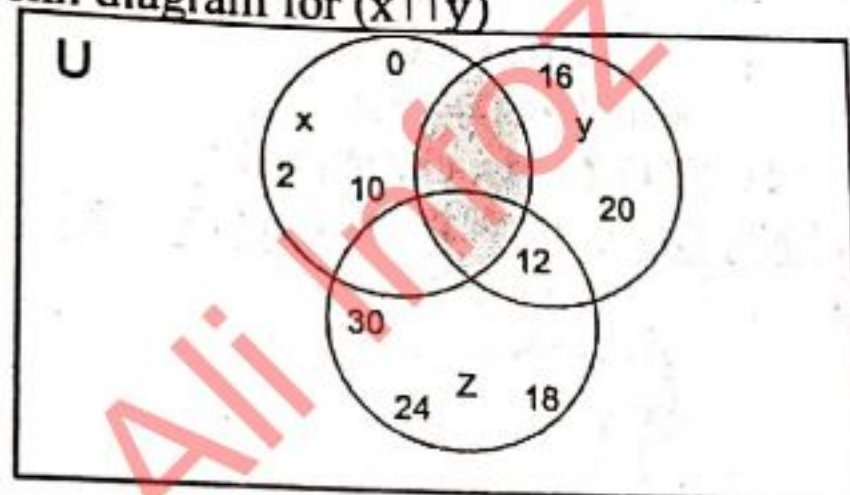
$$X \cup (Y \cap Z) = (X \cup Z)$$

$$(iv) \quad X \cap (Y \cup Z) = X \cap Y \cup X \cap Z$$

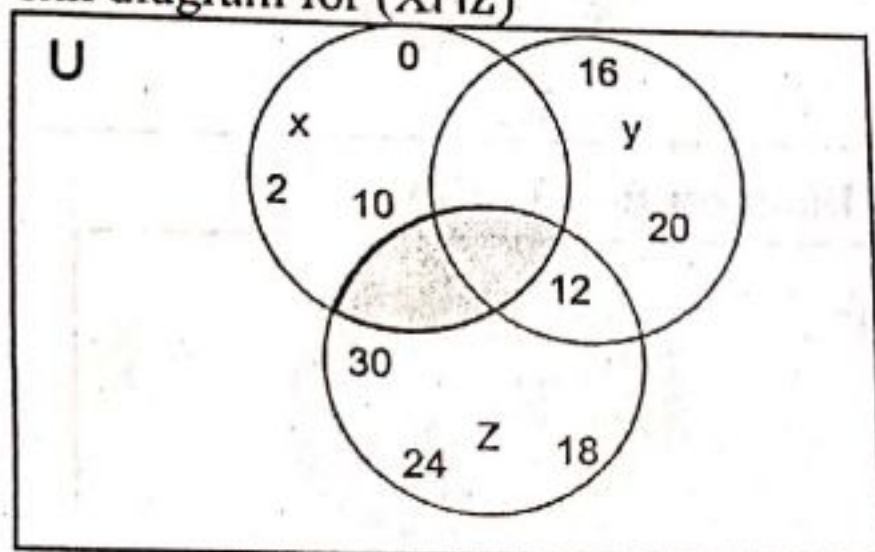
Venn diagram for $x \cap (Y \cup Z)$



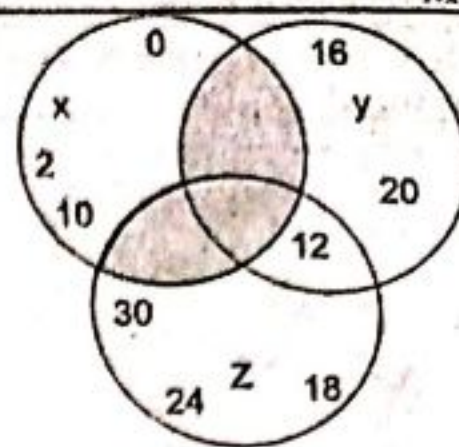
Venn diagram for $(x \cap y)$



Venn diagram for $(X \cap Z)$



Venn diagram for $(X \cap Y) \cup (x \cap Z)$



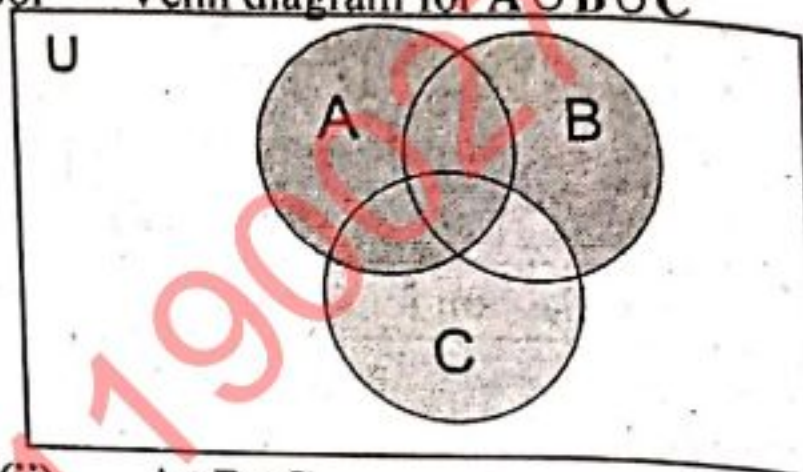
From (i) & (ii)

$$X \cap (Y \cup Z) = (X \cap Y) \cup (X \cap Z)$$

Q4. Use Venn diagrams to request.

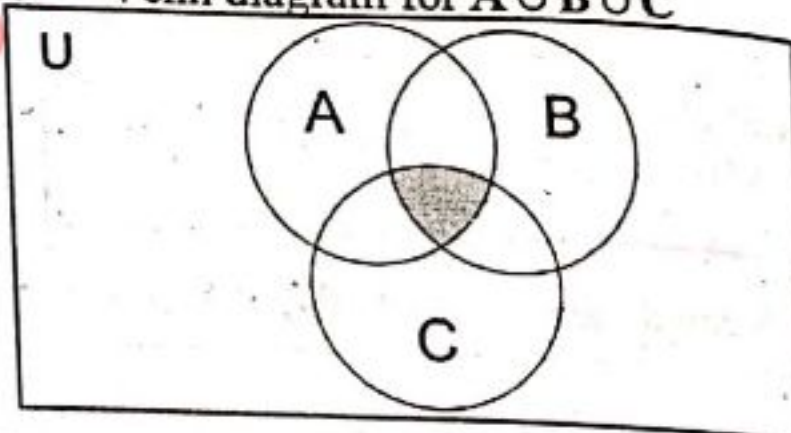
(i) $A \cup B \cup C$

Sol Venn diagram for $A \cup B \cup C$



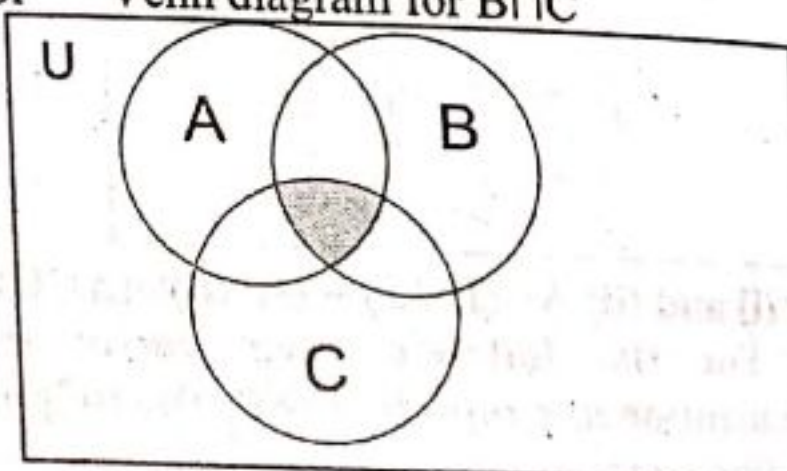
(ii) $A \cap B \cap C$

Sol Venn diagram for $A \cap B \cap C$

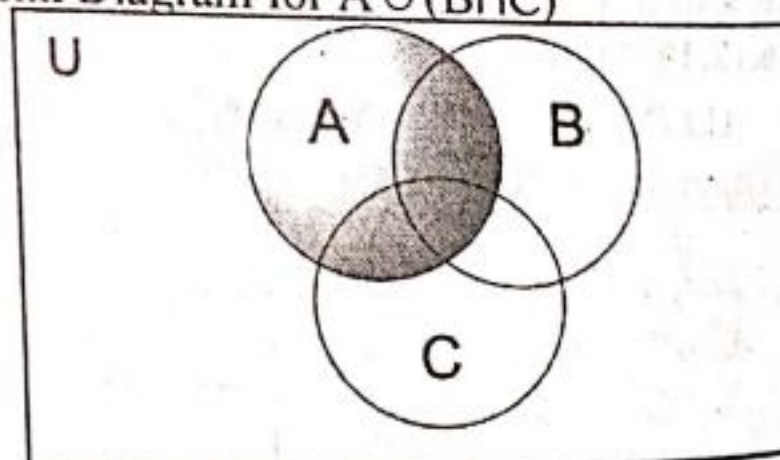


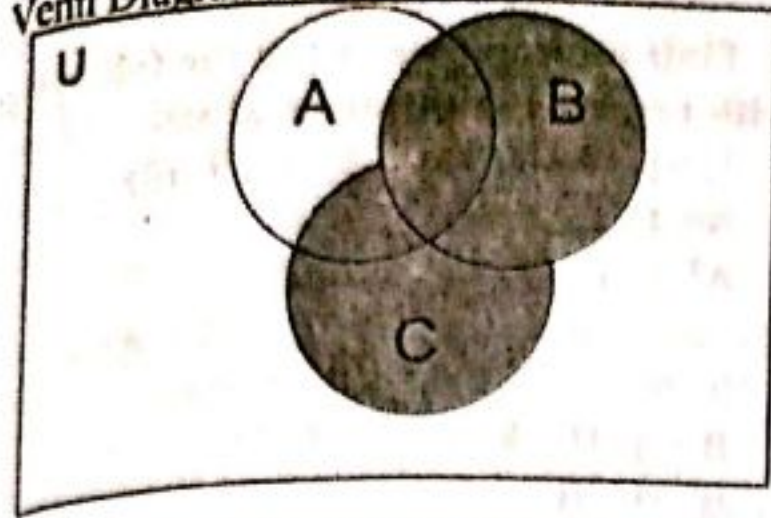
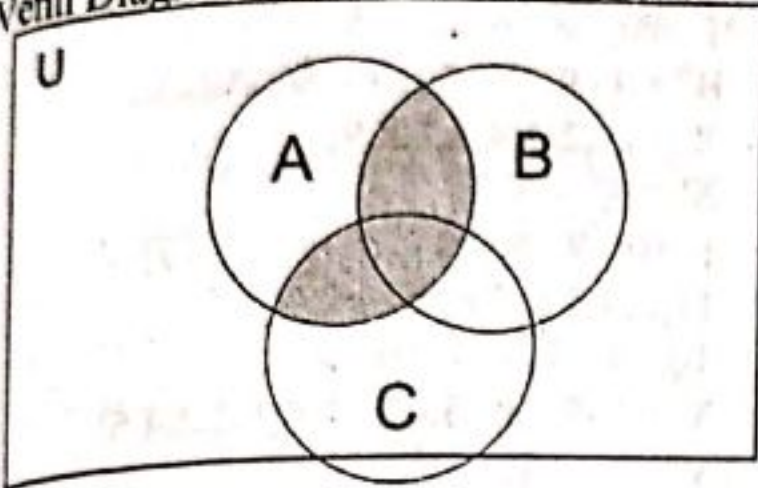
(iii) $A \cup (B \cap C)$

Sol Venn diagram for $B \cap C$



Venn Diagram for $A \cup (B \cap C)$



(iv) $A \cap (B \cup C)$ Venn Diagram for $B \cup C$ Venn Diagram for $A \cap (B \cup C)$ 

Q5. For the sets:

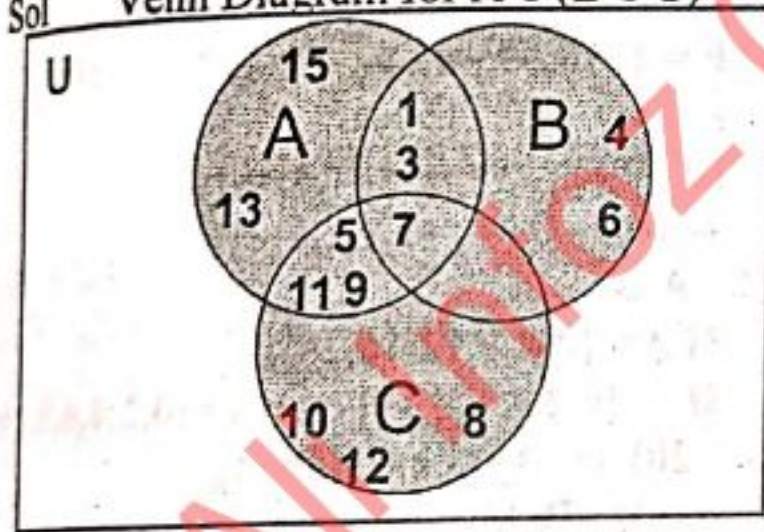
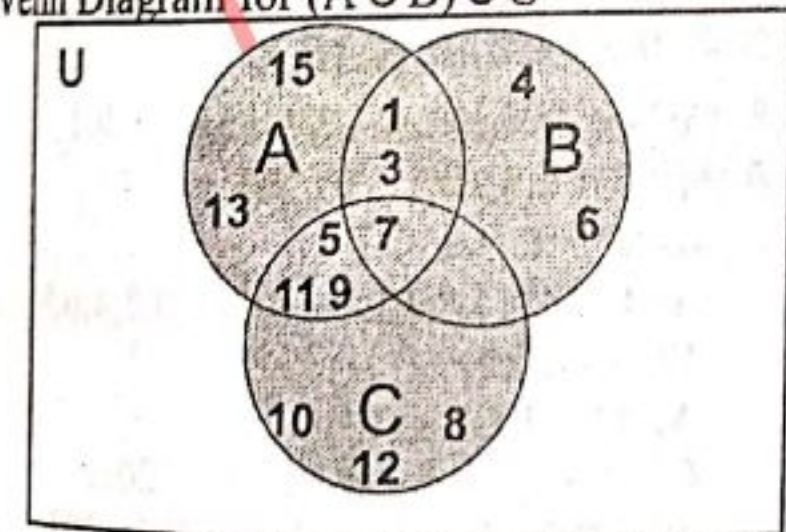
$$A = \{1, 3, 5, 7, 9, 11, 13, 15\}$$

$$B = \{1, 2, 3, 4, 5, 6, 7\} \text{ and}$$

$$C = \{7, 8, 9, 10, 11, 12\}$$

Use Venn diagrams to verify

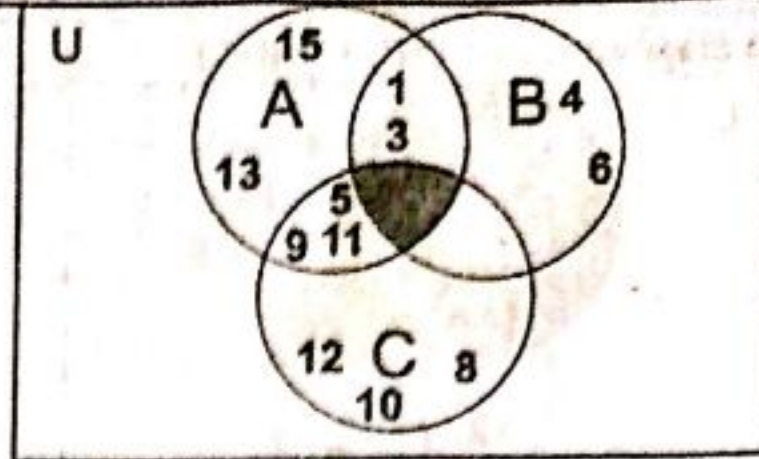
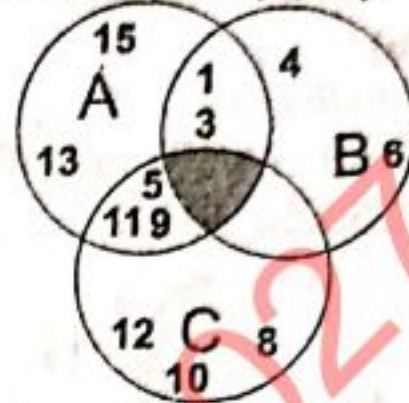
(i) $A \cup (B \cap C) = (A \cup B) \cap C$

Sol Venn Diagram for $A \cup (B \cap C)$ Venn Diagram for $(A \cup B) \cap C$ 

(ii) $A \cap (B \cap C) = (A \cap B) \cap C$

Sol Venn Diagram for $A \cap (B \cap C)$

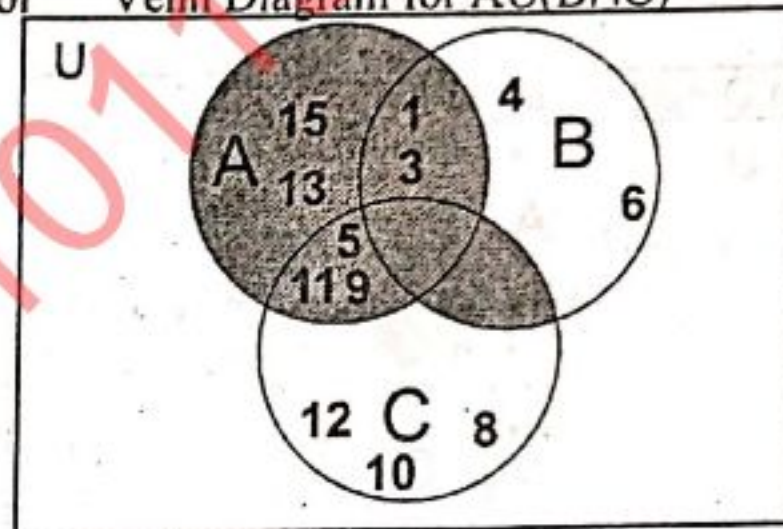
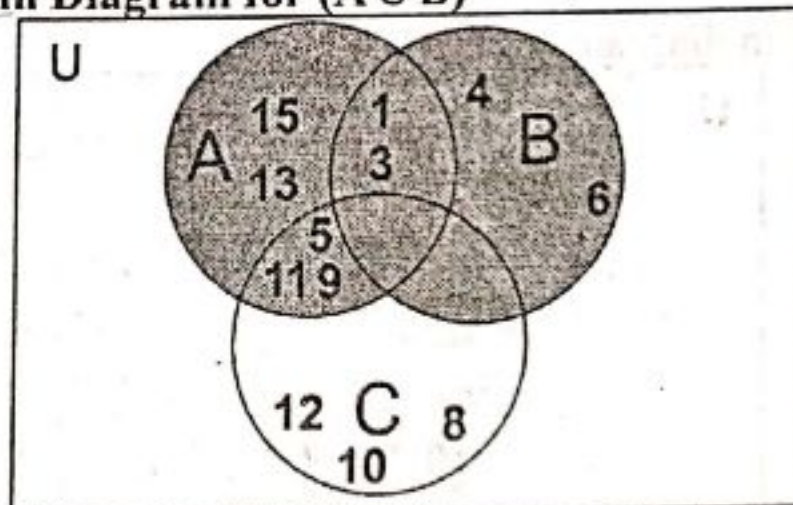
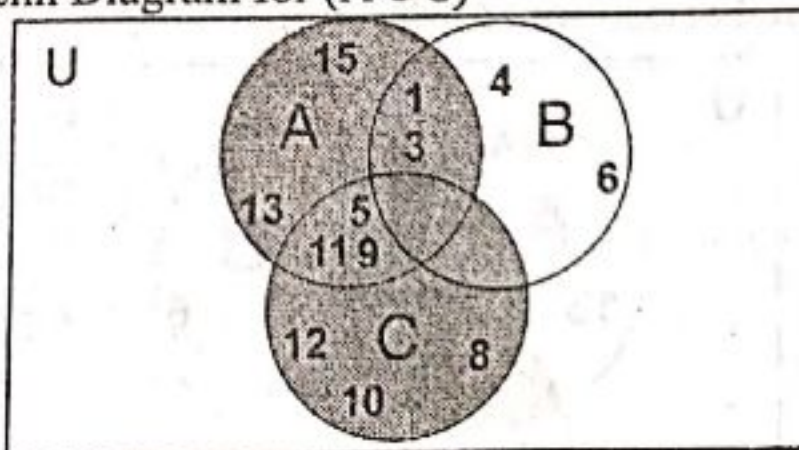
U

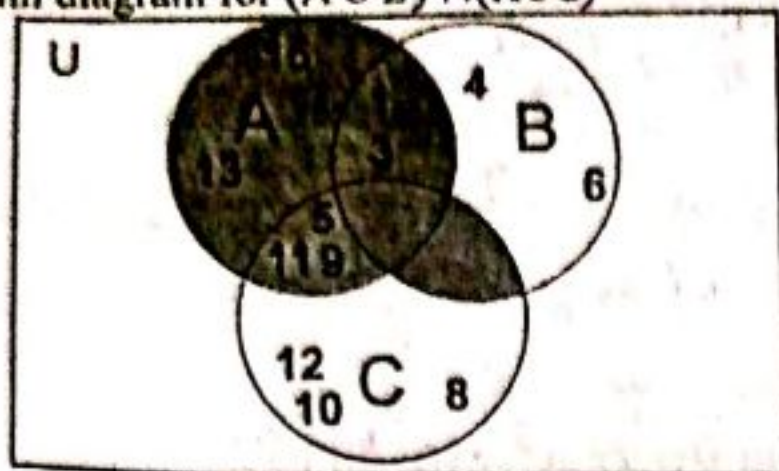
Venn Diagram for $(A \cap B) \cap C$ 

From (i) & (ii)

$$A \cap (B \cup C) = (A \cap B) \cap C$$

(iii) $A \cup (B \cap C) = (A \cup B) \cap C$

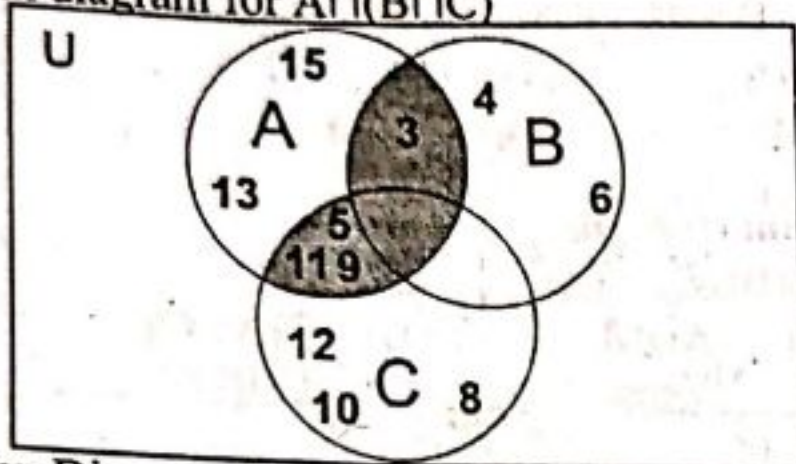
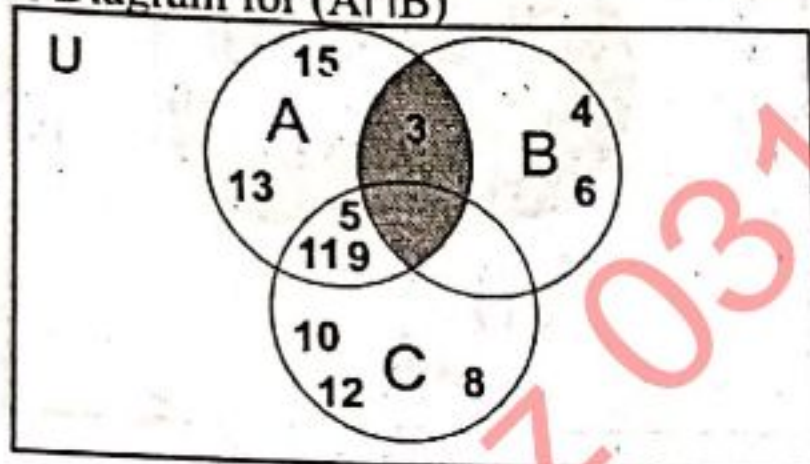
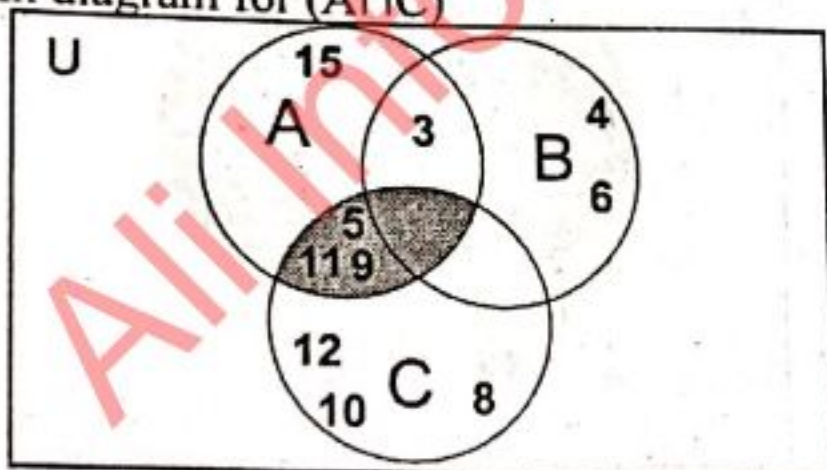
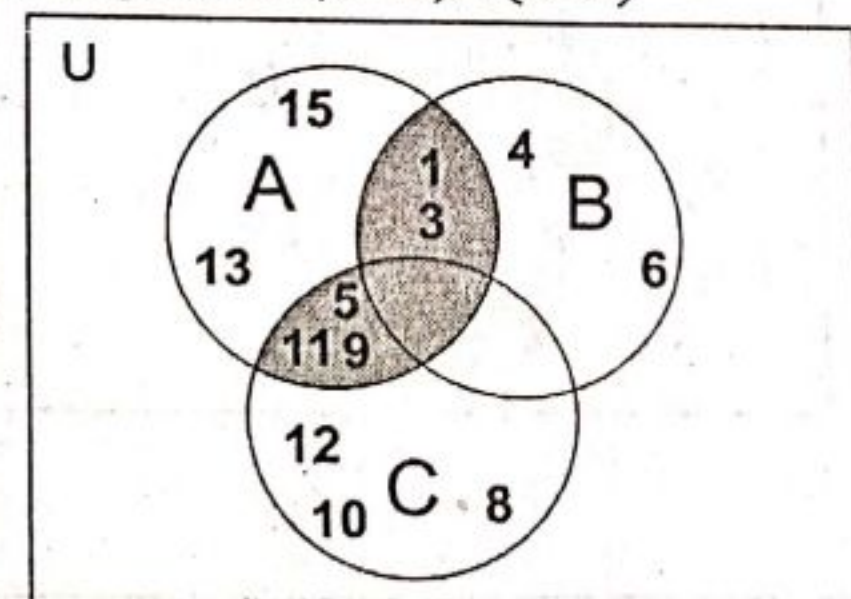
Sol Venn Diagram for $A \cup (B \cap C)$ Venn Diagram for $(A \cup B) \cap C$ Venn Diagram for $(A \cap C)$ 

Venn diagram for $(A \cup B) \cap (A \cup C)$ 

From (i) & (ii)

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

$$(iv) \quad A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

Venn diagram for $A \cap (B \cup C)$ Venn Diagram for $(A \cap B)$ Venn diagram for $(A \cap C)$ Venn diagram for $(A \cap B) \cup (A \cap C)$ 

From (i) & (ii)

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

Q6. Find the complement of the following sets with respect to the universal set:

$$U = \{-10, -9, -8, \dots, 0, \dots, 9, 10\}$$

$$(i) \quad A = \{0, 1, 2, 3, 4, 5\}$$

$$\text{Sol} \quad A^c = U - A$$

$$A^c = \{-10, -9, -8, \dots, 0, \dots, 9, 10\} - \{0, 1, 2, 3, 4, 5\}$$

$$A^c = \{-10, -9, -8, \dots, -1, 6, 7, 8, 9, 10\} \text{ Ans}$$

$$(ii) \quad B = \{-10, -8, -6, \dots, 8, 10\}$$

$$\text{Sol} \quad B^c = U - B$$

$$B^c = \{-10, -9, -8, \dots, 9, 10\} -$$

$$\{-10, -8, -6, \dots, 8, 10\}$$

$$B^c = \{-9, -7, -5, \dots, 9\} \text{ Ans}$$

$$(iii) \quad X = \{1, 2, 3, 4, 5, 7, 8, 9\}$$

$$\text{Sol} \quad X^c = U - X$$

$$X^c = \{-10, -9, -8, \dots, 0, \dots, 9, 10\} -$$

$$\{1, 2, 3, 4, 5, 7, 8, 9\}$$

$$X^c = \{-10, -9, -8, \dots, 0, 10\} \text{ Ans}$$

$$(iv) \quad Y = \{-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}$$

$$\text{Sol} \quad Y^c = U - Y$$

$$Y^c = \{-10, -9, -8, \dots, -6, -7, -8, 6, 7, 8, 9, 10\} -$$

$$\{-5, -4, 3, \dots, 3, 4, 5\}$$

$$Y^c = \{-10, -9, -8, -7, -6, 6, 7, 8, 9, 10\} \text{ Ans}$$

$$(v) \quad M = \{-1, 0, 1\}$$

$$\text{Sol} \quad M^c = U - M$$

$$M^c = \{-10, -9, -8, \dots, 0, \dots, 9, 10\} - \{-1, 0, 1\}$$

$$M^c = \{-10, -9, -8, \dots, -2, 2, 3, 4, \dots, 10\} \text{ Ans}$$

$$(vi) \quad P = \{-10, -9, -8, \dots, -1, 1, 2, \dots, 10\}$$

$$\text{Sol} \quad P^c = U - P$$

$$P^c = \{-10, -9, -8, \dots, 0, \dots, 9, 10\} -$$

$$\{-10, 9, -8, \dots, -1, 1, 2, \dots, 10\}$$

$$P^c = \{0\} \text{ Ans}$$

Q7. If $A = \{0, 4, 8, 12, 16, 20\}$, $B = \{0, 2, 4, 6, 8, 10\}$ and $C = \{0, 2, 4, 6, 8, 10, 12, \dots, 20\}$ verify the following.

$$(i) \quad A \cup B = B \cup A$$

$$A \cup B = \{0, 4, 8, 12, 16, 20\} \cup \{0, 2, 4, 6, 8, 10\}$$

$$A \cup B = \{0, 2, 4, 6, 8, 10, 12, 16, 20\}$$

$$B \cup A = \{0, 2, 4, 6, 8, 10\} \cup \{0, 4, 8, 12, 16, 20\}$$

$$B \cup A = \{0, 2, 4, 6, 8, 10, 12, 16, 20\}$$

$$(ii) \quad A \cap C = C \cap A$$

$$\text{Sol} \quad A \cap C = \{0, 4, 8, 12, 16, 20\} \cap \{0, 2, 4, 6, 8, 10, 12, \dots, 20\}$$

$$A \cap C = \{0, 4, 8, 12, 16, 20\}$$

$$C \cap A = \{0, 2, 4, 6, 8, 10, 12, \dots, 20\} \cap$$

$$\{0, 4, 8, 12, 16, 20\} = \{0, 4, 8, 12, 16, 20\}$$

$$\Rightarrow A \cap C = C \cap A$$

$$(iii) \quad A \cup (B \cap C) = (A \cup B) \cap C$$

$$\text{Sol} \quad B \cap C = \{0, 2, 4, 6, 8, 10, \dots, 20\}$$

$$A \cup (B \cap C) = \{0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$$

$$A \cup B = \{0, 2, 4, 6, 8, 10, 12, 16, 20\}$$

$$(A \cup B) \cup C = \{0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$$

$$\Rightarrow A \cup (B \cap C) = (A \cup B) \cup C$$

$$(iv) \quad B \cap (C \cap A) = (B \cap C) \cap A$$

$$C \cap A = \{0, 4, 8, 12, 16, 20\}$$

$$Sol \quad B \cap (C \cap A) = \{0, 4, 8\}$$

$$B \cap C = \{0, 2, 4, 6, 8, 10\}$$

$$(B \cap C) \cap A = \{0, 4, 8\}$$

$$\Rightarrow B \cap (C \cap A) = (B \cap C) \cap A$$

$$(v) \quad B \cup C = C \cup B$$

$$Sol \quad B \cup C = \{0, 2, 4, 6, 8, 10\} \cup \{0, 2, 4, 6, \dots, 20\}$$

$$B \cup C = \{0, 2, 4, \dots, 20\}$$

$$C \cup B = \{0, 2, 4, 6, \dots, 20\} \cup \{0, 2, 4, 6, 8, 10\}$$

$$C \cup B = \{0, 2, 4, \dots, 20\}$$

$$\Rightarrow B \cup C = C \cup B$$

$$(vi) \quad A - B \neq B - A$$

$$A - B = \{0, 4, 8, 12, 16, 20\} - \{0, 2, 4, 6, 8, 10\}$$

$$A - B = \{12, 16, 20\}$$

$$B - A = \{0, 2, 4, 6, 8, 10\} - \{0, 4, 8, 12, 16, 20\}$$

$$B - A = \{2, 6, 10\}$$

$$\Rightarrow A - B \neq B - A$$

Q8. State and verify the De Morgan's law for the following sets,

$$(i) \quad U = \{1, 2, 3, 4, 5, \dots, 30\},$$

$$A = \{1, 3, 5, 7, \dots, 25\} \text{ and}$$

$$B = \{2, 4, 6, 8, \dots, 26\}$$

Sol: De Morgan's Law:

$$(A \cup B)^c = A^c \cap B^c$$

$$(A \cap B)^c = A^c \cup B^c$$

$$A^c = U - A$$

$$A^c = \{2, 4, 6, \dots, 26, 27, 28, 29, 30\}$$

$$B^c = U - B$$

$$B^c = \{1, 3, 5, \dots, 27, 28, 29, 30\}$$

$$A \cup B = \{1, 2, 3, \dots, 26\}$$

$$A \cap B = \{ \}$$

$$(a) \quad (A \cup B)^c = A^c \cap B^c$$

$$(A \cup B)^c = U - (A \cup B)$$

$$= \{1, 2, 3, \dots, 30\} - \{1, 2, 3, \dots, 26\}$$

$$(A \cup B)^c = \{27, 28, 29, 30\}$$

$$A^c \cap B^c = \{27, 28, 29, 30\}$$

$$\Rightarrow (A \cup B)^c = A^c \cap B^c$$

$$(b) \quad (A \cap B)^c = A^c \cup B^c$$

$$(A \cap B)^c = U - (A \cap B)$$

$$= \{1, 2, 3, \dots, 30\} - \{ \}$$

$$(A \cap B)^c = \{1, 2, 3, \dots, 30\}$$

$$A^c \cup B^c = \{1, 2, 3, \dots, 30\}$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$(ii) \quad U = \mathbb{Z} \text{ (set of integers)}$$

$$A = E \text{ (Set of even integers) and}$$

$$B = \mathbb{Z}^- \text{ (set of negative integers)}$$

Sol De Morgan's law

$$(A \cup B)^c = A^c \cap B^c$$

$$(A \cap B)^c = A^c \cup B^c$$

$$A^c = U - A$$

$$A^c = \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{0, 2, 4, 6, \dots\}$$

$$A^c = \{\pm 1, -2, \pm 3, -4, \pm 5, \dots\}$$

$$B^c = U - B$$

$$B^c = \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{-1, -2, -3, \dots\}$$

$$B^c = \{0, 1, 2, 3, \dots\}$$

$$A \cup B = \{0, 2, 4, 6, \dots\} \cup \{-1, -2, -3, \dots\}$$

$$A \cup B = \{\dots, -3, -2, -1, 0, 2, 4, 6, \dots\}$$

$$A \cap B = \{0, 2, 4, 6, \dots\} \cap \{-1, -2, -3, \dots\}$$

$$A \cap B = \{ \}$$

$$(a) \quad (A \cup B)^c = A^c \cap B^c$$

$$Sol \quad (A \cup B)^c = U - (A \cup B)$$

$$(A \cup B)^c = \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{\dots, -3, -2, -1, 0, 2, 4, 6, \dots\}$$

$$(A \cup B)^c = \{1, 3, 5, 7, \dots\}$$

$$A^c \cap B^c = \{\pm 1, -2, \pm 3, -4, \pm 5, \dots\} \cap \{0, 1, 2, 3, \dots\}$$

$$A^c \cap B^c = \{1, 3, 5, 7, \dots\} \Rightarrow (A \cup B)^c = A^c \cap B^c$$

$$(A \cap B)^c = A^c \cup B^c$$

$$(A \cap B)^c = U - (A \cap B)$$

$$= \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{ \}$$

$$(A \cap B)^c = \{0, \pm 1, \pm 2, \pm 3, \dots\}$$

$$A^c \cup B^c = \{\pm 1, -2, \pm 3, -4, \pm 5, \dots\} \cup \{0, 1, 2, 3, \dots\}$$

$$A^c \cup B^c = \{0, \pm 1, \pm 2, \pm 3, \dots\}$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

$$\{-10, -5, 0, 5, 10\}$$

$$X \cup Z = \{-10, -9, -7, -5, -3, -1, 0, 1, 3, 5, 10\}$$

$$(X \cup Y) \cap (X \cup Z) = \{-9, -7, -5, -3, -1, 0, 1, 3\}$$

$$X \cup (Y \cap Z) = (X \cup Y) \cap (X \cup Z)$$

(ii) $X \cap (Y \cup Z) = (X \cap Y) \cup (X \cap Z)$

Sol $Y \cup Z = \{-5, -3, -1, 0, 3, 5\} \cup \{-10, -5, -0, 5, 10\}$

$$Y \cup Z = \{-10, -5, -3, -1, 0, 1, 3, 5, 10\}$$

$$X \cap (Y \cup Z) = \{-5, -3, -1, -0, 1, 3\}$$

$$X \cap Y = \{-9, -7, -5, -3, -1, 0, 1, 3\} \cap \{-5, -3, -1, 0, 1, 3, 5\}$$

$$X \cap Y = \{-5, -3, -1, 0, 1, 3\}$$

$$X \cap Z = \{-9, -7, -5, -3, -1, 0, 1, 3\} \cap \{-10, -5, 0, 5, 10\}$$

$$X \cap Z = \{-5, 0\}$$

$$(X \cap Y) \cup (X \cap Z) = \{-5, -3, -1, 0, 1, 3\} \cup \{-5, 0\}$$

$$(X \cap Y) \cup (X \cap Z) = \{-5, -3, -1, 0, 1, 3\}$$

$$\Rightarrow X \cap (Y \cup Z) = (X \cap Y) \cup (X \cap Z)$$

Q10. State and verify the associative and distributive laws for the sets:

(i) $R = \{2, 4, 6, 8, \dots\}$
 $S = \{0, 1, 3, 5, 7, \dots\}$
 $T = \{2, 3, 5, 7, 11, \dots\}$

Sol Associative laws of sets.

(a) $R \cap (S \cap T) = (R \cap S) \cap T$ (w.r.t. Intersection)

(b) $R \cup (S \cup T) = (R \cup S) \cup T$ (w.r.t. Union)

(a) $R \cap (S \cap T) = (R \cap S) \cap T$

Sol $S \cap T = \{0, 1, 3, 5, 7, \dots\} \cap \{2, 3, 5, 7, 11, \dots\}$
 $S \cap T = \{3, 5, 7, \dots\}$

$$R \cap (S \cap T) = \{ \}$$

$$R \cap S = \{2, 4, 6, 8, \dots\} \cap \{0, 1, 3, 5, 7, \dots\}$$

$$R \cap S = \{ \}$$

$$(R \cap S) \cap T = \{ \} \cap \{2, 3, 5, 7, 11, \dots\}$$

$$(R \cap S) \cap T = \{ \}$$

$$(R \cap S) \cap T = \{ \} \cap \{2, 3, 5, 7, 11, \dots\}$$

$$(R \cap S) \cap T = \{ \}$$

$$\Rightarrow R \cap (S \cap T) = (R \cap S) \cap T$$

(b) $R \cup (S \cup T) = (R \cup S) \cup T$

Sol $S \cup T = \{0, 1, 3, 5, 7, \dots\} \cup \{2, 3, 5, 7, 11, \dots\}$

$$S \cup T = \{0, 1, 2, 3, \dots\}$$

$$R \cup (S \cup T) = \{2, 4, 6, 8, \dots\} \cup \{0, 1, 2, 3, \dots\}$$

$$R \cup (S \cup T) = \{0, 1, 2, 3, \dots\}$$

$$R \cup S = \{2, 4, 6, 8, \dots\} \cup \{0, 1, 3, 5, 7, \dots\}$$

$$R \cup S = \{0, 2, 3, \dots\}$$

$$(R \cup S) \cup T = \{0, 1, 2, 3, \dots\} \cup \{2, 3, 5, 7, 11, \dots\}$$

$$(R \cup S) \cup T = \{0, 1, 2, 3, \dots\}$$

$$\Rightarrow (R \cup S) \cup T = R \cup (S \cup T)$$

Distributive laws: -

(c) Distributive property of Union of Sets over intersections.

$$R \cup (S \cap T) = (R \cup S) \cap (R \cup T)$$

(d) Distributive property of intersection of sets over union.

(c) $R \cup (S \cap T) = (R \cup S) \cap (R \cup T)$

Sol $S \cap T = \{0, 1, 3, 5, 7, \dots\} \cap \{2, 3, 5, 7, 11, \dots\}$

$$S \cap T = \{3, 5, 7, \dots\}$$

$$R \cup (S \cap T) = \{2, 4, 6, 8, \dots\} \cup \{3, 5, 7, \dots\}$$

$$R \cup (S \cap T) = \{2, 3, 4, 5, \dots\}$$

$$R \cup S = \{2, 4, 6, 8, \dots\} \cup \{0, 1, 3, 5, 7, \dots\}$$

$$R \cup S = \{0, 1, 2, 3, \dots\}$$

$$R \cup T = \{2, 4, 6, 8, \dots\} \cup \{2, 3, 5, 7, 11, \dots\}$$

$$(R \cup T) = \{2, 3, 4, 5, \dots\}$$

$$(R \cup S) \cap (R \cup T) = \{0, 1, 2, 3, \dots\} \cap \{2, 3, 4, 5, \dots\}$$

$$(R \cup S) \cap (R \cup T) = \{2, 3, 4, 5, \dots\}$$

$$\Rightarrow R \cup (S \cap T) = (R \cup S) \cap (R \cup T)$$

(d) $R \cap (S \cup T) = (R \cap S) \cup (R \cap T)$

Sol $S \cup T = \{0, 1, 3, 5, 7, \dots\} \cup \{2, 3, 5, 7, 11, \dots\}$

$$S \cup T = \{0, 1, 2, 3, 5, 7, \dots\}$$

$$R \cap (S \cup T) = \{2, 4, 6, 8, \dots\} \cap \{0, 1, 2, 3, 5, 7, \dots\}$$

$$R \cap (S \cup T) = \{2\}$$

$$R \cap S = \{2, 4, 6, 8, \dots\} \cap \{0, 1, 3, 5, 7, \dots\}$$

$$R \cap S = \{ \}$$

$$R \cap T = \{2, 4, 6, 8, \dots\} \cap \{2, 3, 5, 7, 11, \dots\}$$

$$R \cap T = \{2\}$$

$$(R \cap S) \cup (R \cap T) = \{ \} \cup \{2\}$$

$$(R \cap S) \cup (R \cap T) = \{2\}$$

$$\Rightarrow R \cap (S \cup T) = (R \cap S) \cup (R \cap T)$$

(ii) $M = \{x \mid x \in W \wedge 1 \leq x < 10\}$

$$N = \{x \mid x \in P \wedge 2 < x \leq 13\}$$

$$O = \{x \mid x \in N \wedge 1 \leq x \leq 8\}$$

Sol $M = \{1, 2, 3, \dots, 9\}$

$$N = \{3, 5, 7, 11, 13\}$$

$$O = \{1, 2, 3, \dots, 8\}$$

Associative law of sets.

(a) $M \cap (N \cap O) = (M \cap N) \cap O$
w.r.t union

(b) $M \cup (N \cup O) = (M \cup N) \cup O$ (w.r.t union)

(a) $M \cap (N \cap O) = (M \cap N) \cap O$

$$N \cap O = \{3, 5, 7\}$$

$$M \cap (N \cap O) = \{3, 5, 7\}$$

$$M \cap N = \{1, 2, 3, \dots, 9\} \cap \{3, 5, 7, 11, 13\}$$

$$M \cap N = \{3, 5, 7\}$$

$$(M \cap N) \cap O = \{3, 5, 7\} \cap \{1, 2, 3, \dots, 8\}$$

$$(M \cap N) \cap O = \{3, 5, 7\}$$

$$\Rightarrow M \cup (N \cap O) = (M \cup N) \cup O$$

$$(b) M \cup (N \cap O) = (M \cup N) \cup O$$

$$N \cup O = \{3, 5, 7, 11, 13\} \cup \{1, 2, 3, \dots, 8\}$$

$$N \cup O = \{1, 2, 3, \dots, 8, 11, 13\}$$

$$M \cup (N \cup O) = \{1, 2, 3, \dots, 9\} \cup$$

$$\{1, 2, 3, \dots, 8, 11, 13\} = \{1, 2, 3, \dots, 9, 11, 13\}$$

$$M \cup N = \{1, 2, 3, \dots, 9\} \cup \{3, 5, 7, 11, 13\}$$

$$M \cup N = \{1, 2, 3, \dots, 9, 11, 13\}$$

$$(M \cup N) \cup O = \{1, 2, 3, \dots, 9, 11, 13\} \cup$$

$$\{1, 2, 3, \dots, 8\}$$

$$(M \cup N) \cup O = \{1, 2, 3, \dots, 9, 11, 13\}$$

$$\Rightarrow M \cap (N \cap O) = (M \cap N) \cap O$$

(c) Distributive property of Union of sets over intersection.

$$M \cup (N \cap O) = (M \cup N) \cap (M \cup O)$$

(d) Distributive property of intersection of sets over union.

$$M \cap (N \cup O) = (M \cap N) \cup (M \cap O)$$

$$(c) M \cup (N \cap O) = (M \cup N) \cap (M \cup O)$$

$$N \cap O = \{3, 5, 7, 11, 13\} \cap \{1, 2, 3, \dots, 8\}$$

$$N \cap O = \{3, 5, 7\}$$

$$M \cup (N \cap O) = \{1, 2, 3, \dots, 9\} \cup \{3, 5, 7\}$$

$$M \cup (N \cap O) = \{1, 2, 3, \dots, 9\}$$

$$M \cup N = \{1, 2, 3, \dots, 9\} \cup \{3, 5, 7, 11, 13\}$$

$$M \cup N = \{1, 2, 3, \dots, 9, 11, 13\}$$

$$M \cup O = \{1, 2, 3, \dots, 9\} \cup \{1, 2, 3, \dots, 8\}$$

$$M \cup O = \{1, 2, 3, \dots, 9\}$$

$$(M \cup N) \cap (M \cup O) = \{1, 2, 3, \dots, 9, 11, 13\} \cap$$

$$\{1, 2, 3, \dots, 9\}$$

$$(M \cup N) \cap (M \cup O) = \{1, 2, 3, \dots, 9\}$$

$$\Rightarrow M \cup (N \cap O) = (M \cup N) \cap (M \cup O)$$

$$(d) M \cap (N \cup O) = (M \cap N) \cup (M \cap O)$$

$$N \cup O = \{3, 5, 7, 11, 13\} \cup \{1, 2, 3, \dots, 8\}$$

$$N \cup O = \{1, 2, 3, \dots, 8, 11, 13\}$$

$$M \cap (N \cup O) = \{1, 2, 3, \dots, 9\} \cap \{1, 2, 3, \dots, 8, 11, 13\}$$

$$M \cap (N \cup O) = \{1, 2, 3, \dots, 8\}$$

$$M \cap N = \{1, 2, 3, \dots, 9\} \cap \{3, 5, 7, 11, 13\}$$

$$M \cap N = \{3, 5, 7\}$$

$$M \cap O = \{1, 2, 3, \dots, 9\} \cap \{1, 2, 3, \dots, 8\}$$

$$M \cap O = \{1, 2, 3, \dots, 8\}$$

$$(M \cap N) \cup (M \cap O) = \{3, 5, 7\} \cup \{1, 2, 3, \dots, 8\}$$

$$(M \cap N) \cup (M \cap O) = \{1, 2, 3, \dots, 8\}$$

$$\Rightarrow M \cap (N \cup O) = (M \cap N) \cup (M \cap O)$$

Q11. On a certain day 80 customers visited a stationary shop. 30 customers bought pencils, 25 customers bought erasers and 15 bought both pencils and erasers. Remaining

customer bought other stationary items. Show this information using venn diagram.

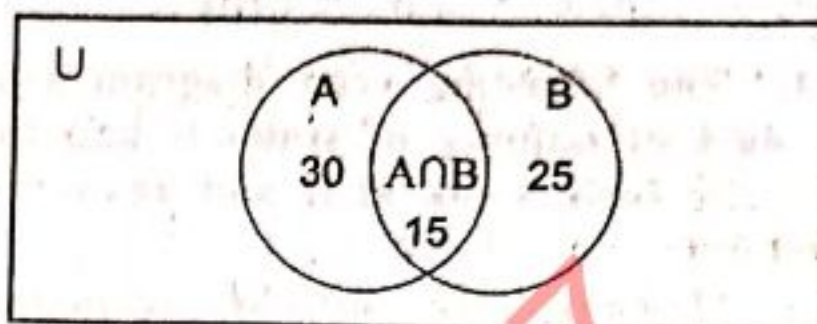
Sol Total customers = 80

Bought pencils = 30 Bought erasers = 25

Both bought pencils and erasers = 15

Remaining = $80 - 30 - 25 - 15 = 10$

Venn Diagram



Q12. In a math book are total 15 units, 6 units are based on algebra and 5 units are based on numbers and operation 2 units are based on both algebra and numbers operation. Other units are based on other standards. Show this information through Venn diagram.

Sol Total units = 15

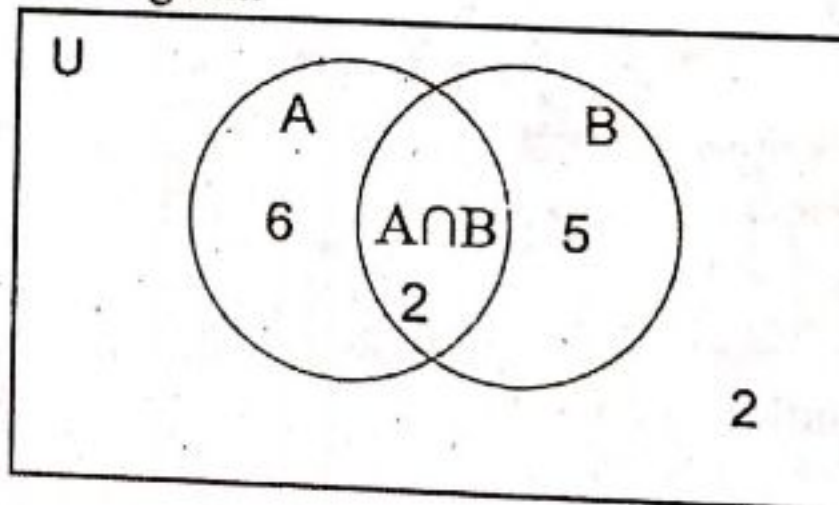
Based on algebra = 6

Based on numbers and operations = 5

Based on both algebra and numbers operation = 2

Based on other standards = $15 - 6 - 5 - 2 = 2$

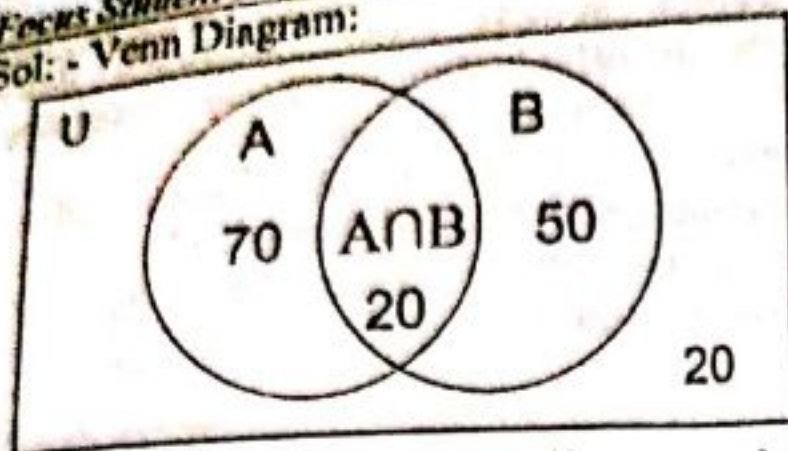
Venn Diagram: -



Q13. The data of 160 students who like math. Science and other subjects.

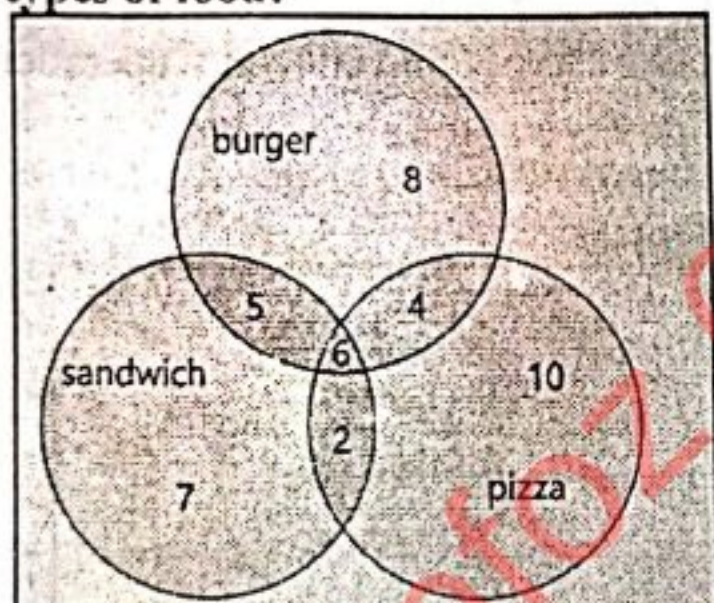
Students who like Maths	Students who like science	Students who like maths and science both	Students who like subjects other than maths and science
70	50	20	20

Create a Venn diagram to illustrate this information.



Q14. The following venn diagram shows the data of number of students and their favourite food. Look at it and answer the questions:

- How many students like only pizza?
- How many students like only sandwich?
- How many students like both pizza and burger?
- How many students like both sandwich and pizza?
- How many students like only pizza and sandwich?
- How many students like all three types of food?



Solution of Part (a)

$$10 + 4 + 6 + 2 = 22$$

22 students like pizza

Solution of Part (b)

7 students who like only sandwich.

Solution of Part (c):

4 students who like both pizza and burger.

Solution of Part (d)

2 students who like both sandwich and pizza.

Solution of Part (e)

$$10 + 7 = 17$$

17 students who like only pizza and sandwich

Solution of part (f)

$$8 + 4 + 5 + 6 + 7 + 2 + 10 = 42$$

42 students who like all three types of food.

Ans

Review exercise (TB Page 101)

Q1. Choose the correct option.

(a) In _____ form of set characteristics of numbers or elements of a particular set are described.

- descriptive
- power
- tabular
- set builder

(b) The set of days of week is the form of set.

- descriptive
- tabular
- set builder
- venn diagram

(c) If a set has three elements then the number of subsets of that set is:

- 6
- 9
- 12
- 3

(d) The power set of the set $A = \{3, 4\}$ is:

- $\{\emptyset, \{3\}, \{4\}, \{3, 4\}\}$
- $\{\{3\}, \{4\}, \{3, 4\}\}$
- $\{\emptyset, \{3\}, \{4\}, \{3, 3\}, \{3, 4\}, \{4, 4\}\}$
- $\{\emptyset, \{3\}, \{4\}, \{3, 4\}, \{4, 3\}\}$

(e) _____ is not the subset of prime numbers up to 10.

- $\{5\}$
- $\{3\}$
- $\{2\}$
- $\{11\}$

(f) The tabular form of the set $A = \{x \mid x \in \mathbb{Z} \wedge x > -4\}$ is:

- $\{-3, -2, -1, 0, 1, 2, 3, \dots\}$
- $\{\{3\}, \{4\}, \{3, 4\}\}$
- $\{\emptyset, \{3\}, \{4\}, \{3, 4\}, \{3, 4\}, \{4, 4\}\}$
- $\{\emptyset, \{3\}, \{4\}, \{3, 4\}, \{4, 3\}\}$

(g) The commutative property of sets with respect to intersection is:

- $A \cup B = B \cup A$
- $A \cup B = A \cap B$
- $A \cap B = B \cup A$
- $A \cap B = B \cap A$

(h) If $U = \{1, 2, 3, 4, \dots, 10\}$ and $A = \{4, 6, 8\}$ then complement of A is:

- $\{1, 2, 3, 5, 7, 9, 10\}$
- $\{3, 5, 7, 9\}$
- $\{1, 2, 3, \dots, 10\}$
- $\{1, 2, 3, 5, 6, \dots, 10\}$

(i) The De-Morgan's law is:

- $(A^c \cap B)^c = A^c \cap B^c$
- $(A \cap B)^c = A^c \cup B^c$
- $(A \cap B^c)^c = A^c \cap B$
- $(A^c \cap B^c)^c = A^c \cap B^c$

Q2. Define the following:

(a) **Tabular form**

Ans In this form, members of a set are written within braces and are separated by commas. Here is an example of tabular form.

$$A = \{1, 3, 5, 7, 9, 11, 13, 17, 19\}$$

$$B = \{a, e, i, o, u\}$$

(b) **Descriptive form**

Ans In this form, instead of writing all the members of the set, such a sentence is written which makes inclusion of each and every members of the set clear. Here is an example of descriptive form.

(i) Set of first ten odd integers

(ii) Set of vowels of English alphabets

(c) **Set builder Notation**

Ans. In this form a set, a general element x and its, characteristic property is mentioned which is common to all the elements of the set. Here is an example of set-builder form:

(i) $A = \{x | x \text{ is odd number and is less than } 20\}$

(ii) $B = \{x | x \text{ is a vowel of English alphabets}\}$

(d) **Union of sets**

Ans. If A and B are any two sets, then the union of set A and Set B consists of all elements in set A or in Set B and is denoted by $A \cup B$, In set builder form.

$$\{A \cup B = \{x | x \in A \text{ or } x \in B\}$$

Q3. Write the given set in set builder notation.

(a) $\{2, 4, 6, 8, 10, \dots, 24\}$

Sol $\{x | x \in E \wedge 0 < x < 26\}$ **Ans**

(b) **The set of prime numbers upto 50.**

Sol $\{x | x \in P \wedge x < 50\}$ **Ans**

(c) **The set of natural numbers upto 20**

Sol $\{x | x \in N \wedge x < 21\}$ **Ans**

(d) $\{5, 10, 15, 20, \dots, 50\}$

Sol $\{x | x \in 5n, n = 1, 2, 3, \dots, 10\}$ **Ans**

Q4. Write the given set in descriptive form.

(a) $\{x | x \in W \wedge x < 20\}$

Sol Set of whole numbers less than 20.

(b) $\{7, 9, 11, 13, \dots\}$

Sol Set of Prime numbers greater than 5.

(c) $\{4, 8, 12, 16, 20\}$

Sol set of multiples of 4 between 0 and 24.

(d) $\{y \text{ is a composite number, } 24 \geq y \leq\}$

Sol Set of composite numbers between 10 and 25, **Ans**

Q5. Write the given sets into tabular form.

(a) **The set of multiples of 9 a greater than 12 and less than 100.**

Sol $\{18, 27, 36, \dots, 99\}$ **Ans**

(b) $\{x | x \in Z \wedge -5 \leq x \leq 20\}$

Sol $= \{-5, -4, -3, \dots, 20\}$ **Ans**

(c) **Set of odd numbers upto 30**

Sol $\{1, 3, 5, \dots, 30\}$ **Ans**

(d) $\{x | x \in E\}$

Sol $\{0, 2, 4, 6, \dots\}$ **Ans**

Q6. Write the power sets of the given sets.

(a) $\{1, 2, 3\}$

Sol let $A = \{1, 2, 3\}$

$$P(A) = \{\Phi, \{1\}, \{2\}, \{3\}, \{1, 2\}$$

$$\{1, 3\}, \{2, 3\}, \{1, 2, 3\}\}$$
 Ans

(b) $\{5, 8, 9, 11\}$

Sol Let $A = \{5, 8, 9, 11\}$

$$P(A) = \{\Phi, \{5\}, \{8\}, \{9\}, \{11\}$$

$$\{5, 8\}, \{5, 9\}, \{5, 11\}, \{8, 9\}, \{8, 11\}$$

$$\{9, 11\}, \{5, 8, 9\}, \{5, 8, 11\}, \{5, 9, 11\}$$

$$\{8, 9, 11\}, \{5, 8, 9, 11\}\}$$
 Ans

(c) $\{0\}$

Sol Let $A = \{0\}$

$$P(A) = \{\Phi, \{0\}\}$$
 Ans

(d) $\{12, 13\}$

Sol Let $A = \{12, 13\}$

$$P(A) = \{\Phi, \{12\}, \{13\}, \{12, 13\}\}$$
 Ans

Q7. If $A = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$,

$B = \{1, 2, 3, 4, \dots, 10\}$, and $U =$ set of integers verify the De-Morgan's law and show it by using venn diagram.

Sol De Morgan's Law

$$(i) (A \cup B)^c = A^c \cap B^c$$

$$(ii) (A \cap B)^c = A^c \cup B^c$$

$$A^c = U - A$$

$$A^c = \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$$

$$A^c = \{\pm 5, \pm 6, \pm 7, \dots\}$$

$$B^c = U - B$$

$$= \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{1, 2, 3, \dots, 10\}$$

$$B^c = \{0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, \pm 11, \pm 12, \dots\}$$

$$(i) (A \cup B)^c = A^c \cap B^c$$

$$A \cup B = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\} \cup \{1, 2, 3, \dots, 10\}$$

$$A \cup B = \{0, \pm 1, \pm 2, \pm 3, \pm 4, 5, 6, 7, 8, 9, 10\}$$

$$(A \cup B)^c = U - (A \cup B)$$

$$(A \cup B)^c = \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{0, \pm 1, \pm 2, \pm 3, \pm 4, 5, 6, 7, 8, 9, 10\}$$

$$(A \cup B)^c = \{-5, -6, -7, -8, -9, -10, +11, +12, \dots\}$$

$$A^c \cap B^c = \{-5, -6, -7, -8, -9, -10, +11, +12, \dots\}$$

$$\Rightarrow (A \cup B)^c = A^c \cap B^c$$

$$(ii) (A \cap B)^c = A^c \cup B^c$$

$$A \cap B = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\} \cap \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A \cap B = \{1, 2, 3, 4\}$$

$$(A \cap B)^c = U - (A \cap B)$$

$$= \{0, \pm 1, \pm 2, \pm 3, \dots\} - \{1, 2, 3, 4\}$$

$$(A \cap B)^c = \{0, -1, -2, -3, -4, \dots, \pm 5, \pm 6, \pm 7, \dots\}$$

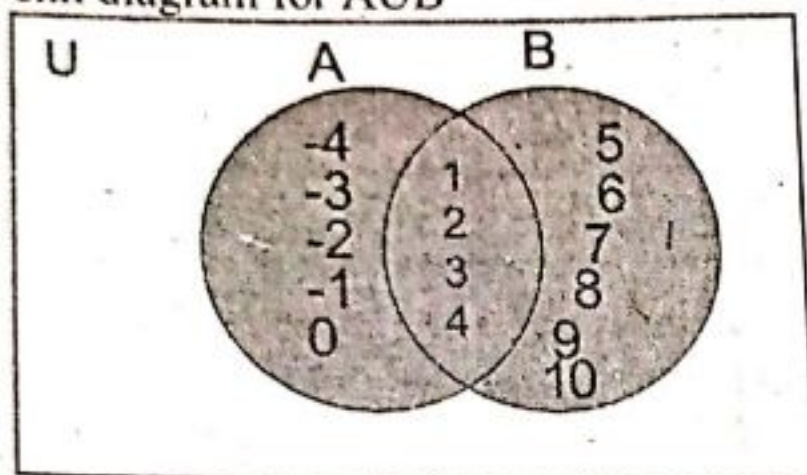
$$A^c \cup B^c = \{0, -1, -2, -3, -4, \dots, \pm 5, \pm 6, \pm 7, \dots\}$$

$$\Rightarrow (A \cap B)^c = A^c \cup B^c$$

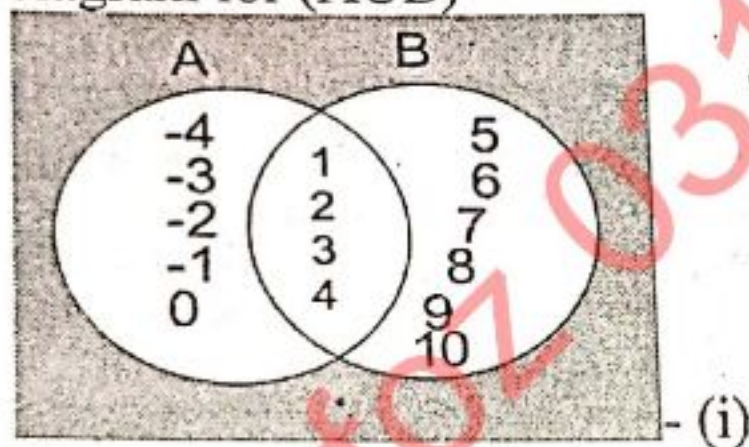
Hence verified

Venn Diagram for $(A \cup B)^c = A^c \cap B^c$

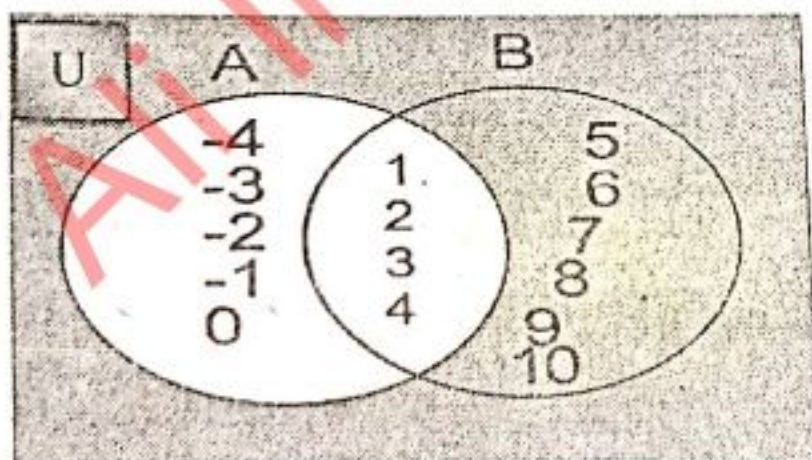
Venn diagram for $A \cup B$



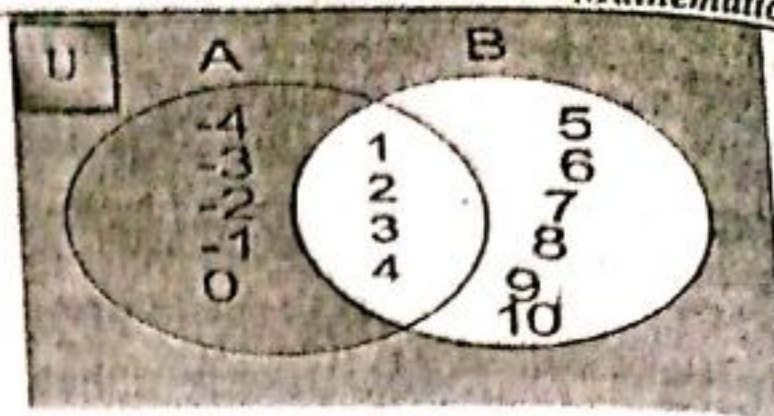
Venn diagram for $(A \cup B)^c$



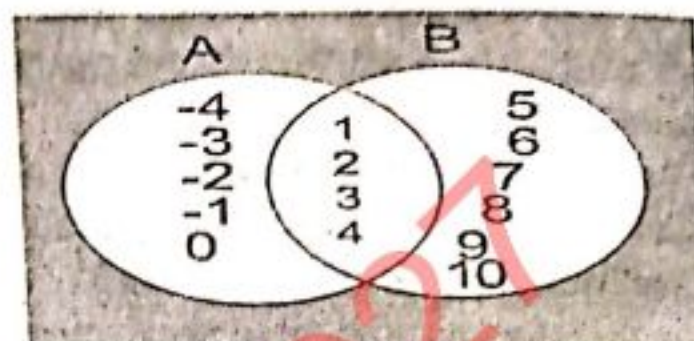
Venn diagram for A^c



Venn diagram for B^c



Venn diagram for $A^c \cap B^c$

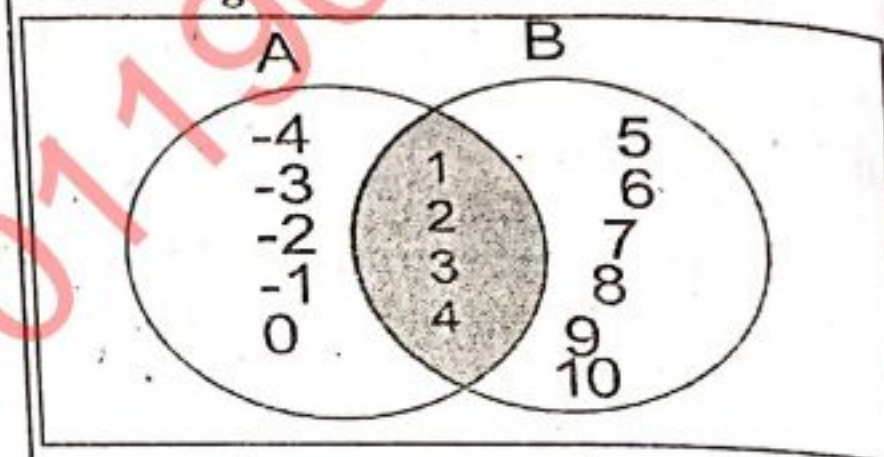


(ii)

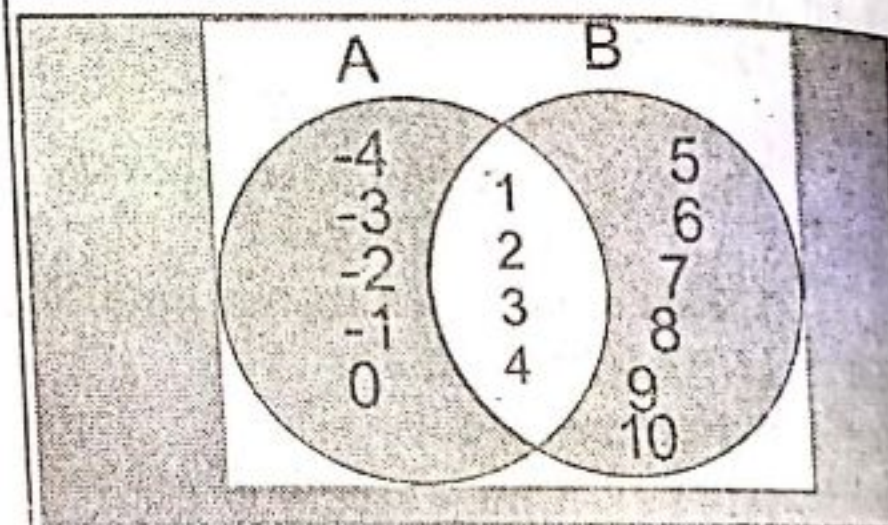
From (i) & (ii) $(A \cup B)^c = A^c \cap B^c$

Venn diagram for $(A \cap B)^c = A^c \cup B^c$

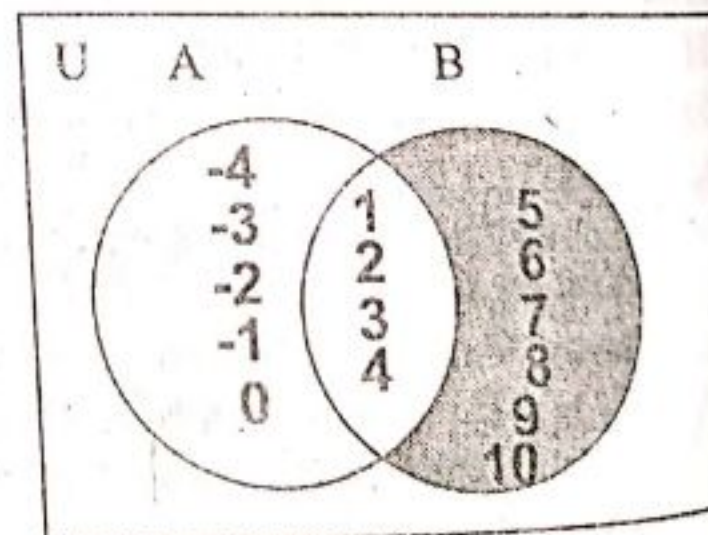
Venn Diagram for $A \cap B$



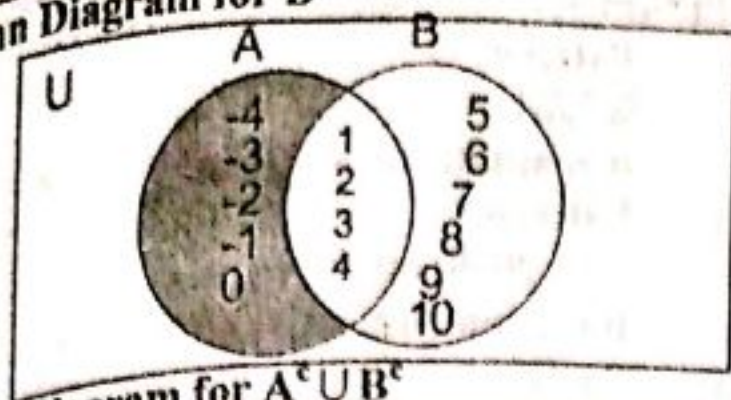
Venn diagram for $(A \cap B)^c$



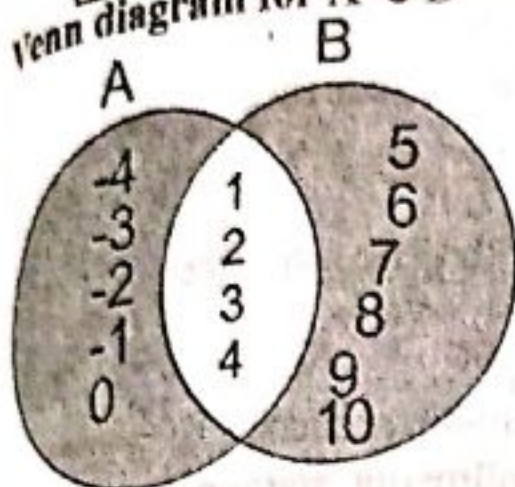
Venn diagram for A^c



Venn Diagram for B^c



Venn diagram for $A^c \cup B^c$



From (iii) & (iv) $(A \cap B)^c = A^c \cup B^c$

Q8. Verify the Associative property of sets with respect to intersection of set are:
 $M = \{2, 3, 5, 7, 11\}$, $N = \{1, 3, 5, 7, 9, 11\}$ and
 $O = \{2, 4, 6, 8, 10, 12\}$

Sol: Associative property of intersection: -

$$M \cap (N \cap O) = (M \cap N) \cap O$$

$$N \cap O = \{ \}, M \cap N = \{3, 5, 7, 11\}$$

$$M \cap (N \cap O) = \{2, 3, 5, 7, 11\} \cap \{ \}$$

$$M \cap (N \cap O) = \{ \} \rightarrow (i)$$

$$(M \cap N) \cap O = \{3, 5, 7, 11\} \cap \{2, 4, 6, 8, 10, 12\}$$

$$(M \cap N) \cap O = \{ \} \rightarrow (ii) \text{ from (i) \& (ii)}$$

$$M \cap (N \cap O) = (M \cap N) \cap O$$

Q9. Verify the commutative property of sets with respect to union if sets are:

$$X = \{1, 2, 3\}, Y = \{1, 2, 4, 5, 6, \dots, 10\}$$

Show the commutative property through venn diagram.

Sol commutative property of union.

$$X \cup Y = \{1, 2, 3\} \cup \{1, 2, 4, 5, 6, \dots, 10\}$$

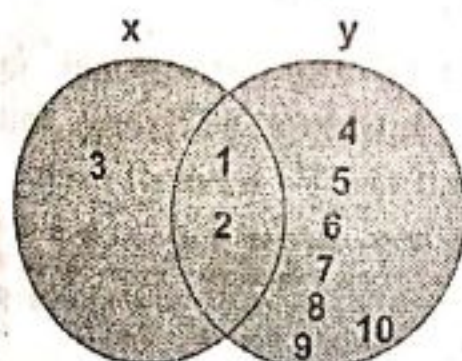
$$X \cup Y = \{1, 2, 3, \dots, 10\}$$

$$Y \cup X = \{1, 2, 4, 5, 6, \dots, 10\} \cup \{1, 2, 3\}$$

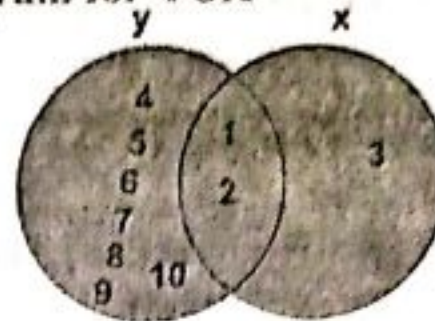
$$Y \cup X = \{1, 2, 3, \dots, 10\}$$

$$X \cup Y = Y \cup X$$

Venn diagram for $X \cup Y$



Venn diagram for $Y \cup X$



From (i) & (ii) $X \cup Y = Y \cup X$

Q10. Verify distributive property of union of sets over interaction.

$$C = \{4, 8, 12, 16, 20\}, D = \{1, 2, 3, 4, \dots, 10\}$$

$$E = \{-1, 0, 1, 2, 3, 4\}$$

Sol Distributive property of union of sets over interaction.

$$C \cup (D \cap E) = (C \cup D) \cap (C \cup E)$$

$$D \cap E = \{1, 2, 3, 4\}$$

$$C \cup D = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 16, 20\}$$

$$C \cup E = \{-1, 0, 1, 2, 3, 4, 8, 12, 16, 20\}$$

$$C \cup (D \cap E) = \{4, 8, 12, 16, 20\} \cup \{1, 2, 3, 4\}$$

$$C \cup (D \cap E) = \{1, 2, 3, 4, 8, 12, 16, 20\} \rightarrow (i)$$

$$(C \cup D) \cap (C \cup E) = \{1, 2, 3, 4, 8, 12, 16, 20\} \rightarrow (ii)$$

From (i) & (ii)

$$C \cup (D \cap E) = (C \cup D) \cap (C \cup E)$$

Q11. On a day during Ramzan 40 people bought different items from a store. 22 people bought dates and 8 people bought fruits and 6 people bought both dates and fruits. Show this information through venn diagram.

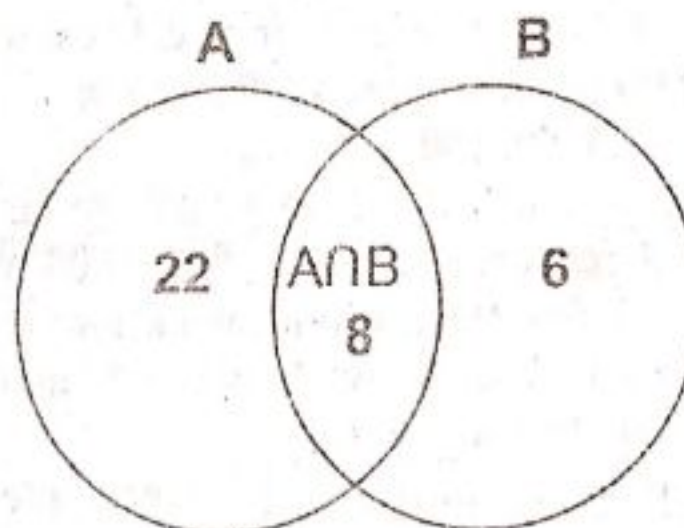
Sol Total people = 40

Bought only dates = 22 $\rightarrow$ Set A

Bought only fruits = 8 $\rightarrow$ set B

Both dates and fruits = 6 $\rightarrow A \cap B$

$$40 - 22 - 8 - 6 = 04$$



Unit No. 6 SEQUENCES AND ALGEBRA

Exercise 6.1

(Tb pg 108)

Q1. Find the rule of the following patterns to justify whether the following sequence are arithmetic or geometric. Extend the patterns to the next 3 terms.

(i) 2, 5, 8, 11

Rule: Add 3 to each term to get next term.

Next three terms are: 14, 17, 20 Ans

(ii) 1, 4, 7, 10, ...

Rule: Add "3" to each term to get next term.

Next three terms are: 13, 16, 19 Ans

(iii) 4, 8, 12, 16, ...

Rule: Add "4" to each term to get next term.

Next three terms are: 20, 24, 28 Ans

(iv) 2, 4, 8, 16, ...

Rule: Multiply by "4" to each term to get next term.

Next three terms are: - 32, 64, 128 Ans

(v) 3, 9, 27, 81, ...

Rule: Multiply by "3" to each term to get next term.

Next three terms are: 243, 729, 2187 Ans

(vi) 2, 6, 18, 54, ...

Rule: multiply by "3" to each term to get next term.

Next three terms are: 162, 486, 1458 Ans

(vii) 64, 60, 56, 52, ...

Rule: subtract "4" from each term to get next term.

Next three terms are: 48, 44, 40 Ans

(viii) 729, 243, 81, ...

Rule: Divide by "3" to get next term.

Next three terms are: - 27, 9, 3 Ans

(ix) 6, 12, 18, 24, 30, 36, ...

Rule: Add "6" to each term to get next term.

Next three terms are: 42, 48, 54 Ans

(x) 25, 50, 100, 200, ...

Rule: Multiply by "2" to get next term.

Next three terms are: 400, 800, 1600 Ans

Q2. Using the given information, cract the pattern and distinguish between arithmetic or geometric sequences:

Starting number	Pattern rule
(i) 2	add 3
(ii) 5	Multiply by 2
(iii) 3	Multiply by 3
(iv) 1	add 4
(v) 80	Subtract 8

Solution: -

(i) Pattern: -

2, 5, 8, 11, ...

It is arithmetic sequence

(ii) Pattern:-

5, 10, 20, 40, 80, ...

It is geometric sequence.

(iii) Pattern: -

3, 9, 27, 81, 243, ...

It is geometric sequence.

(iv) Pattern: -

1, 5, 9, 13, 17, ...

It is an arithmetic sequence

(v) Pattern: -

80, 72, 64, 56, ...

It is arithmetic sequence.

Q3. Is the following sequence arithmetic or geometric?

3, 11, 19, 27, 35, ...

Find the 8th term of the sequence?

Sol: Given sequence is: -

3, 11, 19, 27, 35, ...

$11 - 3 = 19 - 11 = 27 - 19 = 8$

It is an arithmetic sequence here $a = 3, d = 8$

$a_n = a + (n - 1)d$

$a_8 = 3 + (8 - 1)8$

$a_8 = 3 + 7 \times 8$

$a_8 = 3 + 56$

$a_8 = 59$ Ans

Q4. State the rule of the following sequence: 17, 28, 39, 50, ...

What is the 6th term of the sequence?

Sol given sequence is:

17, 28, 39, 50, ...

$28 - 17 = 39 - 28 = 50 - 39 = 11$

So, It is an arithmetic sequence.

Here Rule: Add 11 to get the next term.

$a = 17, d = 11$

$a_n = a + (n - 1)d$

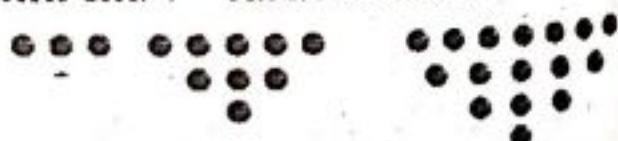
$a_6 = 17 + (6 - 1)11$

$a_6 = 17 + 5 \times 11$

$a_6 = 17 + 55$

$a_6 = 72$ Ans

Q5. Write the numerical form of the following number patterns and apply the rule to find the 7th term of each.

(i) 

Sol: The numerical form is:
3, 9, 16, ...

$$a_1 = 3$$

$$a_2 = 3 + 6 = 9$$

$$a_3 = 9 + 7 = 16$$

$$a_4 = 16 + 8 = 24$$

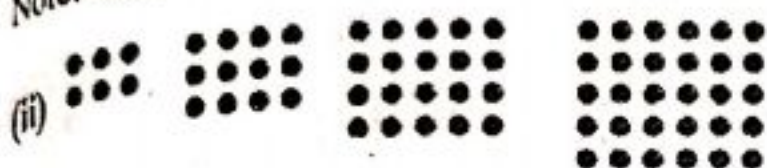
$$a_5 = 24 + 9 = 33$$

$$a_6 = 33 + 10 = 43$$

$$a_7 = 43 + 11 = 54$$

$$\text{So, } a_7 = 54 \text{ Ans}$$

Note: book answer is wrong.



Sol: The numerical form is 6, 12, 20, 30,

$$a_1 = 6$$

$$a_2 = 6 + 6 = 12$$

$$a_3 = 12 + 8 = 20$$

$$a_4 = 20 + 10 = 30$$

$$a_5 = 30 + 12 = 42$$

$$a_6 = 42 + 14 = 56$$

$$a_7 = 56 + 16 = 72$$

$$\text{So, } a_7 = 72 \text{ Ans}$$

Q6. Observe the following sequence, discuss the rules and sort out the sequences which are neither arithmetic nor geometric.

(i) 4, 7, 10, 13, 16, ...

Sol: Rule: Add "3" to get next term. It is an arithmetic sequence.

(ii) 5, 9, 13, 17, 21, ...

Sol: Rule: - Add "4" to get next term. It is an arithmetic sequence.

(iii) 6, 9, 14, 21, 30, ...

Sol: Rule: Add, ...

to get next consecutive terms it is neither arithmetic and nor geometric sequence.

(iv) 0, 3, 8, 15, 24, ...

Sol: Rule: Add 3, 5, 7, 9, ... to get next consecutive terms. It is neither arithmetic and nor geometric sequence.

(v) 2, 5, 10, 17, 26, ...

Sol: Rule: Add 3, 5, 7, 9, ... to get next consecutive terms. It is neither arithmetic and nor geometric sequence.

(vi) 5, 10, 15, 25, 40, ...

Sol: Not a sequence

(vii) 10, 12, 16, 22, ...

Sol: Rule: Add 2, 4, 6, 8, ... to get next consecutive terms it is neither arithmetic and nor geometric sequence.

(viii) 128, 64, 32, ...

Rule: Divide each term by "2" to get next term. It is geometric sequence.

(ix) 1, 3, 4, 7, 11, ...

Sol: Rule: - Each term of the sequence is obtained by adding the two previous terms together. The given sequence is called.

Fibonacci sequence

(x) 15, 30, 60, 120, ...

Sol: Rule: Multiply by "2" to get next term. It is geometric sequence.

Q7. Fill in the missing terms of the following sequences.

(i) 5, 8, ____, ____, 17, 20

Sol: The missing terms are 11, 14 Ans

(ii) 40, 34, ____, 22, 16.

Sol: The missing terms is 28 Ans.

(iii) 1, 3, ____, 27, ____, 243

Sol: The missing terms are 9, 81 Ans

(iv) 324, 108, ____, 12, 4

Sol: The missing terms is 36 Ans

(v) 64, ____, 16, 8, 4.

Sol: The missing term is 32 Ans

Q8. Differentiate between an arithmetic and geometric sequence. Given example.

Ans. Arithmetic Sequence: -

A sequence of numbers in which the difference between any two consecutive numbers is the same, is called an arithmetic sequence. For example, the sequence of odd numbers, i.e. 1, 3, 5, 7, 9 ... is an arithmetic sequence.

$$a_n = a + (n-1)d$$

Geometric Sequence:- A sequence of numbers in which the ratio between any two consecutive numbers is the same, is called a geometric sequence. for example, the sequence 1, 2, 4, 8, 16, 32, ... is a geometric sequence.

$$a_n = ar^{n-1}$$

Q9. What is the 7th term of the sequence having $a_n = 3n+5$

Sol: 7th term = $a_7 = ?$

$$a_n = 3n+5$$

putting $n = 7$

$$n_7 = 3 \times 7 + 5$$

$$n_7 = 21 + 5$$

$$n_7 = 26 \text{ Ans}$$

Q10. What is the 11th term of the sequence having $a_n = n(n-1)$

Sol: 11th term = $a_{11} = ?$

$$a_n = n(n-1)$$

putting $n = 11$

$$a_{11} = 11(11-1)$$

$$a_{11} = 11(10)$$

$$a_{11} = 110 \text{ Ans}$$

Q11. Find the 9th, 13th and 20th term of the sequence generated by $a_n = 4n+1$.

Sol: Required

$$a_9 = ?, a_{13} = ?, a_{20} = ?$$

$$a_n = 4n+1$$

putting $n = 9$

$$a_9 = 4(9) + 1$$

$$a_9 = 36 + 1$$

$$a_9 = 37 \text{ Ans}$$

putting $n = 13$

$$a_{13} = 4(13) + 1$$

$$a_{13} = 52 + 1$$

$$a_{13} = 53 \text{ Ans}$$

putting $n = 20$

$$a_{20} = 4(20) + 1$$

$$a_{20} = 80 + 1 \quad a_{20} = 81 \text{ Ans}$$

Exercise 6.2

(T.B Page 112)

Q1. An arithmetic sequence is given by $-1, 3, 7, 11, 15, \dots$ what is the common difference?

Sol: Required

Common difference = $d = ?$

Given Ap;

$$-1, 3, 7, 11, 15, \dots$$

$$a_1 = -1, a_2 = 3$$

$$d = a_2 - a_1$$

$$d = 3 - (-1)$$

$$d = 3 + 1$$

$$d = 4 \text{ Ans}$$

Q2. Find the general term of each of the following arithmetic sequences. Also find the indicated terms.

(a) $2, 6, 10, 14, \dots (a_1)$

Sol: here $a_1 = 2, a_2 = 6$

$$d = a_2 - a_1$$

$$d = 6 - 2$$

$$d = 4$$

$$a_n = a_1 + (n-1)d \text{ [AP]}$$

$$a_n = 2 + (n-1)4$$

$$a_n = 2 + 4n - 4$$

$$a_n = 4n - 2 \text{ Ans}$$

Putting $n = 1$

$$a_1 = 4(1) - 2$$

$$a_1 = 4 - 2$$

$$a_1 = 2 \text{ Ans}$$

(b) $5, 11, 17, 23, 29, \dots (a_8, a_{10})$

Sol: Here $a_1 = 5, a_2 = 11$

$$d = a_2 - a_1$$

$$d = 11 - 5$$

$$d = 6$$

$$a_n = a_1 + (n-1)d \text{ (AP)}$$

$$a_n = 5 + (n-1)6$$

$$a_n = 5 + 6n - 6$$

$$a_n = 6n - 1 \text{ Ans}$$

Put $n = 8$

$$a_8 = 6(8) - 1$$

$$a_8 = 48 - 1$$

$$a_8 = 47 \text{ Ans}$$

Put $n = 10$

$$a_{10} = 6(10) - 1$$

$$a_{10} = 59 \text{ Ans}$$

(c) $18, 30, 42, 54, 66, \dots (a_{11}, a_{14})$

Sol: Here $a_1 = 18, a_2 = 30$

$$d = a_2 - a_1$$

$$d = 30 - 18$$

$$d = 12$$

$$a_n = a_1 + (n-1)d \text{ (AP)}$$

$$a_n = 18 + (n-1)12$$

$$a_n = 18 + 12n - 12$$

$$a_n = 12n + 6 \text{ Ans}$$

Put $n = 11$

$$a_{11} = 12(11) + 6$$

$$a_{11} = 132 + 6$$

$$a_{11} = 138 \text{ Ans}$$

Put $n = 14$

$$a_{14} = 12(14) + 6$$

$$a_{14} = 168 + 6$$

$$a_{14} = 174 \text{ Ans}$$

$$(d) \quad 11, 10.5, 10, 9.5, 9, \dots (a_{24})$$

$$\text{Sol} \quad \text{Here } a_1 = 11, a_2 = 10.5$$

$$d = a_2 - a_1$$

$$d = 10.5 - 11$$

$$d = -0.5$$

$$a_n = a_1 + (n-1)(AP)$$

$$a_n = 11 + (n-1)(-0.5)$$

$$a_n = 11 - 0.5n + 0.5$$

$$a_n = 11.5 - 0.5n \text{ Ans}$$

$$\text{Put } n = 24$$

$$a_{24} = 11.5 - 0.5(24)$$

$$a_{24} = 11.5 - 12$$

$$a_{24} = -0.5 \text{ Ans Book answer is wrong}$$

$$(c) \quad 7, -2, -11, -20, -29, \dots (a_{24})$$

$$\text{Sol} \quad \text{Here } a_1 = 7, a_2 = -2$$

$$d = a_2 - a_1$$

$$d = -2 - 7$$

$$d = -9$$

$$a_n = a + (n-1)d (AP)$$

$$a_n = 7 + (n-1)(-9)$$

$$a_n = 7 - 9n + 9$$

$$a_n = 16 - 9n \text{ Ans}$$

$$\text{Put } n = 24$$

$$a_{24} = 16 - 9(24)$$

$$a_{24} = 16 - 216$$

$$a_{24} = -200 \text{ Ans}$$

$$(f) \quad 1, 11, 21, 31, 41, 51, \dots (a_9, a_{17})$$

$$\text{Sol:} \quad \text{here } a_1 = a_2 = 11$$

$$d = a_2 - a_1$$

$$d = 11 - 1$$

$$d = 10$$

$$a_n = a_1 + (n-1)d (AP)$$

$$a_n = 1 + (n-1)10$$

$$a_n = 1 + 10n - 10$$

$$a_n = 10n - 9 \text{ Ans}$$

$$\text{Put } n = 9$$

$$a_9 = 10(9) - 9$$

$$a_9 = 90 - 9$$

$$a_9 = 81 \text{ Ans}$$

$$\text{Put } n = 17$$

$$a_{17} = 10(17) - 9$$

$$a_{17} = 170 - 9$$

$$a_{17} = 161 \text{ Ans}$$

Q3. Determine the common difference of an arithmetic sequence, whose first term is 2 and 6th term is 27.

Sol: Required: $d = ?$

Given that

$$a = 2 \text{ and } a_6 = 27$$

We know that

$$a_n = a + (n-1)d (AP)$$

$$a_6 = 2 + (6-1)d$$

$$27 = 2 + 5d$$

$$27 - 2 = 5d$$

$$5d = 25 \Rightarrow d = \frac{25}{5}$$

$$d = 5 \text{ Ans}$$

Q4. Find the 17th term of an arithmetic sequence with first term 2 and common difference 7.

Sol: Required: $a_{17} = ?$

Given that

$$a = 2 \text{ and } d = 7$$

we know that

$$a_n = a + (n-1)d$$

$$a_{17} = 2 + (17-1)7$$

$$a_{17} = 2 + (16)7$$

$$a_{17} = 2 + 112$$

$$a_{17} = 2 + 112$$

$$a_{17} = 114 \text{ Ans}$$

Q5. Madeccha's starting salary in 2012 was Rs 25000. The company raised the salary each year by an increment of Rs 4000. Find her salary in 11th year of her job.

Sol: let starting salary be denoted by "a", so $a = \text{Rs } 25000$. let yearly increment be denoted by d , so $d = \text{Rs } 4000$ to find her salary in 11th year of her job, i.e. $a_{11} = ?$

$$a_n = a + (n-1)d \text{ (AP)}$$

$$a_{11} = 25000 + (11-1)4000$$

$$a_{11} = 25000 + (10)(4000)$$

$$a_{11} = 25000 + 40000$$

$$a_{11} = 65000$$

Madeeha's salary in 11th year is Rs 65000

Q6. In first year of tree planting campaign, 6000 plants were planted and each year there is an increase of 2200 plants. If the sequence continues, how many plants will be planted in 7th year of the campaign?

Sol: Required $a_7 = ?$

$$a_1 = 6000, d = 2200$$

we know that

$$a_n = a + (n-1)d \text{ (AP)}$$

$$a_7 = 6000 + (7-1)2200$$

$$a_7 = 6000 + (6)2200$$

$$a_7 = 6000 + 13200$$

$$a_7 = 19,200$$

19,200 plants will be planted in 7th years of the campaign. Ans

Q7. Each year, the average temperature of a region is increasing by 2.5°C. If the average temperature recorded in 2014 was 27°C, what will be the average temperature in the 10th year?

Sol: required: $a_{10} = ?$

$$d = 2.5^\circ\text{C}, a = 27^\circ\text{C}$$

we know that

$$a_n = a + (n-1)d$$

$$a_{10} = 27 + (10-1)2.5$$

$$a_{10} = 27 + (9)2.5$$

$$a_{10} = 27 + 22.5$$

$$a_{10} = 49.5 \text{ Ans Book answer is wrong}$$

Q8. After every kilometer, there is an increase of 15 meter in the width of a canal. What is the width of canal after 7 kilometer?

Sol: $a_7 = ?$

$$d = 15, a = 30$$

we know that

$$a_n = a + (n-1)d$$

$$a_7 = 30 + (7-1)15$$

$$a_7 = 30 + (6)15$$

$$a_7 = 30 + 90$$

$$a_7 = 120m$$

Exercise 6.3

(Tb pg 117)

Q1. Observe the following algebraic expressions. Identify the variables and constants from each expression.

(i) $4x + 3$

Sol: variable = x
Constant = 3

(iii) $2x + 3y + z$

Sol: Variable = x, y, z
Constants = 0

(v) $2p - 3$

Sol: Variable = p
Constant = -3

(ii) $5y$

Sol: Variable = y
Constant = 0

(iv) $5a + 3b + 2$

Sol: variable = a, b
Constant = 2

Q2. Consider the following polynomials and answer the questions given below.

(i) $a^2 + 2ab + b^2$ (ii) $7x - 5$

(iii) $3y^2 + 15y - 21$ (iv) $5x^2 + 2y$

(v) $2a + 3b + 4c$

(vi) $5x^4 + 2x^3 + 4x^2 + 7x - 20$

(vii) $\sqrt{2}ab + 3bc + 4cd$

(viii) $5r^2 - 4b + 2t - 3u$

(a) Which of the above polynomials are in one variable?

Sol: (ii) $7x - 5$

(iii) $3y^2 + 15y - 21$

(vi) $5x^4 + 2x^3 + 4x^2 + 7x - 20$

(b) Which of the above polynomials are in two variables?

Sol: (i) $a^2 + 2ab + b^2$

(iv) $5x^2 + 2y$

(c) Which of the above polynomials are in three variables?

(v) $2a + 3b + 4c$

(d) Which of the above polynomials are in more than three variables?

(vii) $\sqrt{2}ab + 3bc + 4cd$

(viii) $5r^2 - 4b + 2t - 3u$

Q3. Read the following and classify as linear polynomials, quadratic polynomials,

cubic polynomials or bi-quadratic polynomials.

(i) $5x - 2$

Sol Linear polynomials Ans

(ii) $3x^2 - 15$

Sol Quadratic polynomials Ans

(iii) $x^2 + y^2 + 2xy$

Sol quadratic polynomial Ans

(iv) $y^2 - xz$

Sol quadratic polynomials Ans

(v) $\frac{2}{3}x^3 - \frac{4}{7}y^2 + 28yz$

Sol Cubic Polynomial. Ans

(vi) $5x^4 + 6x^3 + 2x^2 - 11x + 16$

Sol Bi quadratic polynomial Ans

(vii) $x^4 - y^4$

Sol Bi quadratic polynomial. Ans

(viii) $2a + 3b + 4c - 5d$

Sol Linear polynomial

(ix) $v^2 - u^2 + 2gs$

Sol quadratic polynomial Ans

(x) $m^4 - n^4 + 4np$

Sol Bi quadratic polynomial. Ans

(xi) $x^5 - 6x^4 - 16$

Sol It's not. Linear, quadratic, cubic or bi-quadratic polynomial.

(xii) $7.12x + 3.2y + 1.5z$

Sol Linear polynomial. Ans

(xiii) $\sqrt{2}x^2 + \frac{1}{2}y^2 - yz$

Sol Quadratic polynomial. Ans

(xiv) $x^3 + y^3$

Sol Cubic polynomial Ans

(xv) $2x^3 + 4x^2 - 5x + 3$

Sol Cubic polynomial Ans

(xvi) $x^4 + 15x^2 - 16$

Sol Bi quadratic polynomial Ans

Q4. Which of the above polynomials are quadratic polynomials in one variable?

Sol (ii) $3x^2 - 15$ Ans

Q5. Which of the above polynomials are quadratic in two variables?

Sol (iii) $x^2 + y^2 + 2xy$

(iv) $y^2 - xz$

(ix) $v^2 - u^2 + 2gs$

Q6. Which of the cubic polynomials are in more than one variable?

Sol (xiv) $x^3 + y^3$

Q7. Which of the above polynomials have the degree higher than a bi-quadratic polynomials?

Sol (xi) $x^5 - 6x^4 - 16$

Exercise 6.4

(TB pg 118)

Q1. Find the sum of the polynomials in each of the following questions.

(i) $x^2 - 2xy + y^2, x^2 - y^2, 4xy + y^2$

Sol $(x^2 - 2xy + y^2) + (x^2 - y^2) + (4xy + y^2)$

$= x^2 - 2xy + y^2 + x^2 - y^2 + 4xy + y^2$

$= x^2 + x^2 + y^2 + y^2 - y^2 + 4xy - 2xy$

$= 2x^2 + y^2 + 2xy$ Ans

(ii) $p^3 + q^3 - 3p^2q + 5pq^2,$

$4p^3 - q^3 + 6pq^2, 2q^3 + 5p^2q - 11pq^2$

Sol $= (p^3 + q^3 - 3p^2q + 5pq^2) +$

$(4p^3 - q^3 + 6pq^2) + (2q^3 + 5p^2q - 11pq^2)$

$= p^3 + q^3 - 3p^2q + 5pq^2 + 4p^3 - q^3$

$+ 6pq^2 + 2q^3 + 5p^2q - 11pq^2$

$= p^3 + 7p^3 + q^3 - q^3 + 2q^3 - 3p^2q + 5p^2q$

$+ 5pq^2 + 6pq^2 - 11pq^2$

$= 5p^3 + 2q^3 + 2p^2q + 11pq^2 + 11pq^2 - 11pq^2$

$= 5p^3 + 2q^3 + 2p^2q$ Ans

Book answer is wrong.

(iii) $7x^5 - 3x^4 + 11x^3 + 12, 2x^5 - 4x^4 - 6x^2$

$+ 5x - 10, 6x^5 - 8x^3 + 7$

Sol $= (7x^5 - 3x^4 + 11x^3 + 12) + (2x^5 - 4x^4 - 6x^2$

$+ 5x - 10) + (6x^5 - 8x^3 + 7)$

$= 7x^5 - 3x^4 + 11x^3 + 12 + 2x^5 - 4x^4 - 6x^2$

$+ 5x - 10 + 6x^5 - 8x^3 + 7$

$= 7x^5 + 2x^5 + 6x^5 - 3x^4 - 4x^4 + 11x^3 - 8x^3$

$- 6x^2 + 5x + 12 - 10 + 7$

$= 15x^5 - 7x^4 + 3x^3 - 6x^2 + 5x + 9$ Ans

(iv) $12x^3 + 4x^2y - 5xy^2 + 15y^3, 10x^3 - 11y^3,$

$14x^2y - 5xy^2 - 4y^3$

Sol $(12x^3 + 4x^2y - 5xy^2 + 15y^3) + (10x^3 - 11y^3) +$

$14x^2y - 5xy^2 - 4y^3$

$$\begin{aligned}
 &= 12x^3 + 4x^2y - 5xy^2 + 15y^3 + 10x^3 - 11y^3 \\
 &+ 14x^2y - 5xy^2 - 5xy^2 - 4y^3 \\
 &= 12x^3 + 10x^3 + 15y^3 - 11y^3 - 4y^3 + 4x^2y \\
 &+ 14x^2y - 5xy^2 - 5xy^2 \\
 &= 22x^3 + 18x^2y - 10xy^2 \text{ Ans}
 \end{aligned}$$

$$(v) \quad 4x^5 + 5x^4 - 3x^3 - 5x^5, \quad 2x^2 + 8x - 7, \quad 11x^5 - 3x^3 - 2x - 3$$

$$\text{Sol} = (4x^5 + 5x^4 - 3x^3) + (5x^5 - 2x^2 + 8x - 7) + (11x^5 - 3x^3 - 2x - 3)$$

$$= 4x^5 + 5x^4 - 3x^3 + 5x^5 - 2x^2 + 8x - 7$$

$$+ 11x^5 - 3x^3 - 2x - 3$$

$$= 4x^5 + 5x^5 + 11x^5 + 5x^4 - 3x^3 - 3x^3$$

$$- 2x^2 + 8x - 2x - 7 - 3$$

$$= 20x^5 + 5x^4 - 6x^3 - 2x^2 + 6x - 10 \text{ Ans}$$

$$(vi) \quad 15x^3 - 8x^2y - 5xy^2 + 11y^3, \quad 12x^2y + 7xy^2 - 15y^3 - 6x^3 + 4x^2y - 2xy^2$$

$$\text{Sol:} = (15x^3 - 8x^2y - 5xy^2 + 11y^3) + (12x^2y + 7xy^2 - 15y^3) + (-6x^3 + 4x^2y - 2xy^2)$$

$$= 15x^3 - 6x^3 - 8x^2y + 12x^2y + 4x^2y$$

$$- 5xy^2 + 7xy^2 - 2xy^2 + 11y^3 - 15y^3$$

$$= 9x^3 + 8x^2y - 7xy^2 + 7xy^2 - 4y^3$$

$$= 9x^3 + 8x^2y - 4y^3 \text{ Ans}$$

$$(vii) \quad 12p^4 - 3p^3q + 4p^2q^2, \quad 3p^4 - 4q^3, \quad 5p^3q - 9p^2q^2 + 5q^3$$

$$\text{Sol} \quad (12p^4 - 3p^3q + 4p^2q^2) + (3p^4 - 4q^3) + (5p^3q - 9p^2q^2 + 5q^3)$$

$$= 12p^4 + 3p^4 - 3p^3q + 5p^3q + 4p^2q^2$$

$$- 9p^2q^2 - 4q^3 + 5q^3$$

$$= 15p^4 + 2p^3q - 5p^2q^2 + q^3 \text{ Ans}$$

$$(viii) \quad 15u - 20u + 7w, \quad 10u - 15u + 12w, \quad 15u + 20u - 19w$$

$$\text{Sol} = (15u - 20u + 7w) + (10u - 15u + 12w) + (15u + 20u - 19w)$$

$$= (-5u + 7w) + (-5u + 12w) + (35u - 19w)$$

$$= -5u - 5u + 35u + 7w + 12w - 19w$$

$$= -10u + 35u + 19w - 19w$$

$$= 25u \text{ Ans (Book answer is wrong)}$$

Q2. Simplify the following.

$$(i) \quad 3(x^2 - xy + y^2) + 5(x^2 + 2xy + 3y^2)$$

$$\text{Sol} = 3x^2 - 3xy + 3y^2 + 5x^2 + 10xy + 15y^2$$

$$= 3x^2 + 5x^2 - 3xy + 10xy + 3y^2 + 15y^2$$

$$= 8x^2 + 7xy + 18y^2 \text{ Ans}$$

$$(ii) \quad 7(pq + qr - rs) + 4(qr - rs - 7)$$

$$\text{Sol} = 7pq + 7qr - 7rs + 4qr - 4rs - 28$$

$$= 7pq + 7qr + 7qr - 7rs - 4rs - 28$$

$$= 7pq + 14qr - 11rs - 28 \text{ Ans}$$

$$(iii) \quad 10(4x^3 - 3x^2 + 5x - 7) + 2(5x^2 - 12) + 3(7x^3 + 5x^2 - 4x)$$

$$\text{Sol} = 40x^3 - 30x^2 + 50x - 70 + 10x^2 - 24$$

$$+ 21x^3 + 15x^2 - 12x$$

$$= 40x^3 + 21x^3 + 10x^2 + 15x^2 - 30x^2$$

$$+ 50x - 12x - 70 - 24$$

$$= 61x^3 + 25x^2 - 30x^2 + 38x - 94$$

$$= 61x^3 - 5x^2 + 38x - 94 \text{ Ans}$$

Exercise 6.5

(TB pg 120)

Q1. Subtract the first polynomial from the second in each of the following questions.

$$(i) \quad 15a - 18b + 24c, \quad 35a - 40b + 34c$$

$$\text{Sol} = (35a - 40b + 34c) - (15a - 18b + 24c)$$

$$= 35a - 40b + 34c - 15a + 18b - 24c$$

$$= 35a - 15a - 40b + 18b + 34c - 24c$$

$$= 20a - 22b + 10c \text{ Ans}$$

$$(ii) \quad a^3 + a^2b + ab^2 + b^3, \quad 4a^3 + a^2b + ab^2 - b^3$$

$$\text{Sol} = (4a^3 + a^2b + ab^2 - b^3) - (a^3 + a^2b + ab^2 + b^3)$$

$$= 4a^3 + a^2b + ab^2 - b^3 - a^3 - a^2b - ab^2 - b^3$$

$$= 4a^3 - a^3 + a^2b - a^2b + ab^2 - ab^2 - b^3 - b^3$$

$$= 3a^3 - 2b^3$$

$$(iii) \quad p^4 - 5p^3 + 3p^2 - 15, \quad p^5 + p^4 + 5p^3 + 3p^2 + 15$$

$$\text{Sol} = (p^5 + p^4 + 5p^3 + 3p^2 + 15) - (p^4 - 5p^3 + 3p^2 - 15)$$

$$= p^5 + p^4 + 5p^3 + 3p^2 + 15 - p^4 + 5p^3 - 3p^2 + 15$$

$$= p^5 + p^4 - p^4 + 5p^3 + 3p^2 - 3p^2 + 15 + 15$$

$$= p^5 + 10p^3 + 30 \text{ Ans}$$

$$(iv) \quad 9x^4 - 16x^3 + 12x + 17, \quad 25x^5 - 36x^3 + 12x^2 + 20x + 40$$

$$\text{Sol} = (25x^5 - 36x^3 + 12x^2 + 20x + 40) - (9x^4 - 16x^3 + 12x + 17)$$

$$= 25x^5 - 36x^3 + 12x^2 + 20x + 40 - 9x^4 + 16x^3 - 12x - 17$$

$$= 25x^5 - 9x^4 - 36x^3 + 16x^3 + 12x^2 + 20x - 12x + 40 - 17$$

$$= 25x^5 - 9x^4 - 20x^3 + 12x^2 + 8x + 23 \text{ Ans}$$

$$(v) \quad 10x^5 - 13x^4y^3 + 33x^3y^2, \quad 37x^5 - 33x^4y^3 + 20x^3y^2 + 31y^5$$

$$\text{Sol} = (37x^5 - 33x^4y^3 + 20x^3y^2 + 31y^5) - (10x^5 - 13x^4y^3 + 33x^3y^2)$$

$$= 37x^5 - 33x^4y^3 + 20x^3y^2 + 31y^5 - 10x^5 + 13x^4y^3 - 33x^3y^2$$

$$= 27x^5 - 20x^4y^3 + 7x^3y^2 + 31y^5$$

$$\begin{aligned}
 &= 37x^5 - 33x^4y + 20x^3y^2 + 31y^5 - 10x^5 \\
 &\quad + 13x^4y^3 - 33x^3y^2 \\
 &= 37x^5 - 10x^5 - 33x^4y^3 + 13x^4y^3 + 20x^3y^2 - \\
 &\quad 33x^3y^2 + 31y^5 \\
 &= 27x^5 - 20x^4y^3 - 13x^3y^2 + 31y^5 \text{ Ans}
 \end{aligned}$$

Exercise 6.6 (Tb pg 121)

Q1. Simplify.

(i) $(2x+3)(3x+2y)$

$$\begin{aligned}
 \text{Sol} &= 2x(3x+2y) + 3(3x+2y) \\
 &= 6x^2 + 4xy + 9x + 6y \text{ Ans}
 \end{aligned}$$

Book answer is wrong

(ii) $(5x-2y)(2x-3xy)+5y$

$$\begin{aligned}
 \text{Sol} &= 5x(2x-3xy+5y) - 2y(2x-3xy+5y) \\
 &= 10x^2 - 15x^2y + 25xy - 4xy + 6xy^2 - 10y^2 \\
 &= 10x^2 - 15x^2y + 21xy + 6xy^2 - 10y^2 \text{ Ans}
 \end{aligned}$$

(iii) $(7f+5q)(7f-5q)$

$$\begin{aligned}
 \text{Sol} &= 7f(7f-5q) + 5q(7f-5q) \\
 &= 49f^2 - 35fq + 35fq - 25q^2 \\
 &= 49f^2 - 25q^2 \text{ Ans}
 \end{aligned}$$

(iv) $(2p+3q-r)(5p-4r)$

$$\begin{aligned}
 \text{Sol} &= 2p(5p-4r) + 3q(5p-4r) - r(5p-4r) \\
 &= 10p^2 - 8pr + 15pq - 12qr - 5pr + 4r^2 \\
 &= 10p^2 - 8pr - 5pr + 15pq - 12qr + 4r^2 \\
 &= 10p^2 - 13pr + 15pq - 12qr + 4r^2 \text{ Ans}
 \end{aligned}$$

(v) $(p^2+2p)(p^2+q^2-r^2)$

$$\begin{aligned}
 \text{Sol} &= p^2(p^2+q^2-r^2) + 2p(p^2+q^2-r^2) \\
 &= p^4 + p^2q^2 - p^2r^2 + 2p^3 + 2pq^2 - 2pr^2 \text{ Ans}
 \end{aligned}$$

(vi) $(x-2)^2(x^2-4x+4)$

$$\text{Sol} \quad (a-b)^2 = a^2 - 2ab + b^2$$

$$\begin{aligned}
 &= ((x)^2 - 2(x)(2) + (2)^2)(x^2 - 4x + 4) \\
 &= (x^2 - 4x + 4)(x^2 - 4x + 4) \\
 &= x^2(x^2 - 4x + 4) - 4x(x^2 - 4x + 4) + 4(x^2 - 4x + 4) \\
 &= x^4 - 4x^3 + 4x^2 - 4x^3 + 16x^2 - 16x + 4x^2 - 16x + 16 \\
 &= x^4 - 4x^3 - 4x^3 + 4x^2 + 4x^2 + 16x^2 - 16x - 16x + 16 \\
 &= x^4 - 8x^3 + 24x^2 - 32x + 16 \text{ Ans}
 \end{aligned}$$

Book answer is wrong.

Q2. Multiply the polynomials given in each of the following cases;

(i) $x, (x-5)$ and $(x+7)$

$$\begin{aligned}
 \text{Sol} &= x(x-5)(x+7) \\
 &= x(x^2 + 7x - 5x - 35) \\
 &= x(x^2 + 2x - 35) \\
 &= x^3 + 2x^2 - 35x \text{ Ans}
 \end{aligned}$$

(ii) $3x, (x^2+y^2)$ and (x^2-y^2)

$$\text{Sol} \quad = 3x(x^2+y^2)(x^2-y^2)$$

$$\begin{aligned}
 &= 3x(x^4 - \cancel{x^2y^2} + \cancel{x^2y^2} - y^4) \\
 &= 3x(x^4 - y^4) \\
 &= 3x^5 - 3xy^4 \text{ Ans}
 \end{aligned}$$

(iii) $2b, (10c-a), (a-2c)$

$$\begin{aligned}
 \text{Sol} &= 2b(10c-a)(a-2c) \\
 &= 2b(10ac - 20c^2 - a^2 + 2ac) \\
 &= 2b(12ac - 20c^2 - a^2) \\
 &= 24abc - 40bc^2 - 2a^2b \text{ Ans}
 \end{aligned}$$

Book answer is wrong.

(iv) $(p+q), (p-q)$ and (p^2-q^2)

$$\begin{aligned}
 \text{Sol} &= (p+q)(p-q)(p^2-q^2) \\
 &= (p^2 - pq + pq - q^2)(p^2 - q^2) \\
 &= (p^2 - q^2)(p^2 - q^2) \\
 &= p^4 - p^2q^2 - p^2q^2 + q^4 \\
 &= p^4 - 2p^2q^2 + q^4 \text{ Ans}
 \end{aligned}$$

Q3. Simplify the following.

(i) $5(a-2)(a+3) - 2(a+2)(a-3)$

$$\begin{aligned}
 \text{Sol} &= 5(a^2 + 3a - 2a - 6) - 2(a^2 - 3a + 2a - 6) \\
 &= 5(a^2 + a - 6) - 2(a^2 - a - 6) \\
 &= 5a^2 + 5a - 30 - 2a^2 + 2a + 12 \\
 &= 5a^2 - 2a^2 + 5a + 2a - 30 + 12 \\
 &= 3a^2 + 7a - 18 \text{ Ans}
 \end{aligned}$$

(ii) $7x(x^2+4y-Z) + 4(x+2z)(x^2-x)$

$$\begin{aligned}
 \text{Sol} &= 7x^3 + 28xy - 7xZ + 4(x^3 - x^2 + 2x^2z - 2xz) \\
 &= 7x^3 + 28xy - 7xZ + 4x^3 - 4x^2 + 8x^2z - 8xz \\
 &= 7x^3 + 4x^3 + 28xy - 7xZ - 8xz - 4x^2 + 8x^2z \\
 &= 11x^3 + 28xy - 15xZ - 4x^2 + 8x^2z \text{ Ans}
 \end{aligned}$$

(iii) $9(3p-1)(2p+2) - 7(3p-2)^2$

$$\begin{aligned}
 \text{Sol} &= 9(6p^2 + 6p - 2p - 2) - 7((3p)^2 - 2(3p)(2) + (2)^2) \\
 &= 9(6p^2 + 4p - 2) - 7(9p^2 - 12p + 4) \\
 &= 54p^2 + 36p - 18 - 63p^2 + 84p - 28 \\
 &= 54p^2 - 63p^2 + 36p + 84p - 18 - 28 \\
 &= -9p + 120p - 46 \text{ Ans}
 \end{aligned}$$

(iv) $5(x^2-2x+5)(x-5) - 2(x+5)^2$

$$\begin{aligned}
 \text{Sol} &= 5(x^3 - 5x^2 - 2x^2 + 10x + 5x - 25) \\
 &\quad - 2((x)^2 + 2(x)(5) + (5)^2) \\
 &= 5(x^3 - 7x^2 + 15x - 25) - 2(x^2 + 10x + 25) \\
 &= 5x^3 - 35x^2 + 75x - 125 - 2x^2 - 20x - 50 \\
 &= 5x^3 - 35x^2 - 2x^2 + 75x - 20x - 125 - 50 \\
 &= 5x^3 - 37x^2 + 55x - 175 \text{ Ans}
 \end{aligned}$$

(v) $4(2x+5y)^2 - 2(3x-2y)^2$

$$\begin{aligned}
 \text{Sol} &= 4((2x)^2 + 2(2x)(5y) + (5y)^2) \\
 &\quad - 2((3x)^2 - 2(3x)(2y) + (2y)^2) \\
 &= 4(4x^2 + 20xy + 25y^2) \\
 &\quad - 2(9x^2 - 12xy + 4y^2) \\
 &= 16x^2 + 80xy + 100y^2 - 18x^2 + 24xy - 8y^2
 \end{aligned}$$

$$\begin{aligned}
 &= 16x^2 - 18x^2 + 80xy + 24xy + 100y^2 - 8y^2 \\
 &= -2x^2 + 104xy + 92y^2 \text{ Ans} \\
 \text{(vi)} & (2x+3y)^2 + (3x-2y)^2 - (4x+3y)^2 \\
 \text{Sol} &= [(2x)^2 + 2(2x)(3y) + (3y)^2] + \\
 & [(3x)^2 - 2(3x)(2y) + (2y)^2] - [(4x)^2 + 2(4x)(3y) + (3y)^2] \\
 &= (4x^2 + 12xy + 9y^2) + (9x^2 - 12xy + 4y^2) \\
 & \quad - (16x^2 + 24xy + 9y^2) \\
 &= 4x^2 + 9x^2 - 16x^2 + 12xy - 12xy - 24xy \\
 & \quad + 9y^2 + 4y^2 - 9y^2 \\
 &= -3x^2 - 24xy + 4y^2 \text{ Ans}
 \end{aligned}$$

Quick check (TB pg 124)

(1) If the product of two polynomials is $4x^4 + 7x^3 - 15y^2$ and one of the polynomials is $(x+3)$, find the second polynomials.

Sol Let first polynomial $= p(x) = (x+3)$ and 2nd polynomials $= q(x) = ?$

$$p(x) \cdot q(x) = 4x^4 + 7x^3 - 15y^2$$

$$\Rightarrow (x+3) \cdot q(x) = 4x^4 + 7x^3 - 15y^2$$

$$\Rightarrow q(x) = \frac{4x^4 + 7x^3 - 15y^2}{x+3}$$

by long Division method

$$\begin{array}{r}
 x+3 \overline{4x^4 + 7x^3 - 15y^2} \\
 \underline{\pm 4x^4 \pm 12x^3} \\
 -5x^3 - 15y^2 \\
 \underline{\pm 5x^3 \pm 15y^2} \\
 0
 \end{array}$$

$$\therefore 2^{\text{nd}} \text{ polynomials} = 4x^3 - 5x^2 \text{ Ans}$$

Q2. If the product of two polynomials is $2a^3 - 11a^2 - 11a + 15$ and one of the polynomial $(2a+3)$, find the other polynomial.

Sol Required

2nd polynomial $= ?$ First polynomial $= (2a+3)$

Product of two polynomials

$$= 2a^3 - 11a^2 - 11a + 15$$

By long Division method

$$\begin{array}{r}
 a^2 - 7a - 5 \\
 2a+3 \overline{2a^3 - 11a^2 - 11a + 15} \\
 \underline{\pm 2a^3 \pm 3a^2} \\
 -14a^2 - 11a + 15 \\
 \underline{\pm 14a^2 \mp 21a} \\
 10a + 15 \\
 \underline{\pm 10a \pm 15} \\
 0
 \end{array}$$

$$2^{\text{nd}} \text{ polynomial} = (a^2 - 7a + 5) \text{ Ans}$$

Exercise 6.7

(Tb pg 125)

Q1. Divide the first polynomial by the second polynomial.

$$\begin{array}{r}
 \text{(i)} \quad 2x^3 - 4x^2 + 5x \div x \\
 \underline{2x^3 - 4x^2 + 5x} \\
 0
 \end{array}$$

Thus, $(2x^3 - 4x^2 + 5x) \div x = 2x^2 - 4x + 5$ Ans

$$\text{(ii)} \quad 9a^2 + 30ab + 25b^2 \div (3a+5b)$$

Sol

$$\begin{array}{r}
 3a+5b \overline{9a^2 + 30ab + 25b^2} \\
 \underline{\pm 9a^2 \pm 15ab} \\
 15ab + 25b^2 \\
 \underline{\pm 15ab \pm 25b^2} \\
 0
 \end{array}$$

Thus, $(9a^2 + 30ab + 25b^2) \div (3a+5b) = 3a+5b$

$$\text{(iii)} \quad 8p^2 - 12pq \div 4p$$

Sol

$$\begin{array}{r}
 2p-3q \\
 4p\sqrt{8p^2-12pq} \\
 \pm 8p^2 \\
 \hline
 12pq \\
 \mp 12pq \\
 \hline
 0
 \end{array}$$

Thus, $(8p^2-12pq) \div 4p = 2p-3q$ Ans

(iv) $x^2-2xy+y^2, x-y$

Sol

$$\begin{array}{r}
 x-y \\
 x-y\sqrt{x^2-2xy+y^2} \\
 \pm x^2 \mp xy \\
 \hline
 -xy+y^2 \\
 \pm xy \pm y^2 \\
 \hline
 0
 \end{array}$$

Thus, $(x^2-2xy+y^2) \div (x-y) = x-y$

(v) $x^2+2xy+y^2, x+y$

Sol

$$\begin{array}{r}
 x+y \\
 x+y\sqrt{x^2+2xy+y^2} \\
 \pm x^2 \pm xy \\
 \hline
 xy+y^2 \\
 \pm xy \pm y^2 \\
 \hline
 0
 \end{array}$$

Thus, $(x^2+2xy+y^2) \div (x+y) = x+y$ Ans

(vi) $x^3-y^3, x-y$

Sol:

$$\begin{array}{r}
 x^2+xy+y^2 \\
 x-y\sqrt{x^3-y^3} \\
 \pm x^3 \mp x^2y \\
 \hline
 x^2y-y^3 \\
 \pm x^2y \mp xy^2 \\
 \hline
 xy^2-y^3 \\
 \pm xy^2 \mp y^3 \\
 \hline
 0
 \end{array}$$

Thus, $(x^3-y^3) \div (x-y) = x^2+xy+y^2$

(vii) $x^2-y^2, x+y$

Sol

$$\begin{array}{r}
 x-y \\
 x+y\sqrt{x^2-y^2} \\
 \pm x^2 \pm xy \\
 \hline
 -xy-y^2 \\
 \mp xy \mp y^2 \\
 \hline
 0
 \end{array}$$

Thus, $(x^2-y^2) \div (x+y) = x-y$ Ans

(viii) $6x^2+27x+30, 3x+6$

$$\begin{array}{r}
 2x+5 \\
 3x+6\sqrt{6x^2+27x+30} \\
 \pm 6x^2 \pm 12x \\
 \hline
 15x+30 \\
 \pm 15x \pm 30 \\
 \hline
 0
 \end{array}$$

Thus, $(6x^2+27x+30) \div (3x+6) = 2x+5$ Ans

(ix) $y^3+y^2+y+1, y+1$

$$\begin{array}{r}
 y^2+1 \\
 y+1\sqrt{y^3+y^2+y+1} \\
 \pm y^3 \pm y^2 \\
 \hline
 y-y^2 \\
 \pm y \pm y^2 \\
 \hline
 0
 \end{array}$$

Thus, $(y^3+y^2+y+1) \div (y+1) = y^2+1$

Q2. Divide the second polynomials by the first polynomials.

(i) $x-2, x^2-5x+6$

$$\begin{array}{r}
 x-3 \\
 x-2\sqrt{x^2-5x+6} \\
 \pm x^2 \mp 2x \\
 \hline
 -3x+6 \\
 \mp 3x \pm 6 \\
 \hline
 0
 \end{array}$$

Thus $(x^2-5x+6) \div (x-2) = x-3$ Ans

(ii) $2x+3y, 6x^2+19xy+15y^2$

$$\begin{array}{r} 3x+5y \\ \text{Sol } 2x+3y \sqrt{6x^2+19xy+15y^2} \\ \underline{\pm 6x^2 \quad \pm 9xy} \\ 10xy + 15y^2 \\ \underline{\pm 10xy \quad \pm 15y^2} \\ 0 \end{array}$$

Thus, $(6x^2+19xy+15y^2) \div (2x+3y) = 3x+5y$

(iii) $a+b, a^3+b^3$

$$\begin{array}{r} a^2-ab+b^2 \\ \text{Sol } a+b \sqrt{a^3+b^3} \\ \underline{\pm a^3 \quad \pm a^2b} \\ -a^2b + b^3 \\ \underline{\pm a^2b \quad \mp ab^2} \\ ab^2 + b^3 \\ \underline{\pm ab^2 \quad \pm b^3} \\ 0 \end{array}$$

Thus, $(a^3+b^3) \div (a+b) = a^2-ab+b^2$ Ans

(iv) $5x-3, 20x^3-17x^2+34x+15$

$$\begin{array}{r} 4x^2-x \\ \text{Sol } 5x-3 \sqrt{20x^3-17x^2+34x+15} \\ \underline{\pm 20x^3 \quad \mp 12x^2} \\ -5x^2 + 34x + 15 \\ \underline{\mp 5x^2 \quad \pm 3x} \\ 17x+15 \end{array}$$

Remainder is not zero.

(v) $3p-2q, 3p^2+pq-2q^2$

$$\begin{array}{r} p+q \\ \text{Sol } 3p-2q \sqrt{3p^2+pq-2q^2} \\ \underline{\pm 3p^2 \quad \mp 2pq} \\ 3pq - 2q^2 \\ \underline{\pm 3pq \quad \mp 2q^2} \\ 0 \end{array}$$

Thus, $(3p^2+pq-2q^2) \div (3p-2q) = p+q$ Ans

Q3. Solve the following.

(i) $(x^2+5x+6) \div (x+2)$

$$\begin{array}{r} x+3 \\ \text{Sol } x+2 \sqrt{x^2+5x+6} \\ \underline{\pm x^2 \quad \pm 2x} \\ 3x+6 \\ \underline{\mp 3x \quad \pm 6} \\ 0 \end{array}$$

Thus, $(x^2+5x+6) \div (x+2) = x+3$ Ans

(ii) $(2r^2-3rs-20s^2) \div (r-4s)$

$$\begin{array}{r} 2r+5s \\ \text{Sol } r+4s \sqrt{2r^2-3rs-20s^2} \\ \underline{\pm 2r^2 \quad \mp 8rs} \\ 5rs - 20s^2 \\ \underline{\pm 5rs \quad \mp 20s^2} \\ 0 \end{array}$$

Thus, $(2r^2-3rs-20s^2) \div (r-4s) = 2r+5s$ Ans

(iii) $(x^5-y^5) \div (x-y)$

$$\begin{array}{r} x^4+x^3y+x^2y^2+xy^3+y^4 \\ \text{Sol } x-y \sqrt{x^5-y^5} \\ \underline{\pm x^5 \quad \mp x^4y} \\ x^4y - y^5 \\ \underline{\pm x^4y \quad \mp x^3y^2} \\ x^3y^2 - y^5 \\ \underline{\pm x^3y^2 \quad \mp x^2y^3} \\ x^2y^3 - y^5 \\ \underline{\pm x^2y^3 \quad \mp xy^4} \\ xy^4 - y^5 \\ \underline{\pm xy^4 \quad \mp y^5} \\ 0 \end{array}$$

Thus, $(x^5-y^5) \div (x-y) = x^4+x^3y+x^2y^2+xy^3+y^4$ Ans

$$(iv) \frac{(p^4 - q^4) \div (p+q)}{p^3 - p^2q + pq^2 - q^3}$$

$$\begin{array}{r} p+q \sqrt{p^4 - q^4} \\ \pm p^4 \qquad \mp p^3q \\ \hline -p^3q - q^4 \\ \pm p^3q \qquad \mp p^2q^2 \\ \hline p^2q^2 - q^4 \\ \pm p^2q^2 \qquad \pm pq^3 \\ \hline -pq^3 - q^4 \\ \mp pq^3 \mp q^4 \\ \hline 0 \end{array}$$

Thus, $(p^4 - q^4) \div (p+q) = p^3 - p^2q + pq^2 - q^3$ Ans

$$(v) \frac{(2x^3 - 5x^2y + 5xy^2 - 3y^3) \div (2x - 3y)}{x^2 - xy + y^2}$$

$$\begin{array}{r} 2x-3y \sqrt{2x^3 - 5x^2y + 5xy^2 - 3y^3} \\ \pm 2x^2 \mp 3x^2y \\ \hline -2x^2y + 5xy^2 - 3y^3 \\ \mp 2x^2y \pm 3xy^2 \\ \hline 2xy^2 - 3y^3 \\ \pm 2xy^2 \mp 3y^3 \\ \hline 0 \end{array}$$

Thus, $(2x^3 - 5x^2y + 5xy^2 - 3y^3) \div (2x - 3y) = (x^2 - xy + y^2)$ Ans

Exercise 6.8

(TB Pg 127)

Q1. Simplify the following

(a) $2ab + 2b(5a+b)$

Sol: $= 2ab + 10ab + 2b^2$
 $= 12ab + 2b^2$ Ans

(b) $4x + [2y - (2xy + 5x)(1 + 2xy)]$

Sol: $= 4x + [2y - \{2xy + 4x^2y^2 + 5x + 10x^2y\}]$
 $= 4x + [2y - 2xy - 4x^2y^2 - 5x - 10x^2y]$
 $= 4x + 2y - 2xy - 4x^2y^2 - 5x - 10x^2y$
 $= -x + 2y - 2xy - 4x^2y^2 - 10x^2y$ Ans

(c) $4c - 2d\{4cd - 4c(1 + 2d)\}$

Sol $= 4c - 2d\{4cd - 4c - 8cd\}$
 $= 4c - 2d\{-4cd - 4c\}$
 $= 4c + 8cd^2 + 8cd$ Ans

(d) $6m - (2 + 5m) - \{[(2m+n)(5m+2n)] - 4m\}$

$= 6m - 5m - 2 - [10m^2 + 9mn + 2n^2] - 4m$
 $= m - 2 - [10m^2 + 9mn + 2n^2 - 4m]$
 $= m - 2 - 10m^2 - 9mn - 2n^2 + 4m$
 $= 5m - 2 - 10m^2 - 9mn - 2n^2$ Ans

(e) $2x[5y - \{3xy + (4y^2 + 3x^3)\}]$

Sol $= 2x[5y - \{3xy + 4y^2 + 3x^3\}]$
 $= 2x[5y - 3xy - 4y^2 - 3x^3]$
 $= 10xy - 6x^2y - 8xy^2 - 6x^4$ Ans

(f) $9e^2 + 5f - \{4e(e+f)\}$

Sol $= 9e^2 + 5f - \{4e^2 + 4ef\}$
 $= 9e^2 + 5f - 4e^2 - 4ef$ Ans

Book answer is wrong

(g) $24a^2 - [4b^2\{(a+b)(b^2+a) - (a^2+b^3+c)\}]$

Sol $24a^2 - [4b^2\{ab^2 + a^2 + b^3 + ab - a^2 - b^3 - c\}]$
 $= 24a^2 - [4b^2\{ab^2 + ab - c\}]$
 $= 24a^2 - [4ab^4 + 4ab^3 - 4b^2c]$
 $= 24a^2 - 4ab^4 - 4ab^3 + 4b^2c$ Ans

(h) $4y - 2yz[4 + \{(8y + 2z^2) - 4y(5z + 2y)\}]$

Sol $= 4y - 2yz[4 + \{8y + 2z^2 - 20yz - 8y^2\}]$

Which is wrong statement.

(i) $2gh[2 + \{4g(7h + 3g^2h) - 4y(5h^3 + g^4)\}]$

Sol $= 2gh[2 + \{28gh + 12g^3h - 5h^3 - g^4\}]$

Which is wrong statement.

(j) $wx - 2x \div [4x - \{2w(5x + 2wx)\}]$

Sol $= wx - 2x \div [4x - \{10wx + 4w^2x\}]$
 $= wx - 2x \div [4x - 10wx - 4w^2x]$

Which is wrong statement.

Exercise 6.9

(TB Pg 133)

Identity 1: $(x+a)(x+b) = x^2 + (a+b)x + ab$

Identity 2: $(a+b)^2(a^2+2ab)+b^2$

Identity 3: $(a-b)^2 = a^2 - 2ab + b^2$ Identity 4: $a^2 - b^2 = (a-b)(a+b)$

Q1. Simplify the following binomials by using the identity.

(a) $(x+5)(x+4)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= x^2 + (5+4)x + 5 \times 4$$

$$= x^2 + 9x + 20 \text{ Ans}$$

(b) $(y-1)(y-2)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= y^2 + (-1-2)y + (-1)(-2)$$

$$= y^2 + (-3)y + 2$$

$$= y^2 - 3y + 2 \text{ Ans}$$

(c) $(a+6)(a+7)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= a^2 + (6+7)a + 6 \times 7$$

$$= a^2 + 13a + 42 \text{ Ans}$$

(d) $(b+5)(b-7)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= b^2 + (5-7)b + (5)(-7)$$

$$= b^2 + (-2)b - 35$$

$$= b^2 - 2b - 35 \text{ Ans}$$

(e) $(2a+4)(2a-5)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= (2a)^2 + (4-5)a + (4)(-5)$$

$$= 4a^2 + (-1)a - 20$$

$$= 4a^2 - a - 20 \text{ Ans}$$

(f) $(5m+1)(5m+5)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= (5m)^2 + (1+5)m + 1 \times 5$$

$$= 25m^2 + 6m + 5 \text{ Ans}$$

(g) $(4z-1)(4z-4)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= (4z)^2 + (-1-4)z + (-1)(-4)$$

$$= 16z^2 + (-5)z + 4$$

$$= 16z^2 - 5z + 4 \text{ Ans}$$

(h) $(3n+6)(3n+3)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= (3n)^2 + (6+3)n + (6)(3)$$

$$= 9n^2 + 9n + 18 \text{ Ans}$$

(i) $(7l-1)(7l+9)$

Sol $(x+a)(x+b) = x^2 + (a+b)x + ab$

$$= (7l)^2 + (-1+9)l + (-1)(9)$$

$$= 49l^2 + 8l - 9 \text{ Ans}$$

Q2. Evaluate the following by using the algebraic identity.

(a) 34×34

Sol $= (34)^2$

$$= (30+4)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (30)^2 + 2(30)(4) + (4)^2$$

$$= 900 + 240 + 16$$

$$= 1156 \text{ Ans}$$

(b) 103×103

Sol $= (103)^2$

$$= (100+3)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (100)^2 + 2(100)(3) + (3)^2$$

$$= 10000 + 600 + 9$$

$$= 10,609 \text{ Ans}$$

(c) 121×121

Sol $= (121)^2$

$$= (100+21)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (100)^2 + 2(100)(21) + (21)^2$$

$$= 10000 + 4200 + 441$$

$$= 14,641 \text{ Ans}$$

(d) 7.8×7.8

Sol $= (7.8)^2$

$$= (10-2.2)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (10)^2 - 2(2.2) + (2.2)^2$$

$$= 100 - 4.4 + 4.84$$

$$= 60.84 \text{ Ans}$$

2nd method:

Sol 7.8×7.8

$$= (7.8)^2$$

$$= (7+0.8)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (7)^2 + 2(7)(0.8) + (0.8)^2$$

$$= 49 + 11.2 + 0.64$$

$$= 60.84 \text{ Ans}$$

(e) Sol $(204)^2$
 $= (200 + 4)^2$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (200)^2 + 2(200)(4) + (4)^2$$

$$= 40000 + 1600 + 16$$

$$= 41,616 \text{ Ans}$$

(f) Sol $(1005)^2$
 $= (1000 + 5)^2$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (1000)^2 + 2(1000)(5) + (5)^2$$

$$= 1,000,000 + 10,000 + 25$$

$$= 1,010,025 \text{ Ans}$$

(g) Sol $(164)^2$
 $= (160 + 4)^2$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (160)^2 + 2(160)(4) + (4)^2$$

$$= 25600 + 1280 + 16$$

$$= 26,896 \text{ Ans}$$

(h) Sol $(302)^2$
 $= (300 + 2)^2$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$= (300)^2 + 2(300)(2) + (2)^2$$

$$= 90000 + 1200 + 4$$

$$= 91,204 \text{ Ans}$$

Q3. Find $a^2 + b^2$, if $a - b = 8$ and $ab = 3$
 Sol $a^2 + b^2 = ?$

Given that:-

$$a - b = 8 \text{ and } ab = 3$$

$$\text{Now, } a - b = 8$$

Taking square on b/s

$$(a-b)^2 = (8)^2$$

$$a^2 - 2ab + b^2 = 64$$

$$a^2 - 2(3) + b^2 = 64$$

$$a^2 - 6 + b^2 = 64$$

$$a^2 + b^2 = 64 + 6$$

$$a^2 + b^2 = 70 \text{ Ans}$$

Q4. Find $x^2 + \frac{1}{x^2}$ if $x - \frac{1}{x} = 4$.

Sol $x^2 + \frac{1}{x^2} = ?$

Given that

$$x - \frac{1}{x} = 4$$

Taking Square on b/s

$$\left(x - \frac{1}{x}\right)^2 = (4)^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$(x)^2 - 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 16$$

$$x^2 - 2 + \frac{1}{x^2} = 16$$

$$x^2 + \frac{1}{x^2} = 16 + 2$$

Book answer is wrong

$$x^2 + \frac{1}{x^2} = 18 \text{ Ans}$$

Q5. Find the unknown terms.

(a) $\left(x + \frac{1}{x}\right)^2 = x^2 + \underline{\hspace{2cm}} + \frac{1}{x^2}$

Sol $\left(x + \frac{1}{x}\right)^2$

$$= (x)^2 + 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2$$

$$= x^2 + \underline{2} + \frac{1}{x^2}$$

Unknown term = 2

(b) $a^2 - b^2 = (a+b)(a - \underline{\hspace{2cm}})$

Sol $a^2 - b^2$
 $= (a+b)(a - b)$

Unknown term = b. Ans

(c) $(5p+3q)^2 = \underline{\hspace{2cm}} + 30pq + 9q^2$

Sol $(5p+3q)^2$
 $= (5p)^2 + 2(5p)(3q) + (3q)^2$
 $= \underline{25p^2} + 30pq + 9q^2$

Unknown term = $25p^2$ Ans

(d) $(6a-4b)^2 = 36a^2 - 48ab + (\underline{\hspace{2cm}})$

Sol $(6a-4b)^2$
 $= (6a)^2 - 2(6a)(4b) + (4b)^2$
 $= 36a^2 - 48ab + \underline{16b^2}$

Unknown terms = $16b^2$ Ans

(e) $(x+4)(x+5) = x^2 + \underline{\hspace{2cm}} + 20$

Sol $(x+4)(x+5)$

$$= x^2 + (4+5)x + 4 \times 5$$

$$= x^2 + 9x + 20$$

Unknown term = $9x$ Ans

Q6. Expand the following by using basic algebraic formulae.

(a) $\left(2a + \frac{5}{7}\right)^2$

Sol $(a+b)^2 = a^2 + 2ab + b^2$

$$= (2a)^2 + 2(2a)\left(\frac{5}{7}\right) + \left(\frac{5}{7}\right)^2$$

$$= 4a^2 + \frac{20}{7}a + \frac{25}{49} \text{ Ans}$$

(b) $(3a+4b)^2$

Sol $(a+b)^2 = a^2 + 2ab + b^2$

$$= (3a)^2 + 2(3a)(4b) + (4b)^2$$

$$= 9a^2 + 24ab + 16b^2$$

(c) $\left(t^2 - \frac{1}{x^2}\right)^2$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$= (t^2)^2 - 2(t^2)\left(\frac{1}{x^2}\right) + \left(\frac{1}{x^2}\right)^2$$

$$= t^4 - \frac{2t^2}{x^2} + \frac{1}{x^4} \text{ Ans}$$

(d) $\left(\frac{3}{5}x - \frac{2}{3}y\right)^2$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$= \left(\frac{3}{5}x\right)^2 - 2\left(\frac{3}{5}x\right)\left(\frac{2}{3}y\right) + \left(\frac{2}{3}y\right)^2$$

$$= \frac{9}{25}x^2 - \frac{4}{5}xy + \frac{4}{9}y^2 \text{ Ans}$$

(e) $(p^2-4q)^2$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$= (p^2)^2 - 2(p^2)(4q) + (4q)^2$$

$$= p^4 - 8p^2q + 16q^2 \text{ Ans}$$

(f) $\left(x + \frac{1}{x}\right)^2$

Sol $(a+b)^2 = a^2 + 2ab + b^2$

$$= (x)^2 + 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2$$

$$= x^2 + 2 + \frac{1}{x^2} \text{ Ans}$$

(g) $\left(x - \frac{1}{x}\right)^2$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$= (x)^2 + 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2$$

$$= x^2 - 2 + \frac{1}{x^2} \text{ Ans}$$

(h) $\left(x^2 + \frac{1}{t^2}\right)^2$

Sol $(a+b)^2 = a^2 + 2ab + b^2$

$$= (x^2)^2 + 2(x^2)\left(\frac{1}{t^2}\right) + \left(\frac{1}{t^2}\right)^2$$

$$= x^4 + \frac{2x^2}{t^2} + \frac{1}{t^4} \text{ Ans}$$

(i) $\left(\frac{x}{2y} - \frac{2y}{x}\right)^2$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$= \left(\frac{x}{2y}\right)^2 - 2\left(\frac{x}{2y}\right)\left(\frac{2y}{x}\right) + \left(\frac{2y}{x}\right)^2$$

$$= \frac{x^2}{4y^2} - 2 + \frac{4y^2}{x^2} \text{ Ans}$$

Book answer is wrong.

(j) $a^2 - 49$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (a-7)(a+7) \text{ Ans}$$

(k) $25x^2 - 9y^2$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (5x-3y)(5x+3y) \text{ Ans}$$

(l) $1 - 25t^2$

Sol $(a-b)^2 = a^2 - 2ab + b^2$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (1-5t)(1+5t) \text{ Ans}$$

(m) $(x+5)^2 - (x+3)^2$

Sol $a^2 - b^2 = (a-b)(a+b)$
 $= ((x+5)-(x+3))((x+5)+(x+3))$
 $= (x+5-x-3)(x+5+x+3)$
 $= (2)(2x+8)$
 $= 4x+16$ Ans Book answer is wrong

(n)
 Sol $81p^2 - 49q^2$
 $= (9p)^2 - (7q)^2$
 $a^2 - b^2 = (a-b)(a+b)$
 $= (9p-7q)(9p+7q)$ Ans

Q7. Find the value of $x^3 + \frac{1}{x^2}$ when

$$x + \frac{1}{x} = 3.$$

Sol $x^2 + \frac{1}{x^2} = ?$

Given that $x + \frac{1}{x} = 3$

Taking Square on b/s

$$\left(x + \frac{1}{x}\right)^2 = (3)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(x)^2 + 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 9$$

$$x^2 + 2 + \frac{1}{x^2} = 9$$

$$x^2 + \frac{1}{x^2} = 9 - 2$$

$$x^2 + \frac{1}{x^2} = 7$$
 Ans

Q8. Find the value of $x^4 + \frac{1}{x^4}$ when

$$x + \frac{1}{x} = 7.$$

Sol $x^4 + \frac{1}{x^4} = ?$

Given That $x + \frac{1}{x} = 7$

Taking Square on b/s

$$\left(x + \frac{1}{x}\right)^2 = (7)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(x)^2 + 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 49$$

$$x^2 + 2 + \frac{1}{x^2} = 49$$

$$x^2 + \frac{1}{x^2} = 49 - 2$$

$$x^2 + \frac{1}{x^2} = 47$$

Again taking square on b/s

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (47)^2$$

$$(x^2)^2 + 2(x^2)\left(\frac{1}{x^2}\right) + \left(\frac{1}{x^2}\right)^2 = 2209$$

$$x^4 + 2 + \frac{1}{x^4} = 2209$$

$$x^4 + \frac{1}{x^4} = 2209 - 2$$

$$x^4 + \frac{1}{x^4} = 2207$$
 Ans

Q9. Find the value of $x^2 + \frac{1}{x^2}$ when

$$x - \frac{1}{x} = 10.$$

Sol: - $x^2 + \frac{1}{x^2} = ?$

Given that: $x - \frac{1}{x} = 10$

Taking square on b/s

$$\left(x - \frac{1}{x}\right)^2 = (10)^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$(x)^2 - 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 100$$

$$x^2 - 2 + \frac{1}{x^2} = 100$$

$$x^2 + \frac{1}{x^2} = 100 + 2$$

$$x^2 + \frac{1}{x^2} = 100 + 2$$

$$x^2 + \frac{1}{x^2} = 102.$$
 Ans

Q10. Find the value of $b^4 + \frac{1}{b^4}$ when $b - \frac{1}{b} = 4.$

Sol: $b^4 + \frac{1}{b^4} = ?$

Given that $b - \frac{1}{b} = 4$

Taking Square on b/s $\left(b - \frac{1}{b}\right)^2 = (4)^2$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$b^2 + \frac{1}{b^2} = 16 + 2$$

$$b^2 + \frac{1}{b^2} = 18$$

$$(b)^2 - 2\left(\cancel{b}\right)\left(\frac{1}{\cancel{b}}\right) + \left(\frac{1}{b}\right)^2 = 16$$

$$b^2 - 2 + \frac{1}{b^2} = 16$$

Again taking square on b/s

$$\left(b^2 + \frac{1}{b^2}\right)^2 = (18)^2$$

$$(b^2)^2 + 2\left(\cancel{b^2}\right)\left(\frac{1}{\cancel{b^2}}\right) + \left(\frac{1}{b^2}\right)^2 = 324$$

$$b^4 + 2 + \frac{1}{b^4} = 324$$

$$b^4 + \frac{1}{b^4} = 324 - 2$$

$$b^4 + \frac{1}{b^4} = 322 \text{ Ans}$$

Q11. Prove that

$$x + \frac{1}{x} = x^2 + \frac{1}{x^2} = x^4 + \frac{1}{x^4} \text{ when } x + \frac{1}{x} = 2.$$

Sol $x + \frac{1}{x} = 2 \rightarrow (i)$

Taking square on b/s

$$\left(x + \frac{1}{x}\right)^2 = (2)^2$$

$$(x)^2 + 2\left(\cancel{x}\right)\left(\frac{1}{\cancel{x}}\right) + \left(\frac{1}{x}\right)^2 = 4$$

$$x^2 + 2 + \frac{1}{x^2} = 4$$

$$x^2 + \frac{1}{x^2} = 4 - 2$$

$$x^2 + \frac{1}{x^2} = 2 \rightarrow (ii)$$

Again, Taking square on b/s

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (2)^2$$

$$(x^2)^2 + 2\left(\cancel{x^2}\right)\left(\frac{1}{\cancel{x^2}}\right) + \left(\frac{1}{x^2}\right)^2 = 4$$

$$x^4 + 2 + \frac{1}{x^4} = 4$$

$$x^4 + \frac{1}{x^4} = 4 - 2$$

$$x^4 + \frac{1}{x^4} = 2 \rightarrow (iii)$$

From (i), (ii), (iii)

$$x + \frac{1}{x} = x^2 + \frac{1}{x^2} = x^4 + \frac{1}{x^4}$$

Hence verified

Q12. Find the value of $p^4 + \frac{1}{p^4}$ when

$$p^2 + \frac{1}{p^2} = 30.$$

Sol $p^4 + \frac{1}{p^4} = ?$

Given that: $p^2 + \frac{1}{p^2} = 30$

Taking square on b/s $\left(p^2 + \frac{1}{p^2}\right)^2 = (30)^2$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(p^2)^2 + 2\left(\cancel{p^2}\right)\left(\frac{1}{\cancel{p^2}}\right) + \left(\frac{1}{p^2}\right)^2 = 900$$

$$p^4 + 2 + \frac{1}{p^4} = 900$$

$$p^4 + \frac{1}{p^4} = 900 - 2$$

$$p^4 + \frac{1}{p^4} = 898 \text{ Ans Book answer wrong}$$

Q13. Evaluate the following by using appropriate algebraic formulae.

(a) $(98)^2$

Sol $= (100 - 2)^2$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$= (100)^2 - 2(100)(2) + (2)^2$$

$$= 10000 - 400 + 4$$

$$= 9,604 \text{ Ans}$$

(b) $(0.98)^2$

Sol $= (1-0.02)^2$
 $(a-b)^2 = a^2 - 2ab + b^2$
 $= (1)^2 - 2(1)(0.02) + (0.02)^2$
 $= 1 - 0.04 + 0.0004$
 $= 0.9604$ Ans

(c) Sol $(15)^2$
 $= (10+5)^2$
 $(a+b)^2 = a^2 + 2ab + b^2$
 $= (10)^2 + 2(10)(5) + (5)^2$
 $= 100 + 100 + 25$
 $= 225$ Ans

(d) Sol $(1.5)^2$
 $= (1+0.5)^2$
 $(a+b)^2 = a^2 + 2ab + b^2$
 $= (1)^2 + 2(1)(0.5) + (0.5)^2$
 $= 1 + 1 + 0.25$
 $= 2.25$ Ans

(e) Sol $(0.05)^2$
 $= (1-0.95)^2$
 $(a-b)^2 = a^2 - 2ab + b^2$
 $= (1)^2 - 2(1)(0.95) + (0.95)^2$
 $= 1 - 1.9 + 0.9025$
 $= 0.0025$ Ans

(f) Sol $(1205)^2$
 $= (1200+5)^2$
 $(a+b)^2 = a^2 + 2ab + b^2$
 $= (1200)^2 + 2(1200)(5) + (5)^2$
 $= 1440000 + 12000 + 25$
 $= 1,452,025$ Ans

(g) Sol $(3200)^2$
 $= (3000+200)^2$
 $(a+b)^2 = a^2 + 2ab + b^2$
 $= (3000)^2 + 2(3000)(200) + (200)^2$
 $= 9000000 + 1200000 + 40000$
 $= 10240000$ Ans

(h) Sol $(3900)^2$
 $= (4000-100)^2$
 $(a-b)^2 = a^2 - 2ab + b^2$

$$= (4000)^2 - 2(4000)(100) + (100)^2$$

$$= 16000000 - 800000 + 10000$$

$$= 15,210,000$$
 Ans

(i) Sol $(1.10)^2$
 $= (1+0.10)^2$
 $(a+b)^2 = a^2 + 2ab + b^2$

$$= (1)^2 + 2(1)(0.10) + (0.10)^2$$

$$= 1 + 0.20 + 0.01$$

$$= 1.21$$
 Ans

(j) Sol $(105 \times 95)^2$
 $= (100+5)(100-5)$
 $(a+b)(a-b) = a^2 - b^2$

$$= (100)^2 - (5)^2$$

$$= 10,000 - 25 = 9,975$$
 Ans

(k) Sol 325×275
 $= (300+25)(300-25)$
 $(a+b)(a-b) = a^2 - b^2$

$$= (300)^2 - (25)^2$$

$$= 90,000 - 625 = 89,375$$
 Ans

(l) Sol 1010×990
 $= (1000+10)(1000-10)$
 $(a+b)(a-b) = a^2 - b^2$
 $= (1000)^2 - (10)^2$
 $= 1,000,000 - 100 = 999,900$ Ans

Exercise 6.10 (TB Pg 136)

Q1. Factorize the following algebraic expressions.

(a) $2a + 6$
 Sol $= 2(a+3)$ Ans

(b) $5x - 10$
 Sol $= 5(x-2)$ Ans

(c) $x^2 - x$
 Sol $= x(x-1)$ Ans

(d) $3x^3 + 12x^2$
 Sol $= 3x^2(x+4)$ Ans

(e) $7a - 7b + 7c$
 Sol $= 7(a-b+c)$ Ans

(f) $3b^2 + 6b - 15$
 Sol $= 3(b^2 + 2b - 5)$ Ans

(g) $5ax + 10ay - 25az$
 Sol $= 5a(x+2y-5z)$ Ans

(h) $7p^3 - 14p^2 - 21p$

Sol $= 7p(p^2 - 2p - 3)$
 $= 7p(p^2 - 3p + 1p - 3)$
 $= 7p(p(p - 3) + 1(p - 3))$
 $= 7(p - 3)(p + 1)$ Ans

(i) $10p^2q + 25pq^2 - 35pqr$
 Sol $= 5pq(2p + 5q - 7r)$ Ans

(j) $11ab - 22bc + 33cd$
 Sol $= 11(ab - 2bc + 3cd)$ Ans

(k) $a^2 + ab + 3a + 3b$
 Sol $= a(a + b) + 3(a + b)$
 $= (a + b)(a + 3)$ Ans

(l) $4a^2 + 4b^2 + a^2c^2 + b^2c^2$
 Sol $= 4(a^2 + b^2) + c^2(a^2 + b^2)$
 $= (a^2 + b^2)(4 + c^2)$ Ans

(m) $3ax + 3ay - 14x - 14y$
 Sol $= 3a(x + y) - 14(x + y)$
 $= (x + y)(3a - 14)$ Ans

(n) $20xz - 10xy - 15yz$
 Sol $= 5(4xz - 2xy - 3yz)$ Ans

(o) $2tx + 6ty - 3qx - 9qy$
 Sol $= 2t(x + 3y) - 3q(x + 3y)$
 $= (x + 3y)(2t - 3q)$ Ans

(p) $4ay - 20by - az + 5bz$
 Sol $= 4y(a - 5b) - z(a - 5b)$
 $= (a - 5b)(4y - z)$ Ans

(q) $pr + ps + qr + qs$
 Sol $= p(r + s) + q(r + s)$
 $= (r + s)(p + q)$ Ans

(r) $su - sv - tu + tv$
 Sol $= s(u - v) - t(u - v)$
 $= (u - v)(s - t)$ Ans

(s) $6x^2 - 4xy - 9xy + 6y^2$
 Sol $= 2x(3x - 2y) - 3y(3x - 2y)$
 $= (3x - 2y)(2x - 3y)$ Ans

(t) $15ax^2 + 21ay^2 - 20bx^2 - 28by^2$
 Sol $= 3a(5x^2 + 7y^2) - 4b(5x^2 + 7y^2)$
 $= (5x^2 + 7y^2)(3a - 4b)$ Ans

Exercise 6.11

(TB pg 138)

Q1. Factorize the following algebraic expressions.

(a) $a^2 + 6a + 9$

Sol $= (a)^2 + 2(a)(3) + (3)^2$

$$a^2 + 2ab + b^2 = (a + b)^2$$

$= (a + 3)^2$ Ans

(b) $4a^2 + 20ab + 25b^2$

Sol $= (2a)^2 + 2(2a)(5b) + (5b)^2$

$$a^2 + 2ab + b^2 = (a + b)^2$$

$(2a + 5b)^2$ Ans

(c) $9x^2 + 12xy + 4y^2$

Sol $= (3x)^2 + 2(3x)(2y) + (2y)^2$

$$a^2 + 2ab + b^2 = (a + b)^2$$

$= (3x + 2y)^2$ Ans

(d) $4a^2 - 12a + 9$

Sol $= (2a)^2 - 2(2a)(3) + (3)^2$

$$a^2 - 2ab + b^2 = (a - b)^2$$

$= (2a - 3)^2$ Ans

(e) $9a^2 - 30ab + 25b^2$

Sol $= (3a)^2 + 2(3a)(5b) + (5b)^2$

$$a^2 - 2ab + b^2 = (a + b)^2$$

$= (3a - 5b)^2$ Ans

(f) $25p^2 + 70pq + 49q^2$

Sol: The statement of given question is wrong.

(g) $49p^2 - 126pq + 81q^2$

Sol $= (7p)^2 - 2(7p)(9q) + (9q)^2$

$$a^2 - 2ab + b^2 = (a - b)^2$$

$= (7p - 9q)^2$ Ans

(h) $49t^2 + 154tv + 121v^2$

Sol $= (7t)^2 + 2(7t)(11v) + (11v)^2$

$$a^2 + 2ab + b^2 = (a + b)^2$$

$= (7t + 11v)^2$ Ans

(i) $t^2 - \frac{4}{5}tv + \frac{4}{25}v^2$

Sol $= (t)^2 - 2(t)\left(\frac{2}{5}v\right) + \left(\frac{2}{5}v\right)^2$

$$a^2 - 2ab + b^2 = (a - b)^2$$

$= \left(t - \frac{2}{5}v\right)^2$ Ans

(j) $16x^2 - 56xy + 49y^2$

Sol $= (4x)^2 - 2(4x)(7y) + (7y)^2$

$$a^2 - 2ab + b^2 = (a - b)^2$$

$= (4x - 7y)^2$ Ans

(k) $a^2 - 25$

Sol $= (a)^2 - (5)^2$

$$a^2 - b^2 = (a - b)(a + b)$$

$= (a - 5)(a + 5)$ Ans

(l) $4b^2 - 81$

Sol $= (2b)^2 - (9)^2$

$$a^2 - b^2 = (a - b)(a + b)$$

$= (2b - 9)(2b + 9)$ Ans

(m) $9t^2 - 49q^2$
 Sol $= (3t)^2 - (7q)^2$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (3t-7q)(3t+7q) \text{ Ans}$$

(n) $\frac{9}{16}u^2 - \frac{25}{49}v^2$

Sol $= \left(\frac{3}{4}u\right)^2 - \left(\frac{5}{7}v\right)^2$

$$a^2 - b^2 = (a-b)(a+b)$$

$$\left(\frac{3}{4}u - \frac{5}{7}v\right)\left(\frac{3}{4}u + \frac{5}{7}v\right)$$

(o) $225x^2 - 256y^2$
 Sol $= (15x)^2 - (16y)^2$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (15x-16y)(15x+16y) \text{ Ans}$$

(p) $(a+5)^2 - c^2$
 Sol $= (a+5)^2 - (c)^2$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (a+5-c)(a+5+c) \text{ Ans}$$

(q) $9b^2 + 42b + 49 - d^2$
 Sol $= (3b)^2 + 2(3b)(7) + (7)^2 - d^2$

$$a^2 + 2ab + b^2 = (a+b)^2$$

$$= (3b+7)^2 - (d)^2$$

$$= (3b+7-d)(3b+7+d) \text{ Ans}$$

(r) $25p^2 - 70pq + 49d^2 - 25r^2$
 Sol $= (5p)^2 - 2(5p)(7d) + (7d)^2 - 25r^2$

$$a^2 - 2ab + b^2 = (a-b)^2$$

$$= (5p-7d)^2 - (5r)^2$$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (5p-7d-5r)(5p-7d+5r) \text{ Ans}$$

(s) $49t^2 - q^2 + 121u^2 - 154tu$

Sol $49t^2 - 154tu + 121u^2 - q^2$
 $= (7t)^2 - 2(7t)(11u) + (11u)^2 - q^2$

$$a^2 + 2ab + b^2 = (a+b)^2$$

$$= (7t-11u)^2 - (q)^2$$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (7t-11u-q)(7t-11u+q) \text{ Ans}$$

(t) $225x^2 - 510xy - 400z^2 + 289y^2$
 Sol $225x^2 - 510xy + 289y^2 - 400z^2$

$$= (15x)^2 - 2(15x)(17y) + (17y)^2 - 400z^2$$

$$a^2 - 2ab + b^2 = (a-b)^2$$

$$(15x-17y)^2 - (20z)^2$$

$$a^2 - b^2 = (a-b)(a+b)$$

$$= (15x-17y-20z)(15x-17y+20z) \text{ Ans}$$

Exercise 6.12

(Tb pg 141)

Q1. Expand the following algebraic expressions by using the algebraic formulae.

(a) $(2a+3b)^3$

Sol $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$$= (2a)^3 + 3(2a)^2(3b) + 3(2a)(3b)^2 + (3b)^3$$

$$= 8a^3 + 3(4a^2)(3b) + 3(2a)(9b^2) + 27b^3$$

$$= 8a^3 + 36a^2b + 54ab^2 + 27b^3 \text{ Ans}$$

(b) $(x+5y)^3$

Sol $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$$= (x)^3 + 3(x)^2(5y) + 3(x)(5y)^2 + (5y)^3$$

$$= x^3 + 3(x^2)(5y) + 3(x)(25y^2) + 125y^3$$

$$= x^3 + 15yx^2 + 75xy^2 + 125y^3 \text{ Ans}$$

(c) $(a-5b)^3$

Sol $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$

$$= (a)^3 - 3(a)^2(5b) + 3(a)(5b)^2 - (5b)^3$$

$$= a^3 - 3(a^2)(5b) + 3(a)(25b^2) - 125b^3$$

$$= a^3 - 15a^2b + 75ab^2 - 125b^3 \text{ Ans}$$

(d) $(3p+4q)^3$

Sol $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$$= (3p)^3 + 3(3p)^2(4q) + 3(3p)(4q)^2 + (4q)^3$$

$$= 27p^3 + 3(9p^2)(4q) + 3(3p)(16q^2) + 64q^3$$

$$= 27p^3 + 108p^2q + 144pq^2 + 64q^3 \text{ Ans}$$

(e) $(5p-7q)^3$

Sol $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$

$$= (5p)^3 - 3(5p)^2(7q) + 3(5p)(7q)^2 + (7q)^3$$

$$= 125p^3 - 3(25p^2)(7q) + 3(5p)(49q^2) + 343q^3$$

$$= 125p^3 - 525p^2q + 735pq^2 + 343q^3 \text{ Ans}$$

(f) $(2t-3u)^3$

Sol $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
 $= (2t)^3 - 3(2t)^2(3u) + 3(2t)(3u)^2 - (3u)^3$
 $= 8t^3 - 3(4t^2)(3u) + 3(2t)(9u^2) - 27u^3$
 $= 8t^3 - 36t^2u + 54tu^2 - 27u^3$ Ans

(g) $\left(x + \frac{1}{x}\right)^3$

Sol $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
 $= (x)^3 + 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 + \left(\frac{1}{x}\right)^3$
 $= x^3 + 3(x^2)\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x^2}\right) + \frac{1}{x^3}$
 $= x^3 + 3x + \frac{3}{x} + \frac{1}{x^3}$ Ans

(h) $\left(x - \frac{1}{x}\right)^3$

Sol $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
 $= (x)^3 - 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 - \left(\frac{1}{x}\right)^3$
 $= x^3 - 3(x^2)\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x^2}\right) - \frac{1}{x^3}$
 $= x^3 - 3x + \frac{3}{x} - \frac{1}{x^3}$ Ans

(i) $\left(4p - \frac{1}{4}\right)^3$

Sol $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
 $= (4p)^3 - 3(4p)^2\left(\frac{1}{4}\right) + 3(4p)\left(\frac{1}{4}\right)^2 - \left(\frac{1}{4}\right)^3$
 $= 64p^3 - 3(16p^2)\left(\frac{1}{4}\right) + 3(4p)\left(\frac{1}{16}\right) - \frac{1}{64}$
 $= 64p^3 - 12p^2 + \frac{3}{4}p - \frac{1}{64}$ Ans

(j) $\left(5x + \frac{1}{5x}\right)^3$

Sol $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$$= (5x)^3 + 3(5x)^2\left(\frac{1}{5x}\right) + 3(5x)\left(\frac{1}{5x}\right)^2 + \left(\frac{1}{5x}\right)^3$$

$$= 125x^3 + 3(25x^2)\left(\frac{1}{5x}\right) + \frac{3}{5x} + \frac{1}{125x^3}$$

$$125x^3 + 15x + \frac{3}{5x} + \frac{1}{125x^3}$$
 Ans

(k) Find the value of $x^3 + \frac{1}{x^3}$ when

$$x + \frac{1}{x} = 4.$$

Sol: $x^3 + \frac{1}{x^3} = ?$

Given that: $x + \frac{1}{x} = 4$

Taking cube on b/s $\left(x + \frac{1}{x}\right)^3 = (4)^3$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$\left(x + \frac{1}{x}\right)^3 + 3\left(x + \frac{1}{x}\right)^2\left(\frac{1}{x}\right) + 3\left(x + \frac{1}{x}\right)\left(\frac{1}{x}\right)^2 + \left(\frac{1}{x}\right)^3 = 64$$

$$x^3 + 3\left(x^2\right)\left(\frac{1}{x}\right) + 3\left(x\right)\left(\frac{1}{x^2}\right) + \frac{1}{x^3} = 64$$

$$x^3 + 3x + \frac{3}{x} + \frac{1}{x^3} = 64$$

$$x^3 + 3\left(x + \frac{1}{x}\right) + \frac{1}{x^3} = 64$$

$$x^3 + 3(4) + \frac{1}{x^3} = 64$$

$$x^3 + 12 + \frac{1}{x^3} = 64$$

$$x^3 + \frac{1}{x^3} = 64 - 12$$

$$x^3 + \frac{1}{x^3} = 52$$
 Ans

(l) Find the value of $x^3 + \frac{1}{x^3}$ when

$$x + \frac{1}{x} = 7$$

Sol: $x^3 + \frac{1}{x^3} = ?$

Given that: $x + \frac{1}{x} = 7$

Taking cube on b/s $\left(x + \frac{1}{x}\right)^3 = (7)^3$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(x)^3 + 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 + \left(\frac{1}{x}\right)^3 = 343$$

$$x^3 + (x^2)\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x^2}\right) + \frac{1}{x^3} = 343$$

$$x^3 + 3\left(x + \frac{1}{x}\right) + \frac{1}{x^3} = 343$$

$$x^3 + 3(7) + \frac{1}{x^3} = 343$$

$$x^3 + 21 + \frac{1}{x^3} = 343$$

$$x^3 + \frac{1}{x^3} = 343 - 21$$

$$x^3 + \frac{1}{x^3} = 322 \text{ Ans}$$

(m) Find the value of $x^3 - \frac{1}{x^3}$ when

$$x - \frac{1}{x} = 3$$

Sol: $x^3 - \frac{1}{x^3} = ?$

Given that $x - \frac{1}{x} = 3$

Taking cube on b/s $\left(x - \frac{1}{x}\right)^3 = (3)^3$

$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$$(x)^3 - 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 - \left(\frac{1}{x}\right)^3 = 27$$

$$x^3 - 3x + \frac{3}{x} - \frac{1}{x^3} = 27$$

$$x^3 - 3\left(x - \frac{1}{x}\right) - \frac{1}{x^3} = 27$$

$$x^3 - 3\left(x - \frac{1}{x}\right) - \frac{1}{x^3} = 27$$

$$x^3 - 3(3) - \frac{1}{x^3} = 27$$

$$x^3 - 9 - \frac{1}{x^3} = 27$$

$$x^3 - \frac{1}{x^3} = 27 + 9$$

$$x^3 - \frac{1}{x^3} = 36 \text{ Ans}$$

(n) Find the value of $x^3 - \frac{1}{x^3}$ when

$$x - \frac{1}{x} = 5$$

Sol $x - \frac{1}{x} = ?$

Given that

$$x - \frac{1}{x} = 5$$

Taking cube on b/s $\left(x - \frac{1}{x}\right)^3 = (5)^3$

$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$$(x)^3 - 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 - \left(\frac{1}{x}\right)^3 = 125$$

$$x^3 - 3(x^2)\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x^2}\right) - \frac{1}{x^3} = 125$$

$$x^3 - 3x + \frac{3}{x} - \frac{1}{x^3} = 125$$

$$x^3 - 3\left(x - \frac{1}{x}\right) - \frac{1}{x^3} = 125$$

$$x^3 - 3(5) - \frac{1}{x^3} = 125$$

$$x^3 - 15 - \frac{1}{x^3} = 125$$

$$x^3 - \frac{1}{x^3} = 125 + 15 \Rightarrow x^3 - \frac{1}{x^3} = 140 \text{ Ans}$$

(O) Find the value of $x^3 - \frac{1}{x^3}$ when $x + \frac{1}{x} = 8$

Sol $x^3 - \frac{1}{x^3} = ?$

Given that

$$x + \frac{1}{x} = 8$$

Taking cube on b/s $\left(x + \frac{1}{x}\right)^3 = (8)^3$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(x)^3 + 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 + \left(\frac{1}{x}\right)^3 = 512$$

$$x^3 + 3(x^2)\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x^2}\right) + \frac{1}{x^3} = 512$$

$$x^3 + 3x + \frac{3}{x} + \frac{1}{x^3} = 512$$

$$x^3 + 3x + \frac{3}{x} + \frac{1}{x^3} = 512$$

$$x^3 + 3\left(x + \frac{1}{x}\right) + \frac{1}{x^3} = 512$$

$$x^3 + 3(8) + \frac{1}{x^3} = 512$$

$$x^3 + 24 + \frac{1}{x^3} = 512$$

$$x^3 + \frac{1}{x^3} = 512 - 24$$

$$x^3 + \frac{1}{x^3} = 488 \text{ Ans}$$

(p) Find the value of $x^3 - \frac{1}{x^3}$ when $x - \frac{1}{x} = 10$.

Sol: $x^3 - \frac{1}{x^3} = ?$

Given that $x - \frac{1}{x} = 10$

Taking cube on b/s $\left(x - \frac{1}{x}\right)^3 = (10)^3$

$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 + b^3$$

$$(x)^3 - 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 - \left(\frac{1}{x}\right)^3 = 1000$$

$$x^3 - 3\left(x^2\right)\left(\frac{1}{x}\right) + 3\left(x\right)\left(\frac{1}{x^2}\right) - \frac{1}{x^3} = 1000$$

$$x^3 - 3x + \frac{3}{x} - \frac{1}{x^3} = 1000$$

$$x^3 - 3\left(x - \frac{1}{x}\right) - \frac{1}{x^3} = 1000$$

$$x^3 - 3(10) - \frac{1}{x^3} = 1000$$

$$x^3 - 30 - \frac{1}{x^3} = 1000$$

$$x^3 - \frac{1}{x^3} = 1000 + 30 \Rightarrow x^3 - \frac{1}{x^3} = 1030 \text{ Ans}$$

Review Exercise

(TB Pg 143)

Q1. Choose the correct option.

(a) The general term for the sequence $-5, 7, 19, 31, \dots$

(i) $a_n = 5 + 12(n+1)$

(ii) $a_n = -5 + 12(n+1)$

(iii) $a_n = 5 - 12(n+1)$

(iv) $a_n = -5 + 12(n-1)$

(b) The 11th term of the sequence 3, 11, 19, 27, ... is:

(i) 80

(ii) ☒ 83

(iii) 91

(iv) 75

(c) A sequence of numbers in which each term is obtained by the preceding term by a fixed number is called:

(i) Arithmetic sequence (ii) ☒ Geometric Series

(iii) Fibonacci Sequence (iv) term to term rule

(d) A polynomial with degree three is known as a _____ poly.

(i) Linear

(ii) ☒ quadratic

(iii) ☒ cubic

(iv) biquadratic

(e) The result of multiplication of $(2x+3)$ and $(1+4x)$ is:

(i) ☒ $8x^2 + 14x + 3$

(ii) $14x + 3$

(iii) $8x^2 + 14x - 3$

(iv) $8x^2 - 14x + 3$

(f) $(2a-4)^2$ is equal to:

i. $4a^2 - 8a + 16$

(ii) ☒ $4a^2 - 16a + 16$

iii. $a^2 - 16a + 16$

(iv) $4a^2 - 16a - 16$

(g) The factorization of $x^2 + 7x + 12$ is:

i. $(x+4)(x-3)$

ii. $(x-4)(x-3)$

iii. ☒ $(x+4)(x+3)$

iv. $(x-4)(x+3)$

(h) $(m-n)^3$ is equal to:

(i) ☒ $m^3 - 3m^2n + 3mn^2 - n^3$

(ii) $m^3 + 3m^2n + 3mn^2 - n^3$

(iii) $m^3 - 3m^2n - 3mn^2 - n^3$

(iv) $m^3 - 3m^2n + 3mn^2 + n^3$

(i) An _____ is a combination of variables, constant, coefficient, exponent and symbol of operations.

(i) ☒ expression (ii) equation

(iii) equality (iv) inequality

(j) _____ are the algebraic expressions in which the powers of variables are whole numbers.

(i) expression

(ii) arithmetic sequence

(iii) open sentence

(iv) ☒ polynomial

Q2. Find the 27th and 34th term of the given sequence $-31, -21, -11, -1, 9, \dots$

Sol $a_{27} = ?$

$$a_{34} = ?$$

Given sequence is: $-31, 21, -11, -1, 1, 9, \dots$

Here

$$a_1 = -31, a_2 = -21, a_3 = -11$$

$$d = a_2 - a_1 = a_3 - a_2$$

$$d = -21 - (-31) = -11 - (-21)$$

$$d = -21 + 31 = -11 + 21 = 10$$

We know that

$$a_n = a + (n-1)d$$

put $n = 27$

$$a_{27} = -31 + (27-1)10$$

$$a_{27} = -31 + (26)10$$

$$a_{27} = -31 + 260$$

$$a_{27} = 229 \text{ Ans}$$

put $n = 34$

$$a_{34} = -31 + (34-1)10$$

$$a_{34} = -31 + (33)10$$

$$a_{34} = -31 + 330$$

$$a_{34} = 299 \text{ Ans}$$

Q3. Rehan bought a bike in Rs 87800 on installment. If he pays Rs 1500 in one month, Rs 2200 on the second month, Rs 2900 on third month. If he keeps increasing the installment money. How much will he pay on 11th month and 15th month?

Sol $a_{11} = ?, a_{15} = ?$

$$a_1 = 1500, a_2 = 2200, a_3 = 2900,$$

$$a_2 - a_1 = a_3 - a_2$$

$$2200 - 1500 = 2900 - 2200$$

$$700 = 700$$

$$\Rightarrow d = 700$$

$$a_n = a + (n-1)d \rightarrow$$

put $n = 11$

$$a_{11} = 1500 + (11-1)700$$

$$a_{11} = 1500 + (10)700$$

$$a_{11} = 1500 + 7000$$

$$a_{11} = 8,500 \text{ Ans}$$

Put $n = 15$

$$a_{15} = 1500 + (15-1)700$$

$$a_{15} = 1500 + (14)700$$

$$a_{15} = 1500 + 9800$$

$$a_{15} = 11,300 \text{ Ans}$$

Q4. Wasif wants to participate in a race. For this, he is going to nearby park for running practice. First day he runs for 15

minutes, second day he runs for 30 minutes, third day he runs for 45 minutes. He keeps increase the time for practice. For how much time will he run on 12th and 19th day?

Sol: $a_{12} = ?, a_{19} = ?$

$$a_1 = 15, a_2 = 30, a_3 = 45$$

$$a_2 - a_1 = a_3 - a_2 = 30, a_3 = 45$$

$$a_2 - a_1 = a_3 - a_2$$

$$30 - 15 = 45 - 30$$

$$15 = 15$$

$$\Rightarrow d = 15$$

We know that

$$a_n = a_1 + (n-1)d \rightarrow (i)$$

put $n = 12$

$$a_{12} = 15 + (12-1)15$$

$$a_{12} = 15 + (11)15$$

$$a_{12} = 15 + 165$$

$$a_{12} = 180 \text{ Ans}$$

Put $n = 19$

$$a_{19} = 15 + (19-1)15$$

$$a_{19} = 15 + (14)15$$

$$a_{19} = 15 + 210$$

$$a_{19} = 225 \text{ Ans}$$

Q5. Rabia gave donation to an Eidi center. First month she donate the money with increase of Rs 750 that is Rs 3750, third month she donated Rs 4500. If she keeps donating an next months in the same pattern, how much she will donate in 7th month and 11th months.

Sol: $a_7 = ?, a_{11} = ?$

$$a_1 = 3000, a_2 = 3750, a_3 = 4500, d = 750$$

we know that

$$a_n = a + (n-1)d \rightarrow (i)$$

put $n = 7$

$$a_7 = 3000 + (7-1)750$$

$$a_7 = 3000 + (6)750$$

$$a_7 = 3000 + 4500$$

$$a_7 = 7500 \text{ Ans}$$

Put $n = 11$

$$a_{11} = 3000 + (11-1)750$$

$$a_{11} = 3000 + (10)750$$

$$a_{11} = 10,500 \text{ Ans}$$

Q6. Find the 21st term of an arithmetic sequence with first term -9 and the common difference is 11.

Sol: $a_{21} = ?$

Given that

$a = -9, d = 11$

we know that

$$a_n = a + (n-1)d \rightarrow (i)$$

$$a_{21} = -9 + (21-1)11$$

$$a_{21} = -9 + (20)11$$

$$a_{21} = -9 + 220$$

$$a_{21} = 211 \text{ Ans}$$

Q7. Find the sum of $5x-3y+5z$, $2x+7y$ and $7y+12z$.

$$\begin{aligned} \text{Sol } &= (5x-3y+5z) + (2x+7y) + (7y+12z) \\ &= 5x+2x-3y+7y+7y+5z+12z \\ &= 7x+11y+17z \text{ Ans} \end{aligned}$$

Q8. Find the difference of $15x^4+4y^3+10x+5$ and $7x^4-8x^2+7y^3-8$

$$\begin{aligned} \text{Sol } &= (15x^4+4y^3+10x+5) - (7x^4-8x^2+7y^3-8) \\ &= 15x^4+4y^3+10x+5-7x^4+8x^2-7y^3+8 \\ &= 8x^4-3y^3+8x^2+10x+13 \text{ Ans} \end{aligned}$$

Q9. Find the product of $(x^3+yz+2y^2)$ and x^2+2y .

$$\begin{aligned} \text{Sol } &= (x^2+2y)(x^3+yz+2y^2) \\ &= x^2(x^3+yz+2y^2) + 2y(x^3+yz+2y^2) \\ &= x^5+x^2yz+2x^2y^2+2x^3y+2y^2z+4y^3 \text{ Ans} \end{aligned}$$

Q10. Simplify the following.

(a) $5v-v[4u^2+5w\{(4v+2w)(u^2+2v)\}]$

$$\begin{aligned} \text{Sol } &= 5v-v[4u^2+5w\{4u^2v+8v^2+2u^2w+4wv\}] \\ &= 5v-v[4u^2+20u^2w+40v^2w+10u^2w^2+20w^2v] \\ &= 5v-4u^2v-20u^2vw-40v^3w-10u^2w^3v-20w^2v^2 \end{aligned}$$

(b) $6y+3xy[7y^2-\{5x^3+(6y+3x^2y)\}]$

$$\begin{aligned} \text{Sol } &= 6y+3xy[7y^2-\{5x^3+6y+3x^2y\}] \\ &= 6y+3xy[7y^2-5x^3-6y-3x^2y] \\ &= 6y+21xy^3-15x^4y-18xy^2-9x^3y^2 \text{ Ans} \end{aligned}$$

Q11. Divide $6x^2y+3xy+3y^2$ by $3y$.

$$\begin{array}{r} 2x^2+x+y \\ \text{Sol } 3y \overline{) 6x^2y+3xy+3y^2} \\ \underline{\pm 6x^2y} \\ 3xy+3y^2 \\ \underline{\pm 3xy} \\ 3y^2 \\ \underline{} \\ 0 \end{array}$$

Thus,

$$(6x^2y+3xy+3y^2) \div 3y = 2x^2+x+y \text{ Ans}$$

Q12. Simplify the following.

(a) $(y+5)(y-5)$

$$\begin{aligned} \text{Sol } &= (a+b)(a-b) = a^2-b^2 \\ &= (y)^2 - (5)^2 \\ &= y^2 - 25 \text{ Ans} \end{aligned}$$

(b) $(4t+5u)^2$

$$\begin{aligned} \text{Sol } &= (a+b)^2 = a^2+2ab+b^2 \\ &= (4t)^2 + 2(4t)(5u) + (5u)^2 \\ &= 16t^2 + 40tu + 25u^2 \text{ Ans} \end{aligned}$$

(c) $(102)^2$

$$\begin{aligned} \text{Sol } &= (100+2)^2 \\ &= (a+b)^2 = a^2+2ab+b^2 \\ &= (100)^2 + 2(100)(2) + (2)^2 \\ &= 10000 + 400 + 4 \\ &= 10,404 \text{ Ans} \end{aligned}$$

Q13. Find the value of $x^2 + \frac{1}{x^2}$ when $x + \frac{1}{x} = 4$

Sol $x^2 + \frac{1}{x^2} = ?$

Given that $x + \frac{1}{x} = 4$

Taking square on b/s

$$\left(x + \frac{1}{x}\right)^2 = (4)^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(x)^2 + 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 16$$

$$x^2 + 2 + \frac{1}{x^2} = 16$$

$$x^2 + \frac{1}{x^2} = 16 - 2$$

$$x^2 + \frac{1}{x^2} = 14. \text{ Ans}$$

Q14. Factorize the following expression.

(a) $9x^2+6xy+6xy+6y^2$

Sol: cannot be factorized.

(b) $3s+6t$

Sol $= 3(s+2t) \text{ Ans}$

(c) $b^2+6ab+(3a)^2$

$$= (b)^2 + 2(b)(3a) + (3a)^2$$

$$a^2 + 2ab + b^2 = (a+b)^2$$

$$= (b+3a)^2 \text{ Ans}$$

Q15. Find the value of $x^3 + \frac{1}{x^3}$ if:

(a) $x + \frac{1}{x} = 6$ (b) $x + \frac{1}{x} = 12$

Solution of Part (a): $x^3 + \frac{1}{x^3} = ?$

$x + \frac{1}{x} = 6$ (given) Taking cube on b/s

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(x)^3 + 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 + \left(\frac{1}{x}\right)^3 = 216$$

$$x^3 + 3(x^2)\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x^2}\right) + \frac{1}{x^3} = 216$$

$$x^3 + 3x + \frac{3}{x} + \frac{1}{x^3} = 216$$

$$x^3 + 3\left(x + \frac{1}{x}\right) + \frac{1}{x^3} = 216$$

$$x^3 + 3(6) + \frac{1}{x^3} = 216$$

$$x^3 + 18 + \frac{1}{x^3} = 216$$

$$x^3 + \frac{1}{x^3} = 216 - 18$$

$$x^3 + \frac{1}{x^3} = 198 \text{ Ans}$$

Solution of part (b): $x^3 + \frac{1}{x^3} = ?$ $x + \frac{1}{x} = 12$

Taking cube on b/s $\left(x + \frac{1}{x}\right)^3 = (12)^3$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(x)^3 + 3(x)^2\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x}\right)^2 + \left(\frac{1}{x}\right)^3 = 1728$$

$$x^3 + 3(x^2)\left(\frac{1}{x}\right) + 3(x)\left(\frac{1}{x^2}\right) + \frac{1}{x^3} = 1728$$

$$x^3 + 3x + \frac{3}{x} + \frac{1}{x^3} = 1728$$

$$x^3 + 3\left(x + \frac{1}{x}\right) + \frac{1}{x^3} = 1728$$

$$x^3 + 3(12) + \frac{1}{x^3} = 1728$$

$$x^3 + 36 + \frac{1}{x^3} = 1728$$

$$x^3 + \frac{1}{x^3} = 1728 - 36$$

$$x^3 + \frac{1}{x^3} = 1692 \text{ Ans}$$

Q16. An arithmetic sequence has the first term 7 and the common difference between the term is 9, find the general term, also find the 11th term and 12th term?

Sol $a_n = ?$ (General term)

$$a_{11} = ? , a_{12} = ?$$

Given that: $a = 7$ and $d = 9$

We know that

$$a_n = a + (n-1)d$$

$$a_n = 7 + (n-1)9$$

$$a_n = 7 + 9n - 9$$

$$a_n = 7 + 9n - 9$$

$$a_n = 9n - 2 \text{ Ans}$$

$$\text{put } n = 11$$

$$a_{11} = 9(11) - 2$$

$$a_{11} = 99 - 2$$

$$a_{11} = 97 \text{ Ans}$$

$$\text{put } n = 12$$

$$a_{12} = 9(12) - 2$$

$$a_{12} = 108 - 2$$

$$a_{12} = 106 \text{ Ans}$$

Unit No. 7
EXPONENTS AND LAWS OF EXPONENTS
Exercise # 7.1
(Tb pg 150)

(190)

Mathematics-8

Q1. Identify the exponent and base of the following terms. Then write value of each.

(a) 7^2
 Sol exponent = 2 Ans
 Base = 7 Ans
 $7^2 = 7 \times 7 = 49$
 Value = 49 Ans

(b) $\left(\frac{1}{2}\right)^3$
 Sol exponent = 3
 Base = $\frac{1}{2}$
 $\left(\frac{1}{2}\right)^3 = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$
 Value = $\frac{1}{8}$ Ans

(c) $(5)^2$
 Sol exponent = 2 Ans
 Base = 5 Ans
 $(5)^2 = 5 \times 5 = 25$
 Value = 25 Ans

(d) 3^4
 Sol exponent = 4 Ans
 Base = 3 Ans
 $3^4 = 3 \times 3 \times 3 \times 3 = 81$
 Value = 81 Ans

(e) $(1)^9$
 Sol Exponent = 9 Ans
 Base = 1 Ans
 $(1)^9 = 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1$
 Value = 1 Ans

(f) $(8)^2$
 Sol Exponent = 2 Ans
 Base = 8 Ans
 $(8)^2 = 8 \times 8 = 64$
 Value = 64 Ans

(g) $\left(\frac{7}{13}\right)^8$
 Exponent = 8 Ans

Base = $\frac{7}{13}$ Ans

$\left(\frac{7}{13}\right)^8 = \frac{5764801}{815730721}$

Value = $\frac{5764801}{815730721}$ Ans

(h) $(12)^2$
 Exponent = 2 Ans
 Base = 12 Ans
 $(12)^2 = 12 \times 12 = 144$
 Value = 144 Ans

(i) $\left(\frac{1}{3}\right)^3$
 Exponent = 3 Ans
 Base = $\frac{1}{3}$ Ans
 $\left(\frac{1}{3}\right)^3 = \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} = \frac{1}{27}$
 Value = $\frac{1}{27}$ Ans

(j) $\left(\frac{22}{133}\right)^2$
 Exponent = 2 Ans
 Base = $\frac{22}{133}$ Ans
 $\left(\frac{22}{133}\right)^2 = \frac{22}{133} \times \frac{22}{133} = \frac{484}{17689}$
 Value = $\frac{484}{17689}$ Ans

(k) 144^2
 Exponent = 2 Ans
 Base = 144 Ans
 $144^2 = 144 \times 144 = 20,736$
 Value = 20,736 Ans

(l) $\left(\frac{3}{4}\right)^5$
 Exponent = 5 Ans
 Base = $\frac{3}{4}$ Ans
 $\left(\frac{3}{4}\right)^5 = \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4}$

$$\text{Value} = \frac{243}{1024} \text{ Ans}$$

Q2. Write the following in exponential form. Also tell the way to read the exponential form.

(a) $4 \times 4 \times 4 \times 4 \times 4$

Sol $= (4)^5 \text{ Ans}$

4 to the power 5 Ans

(b) $n \times n \times n \times n \times n \times n$

Sol $= (n)^6 \text{ Ans}$

n to the power 6 Ans

(c) $ab \times ab \times ab$

$= a^3 b^3 = (ab)^3 \text{ Ans}$

ab to the power 3 Ans

(d) $e \times e \times e \times e$

Sol $e \text{ to the power 4 Ans}$

(e) $\left(\frac{-1}{2}\right) \times \left(\frac{-1}{2}\right) \times \left(\frac{-1}{2}\right)$

Sol $= \left(\frac{-1}{2}\right)^3$

$\left(\frac{-1}{2}\right)$ to the power 3 Ans

(f) $\left(\frac{1}{9}\right) \times \left(\frac{1}{9}\right) \times \left(\frac{1}{9}\right) \times \left(\frac{1}{9}\right)$

Sol $= \left(\frac{1}{9}\right)^4 \text{ Ans}$

$\left(\frac{1}{9}\right)$ to the power 4 Ans

(g) $\left(\frac{a}{b}\right) \times \left(\frac{a}{b}\right) \times \left(\frac{a}{b}\right) \times \left(\frac{a}{b}\right)$

Sol: $\left(\frac{a}{b}\right)^4$

$\frac{a}{b}$ to the power of 4

(h) $(-by) \times (-by) \times (-by) \times (-by) \times (-by) \times (-by)$

Sol: $(-by)^6 \text{ Ans}$

$= (-by)$ to the power 6

$(12)^2 = 12 \times 12 = 144$

Value = 144 Ans

(i) $(-9) \times (-9) \times (-9) \times (-9)$

Sol $= (-9)^4 \text{ Ans}$

(-9) to the power 4

(j) $\left(\frac{1}{10}\right) \times \left(\frac{1}{10}\right) \times \left(\frac{1}{10}\right) \times \left(\frac{1}{10}\right) \times \left(\frac{1}{10}\right)$

Sol $\left(\frac{1}{10}\right)^5 \text{ Ans}$

$\left(\frac{1}{10}\right)$ to the power 5 Ans

Q3. Prove the following equalities.

(a) $\left(\frac{5}{2}\right)^3 = \frac{3125}{32}$

Sol $L.H.S = \left(\frac{5}{2}\right)^5$

$L.H.S = \frac{(5)^5}{(2)^5}$

$L.H.S = \frac{5 \times 5 \times 5 \times 5 \times 5}{2 \times 2 \times 2 \times 2 \times 2}$

$L.H.S = \frac{3125}{32}$

$L.H.S = R.H.S$

So, $\left(\frac{5}{2}\right)^5 = \frac{3125}{32} \text{ Ans}$

(b) $(7)^6 = 117649$

Sol: $L.H.S = (7)^6$

$= 7 \times 7 \times 7 \times 7 \times 7 \times 7$

$= 117649$

$L.H.S = R.H.S$

So, $(7)^6 = 117649 \text{ Ans}$

(c) $\left(\frac{4}{5}\right)^2 = \frac{16}{25}$

$L.H.S = \left(\frac{4}{5}\right)^2$

Sol: $L.H.S = \frac{4}{5} \times \frac{4}{5}$

$L.H.S = \frac{16}{25}$

$L.H.S = R.H.S$

So $\left(\frac{4}{5}\right)^2 = \frac{16}{25} \text{ Ans}$

(d) $(5)^3 = 125$

Sol $L.H.S = (5)^3$

$L.H.S = 5 \times 5 \times 5$

$L.H.S = 125$

$L.H.S = R.H.S$

So, $(5)^3 = 125$ Ans

(c) $\left(\frac{2}{6}\right)^3 = \left(\frac{8}{216}\right)$

Sol LHS = $\left(\frac{2}{6}\right)^3$

$$LHS = \frac{(2)^3}{(6)^3}$$

$$LHS = \frac{2 \times 2 \times 2}{6 \times 6 \times 6}$$

$$LHS = \frac{8}{216}$$

$$LHS = RHS$$

So, $\left(\frac{2}{6}\right)^3 = \frac{8}{216}$ Ans

(f) $(4)^3 = 64$

Sol LHS = $(4)^3$

$$LHS = 4 \times 4 \times 4$$

$$LHS = 64$$

$$LHS = RHS$$

So, $(4)^3 = 64$ Ans

(g) $\left(\frac{1}{10}\right)^4 = \left(\frac{1}{10000}\right)$

Sol LHS = $\left(\frac{1}{10}\right)^4$

$$LHS = \frac{(1)^4}{(10)^4}$$

$$LHS = \frac{1 \times 1 \times 1 \times 1}{10 \times 10 \times 10 \times 10}$$

$$LHS = \frac{1}{10000}$$

$$LHS = RHS$$

So, $\left(\frac{1}{10}\right)^4 = \left(\frac{1}{10000}\right)$

(h) $(1)^8 = 1$

Sol LHS = $(1)^8$

$$LHS = 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1$$

$$LHS = 1$$

$$LHS = RHS$$

So, $(1)^8 = 1$ Ans

(i) $\left(\frac{7}{6}\right)^5 = \left(\frac{16807}{7776}\right)$

Sol LHS = $\left(\frac{7}{6}\right)^5$

$$LHS = \frac{(7)^5}{(6)^5}$$

$$LHS = \frac{7 \times 7 \times 7 \times 7 \times 7}{6 \times 6 \times 6 \times 6 \times 6}$$

$$LHS = \frac{16807}{7776}$$

$$LHS = RHS$$

So, $\left(\frac{7}{6}\right)^5 = \left(\frac{16807}{7776}\right)$

(j) $(12)^3 = 1728$

Sol LHS = $(12)^3$

$$LHS = 12 \times 12 \times 12$$

$$LHS = 1728$$

$$LHS = RHS$$

So, $(12)^3 = 1728$ Ans

Q4. Express the following rational numbers in exponential form.

Sol $196 = 2 \times 2 \times 7 \times 7$
 $196 = 2^2 \times 7^2$

2	196
2	98
7	49
7	7
	1

$196 = (2 \times 7)^2$ $196 = (14)^2$ Ans

(b) 64

Sol $64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$
 $64 = (2)^6$ Ans

2	64
2	32
2	16
2	8
2	4
2	2
	1

(c) 729

Sol $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$
 $729 = (3)^6$ Ans

3	729
3	243
3	81
3	27
3	9
3	3
	1

(d) $\frac{1}{100}$

Sol
$$= \frac{1}{2 \times 2 \times 5 \times 5}$$

$$= \frac{1^2}{2^2 \times 5^2}$$

$$= \left(\frac{1}{2 \times 5}\right)^2$$

$$= \left(\frac{1}{10}\right)^2 \text{ Ans}$$

2	100
2	50
5	25
5	5
	1

$$= \frac{2 \times 2 \times 2}{3 \times 3 \times 3}$$

$$= \left(\frac{2}{3}\right)^3 \text{ Ans}$$

2	4
2	2
	1

(e) $\frac{36}{441}$

Sol
$$= \frac{2 \times 2 \times 3 \times 3}{3 \times 3 \times 7 \times 7}$$

$$= \frac{2 \times 2}{7 \times 7}$$

$$= \frac{2 \times 2}{7 \times 7}$$

$$= \frac{2^2}{7^2}$$

$$= \left(\frac{2}{7}\right)^2 \text{ Ans}$$

2	36
2	18
3	9
3	3
	1

3	441
3	147
7	49
7	7
	1

Exercise 7.2 (Tb Pg 157)

Q1. Simplify the following by applying the product law of exponents.

(a) $(-8)^3 \times (-8)^3$

Sol
$$a^m \times a^n = a^{m+n}$$

$$= (-8)^{3+3} = (-8)^6 \text{ Ans}$$

(b) $x^5 \times x^4$

Sol
$$a^m \times a^n = a^{m+n}$$

$$= x^{5+4} \text{ Ans}$$

Note: Book answer is wrong.

(c) $(4)^2 \times (5)^2$

Sol
$$a^m \times b^m = (a \times b)^m$$

$$= (4 \times 5)^2$$

$$= (20)^2 \text{ Ans}$$

(d) $(3)^7 \times (6)^7$

Sol
$$a^m \times b^m = (a \times b)^m$$

$$= (3 \times 6)^7$$

$$= (18)^7 \text{ Ans}$$

(e) $5^2 \times 3^2 \times (5 \times 3)^3$

Sol
$$= (5 \times 3)^2 \times (5 \times 3)^3$$

$$= (15)^2 \times (15)^3$$

$$= (15)^{2+3}$$

$$= (15)^5 \text{ Ans}$$

(f) $(x^2 y^3 z^7) \times (x^7 y^4 z^3)$

Sol
$$= (x^2 \times x^7) \times (y^3 \times y^4) \times (z^7 \times z^3)$$

$$a^m \times a^n = a^{m+n}$$

(f) $\frac{1}{16}$

Sol
$$= \frac{1}{2 \times 2 \times 2 \times 2}$$

$$= \frac{1}{2^4}$$

$$= \left(\frac{1}{2}\right)^4 \text{ Ans}$$

2	16
2	8
2	4
2	2
	1

(g) 27

Sol
$$= 3 \times 3 \times 3$$

$$= 3^3$$

$$= (3)^3$$

3	27
3	9
3	3
	1

(h) $\frac{64}{216}$

Sol
$$= \frac{2 \times 2 \times 2 \times 2 \times 2 \times 2}{2 \times 2 \times 2 \times 3 \times 3 \times 3}$$

2	64
2	32
2	16
2	8

$$= (x^{2+7})(y^{3+4})(z^{7+3})$$

$$= x^9 \cdot y^7 \cdot z^{10} \text{ Ans}$$

(g) $4^7 \times 4^{-5}$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= (4)^{7-5}$$

$$= (4)^2$$

(h) $\left(\frac{5}{8}\right)^2 \times \left(\frac{5}{8}\right)^3$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= \left(\frac{5}{8}\right)^{2+3}$$

$$= \left(\frac{5}{8}\right)^5 \text{ Ans}$$

(i) $\left(\frac{6}{5}\right)^2 \times \left(\frac{6}{5}\right)^{-4}$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= \left(\frac{6}{5}\right)^{2-4}$$

$$= \left(\frac{6}{5}\right)^{-2}$$

$$\boxed{\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m}$$

$$= \left(\frac{5}{6}\right)^2 \text{ Ans}$$

(j) $(3)^6 \times (3)^5$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= (3)^{6+5}$$

$$= (3)^{11} \text{ Ans}$$

(k) $(2^{-2} \times 4^3 \times 5^{-7}) \times (2^7 \times 4^{-4} \times 5^3)$

$$(2^{-2+7}) \times (4^{3-4}) \times (5^{-7+3})$$

$$= 2^5 \times 4^{-1} \times 5^{-4}$$

(l) $\left(\frac{2}{5}\right)^4 \times \left(\frac{2}{5}\right)^5 \times \left(\frac{2}{5}\right)^{-6}$

Sol $= \left(\frac{2}{5}\right)^{4+5-6}$

$$= \left(\frac{2}{5}\right)^3 \text{ Ans}$$

Q2. Simplify using quotient law.

(a) $3^7 \div 3^5$

$$\boxed{a^m \div a^n = a^{m-n}}$$

$$= 3^{7-5}$$

$$= 3^2 \text{ Ans}$$

(b) $(-7)^9 \div (-7)^5$

Sol $\boxed{a^m \div a^n = a^{m-n}}$

$$= (-7)^{9-5}$$

$$= (-7)^4 \text{ Ans}$$

(c) $(5)^{12} \div (5)^8$

Sol $\boxed{a^m \div a^n = a^{m-n}}$

$$= (5)^{12-8}$$

$$= (5)^4 \text{ Ans}$$

Book answer is wrong

(d) $\left(\frac{-4}{10}\right)^{15} \div \left(\frac{-4}{10}\right)^7$

Sol $\boxed{a^m \div a^n = a^{m-n}}$

$$= \left(\frac{-4}{10}\right)^{15-7}$$

$$= \left(\frac{-4}{10}\right)^8 \text{ Ans}$$

(e) $\left(\frac{3}{7}\right)^{21} \div \left(\frac{3}{7}\right)$

Sol $\boxed{a^m \div a^n = a^{m-n}}$

$$= \left(\frac{3}{7}\right)^{21} \div \left(\frac{3}{7}\right)^1$$

$$= \left(\frac{3}{7}\right)^{21-1} = \left(\frac{3}{7}\right)^{20} \text{ Ans}$$

(f) $\left(\frac{-1}{9}\right)^9 \div \left(\frac{-1}{12}\right)^3$

Sol $\boxed{a^m \div a^n = a^{m-n}}$

$$= \left(\frac{-1}{12}\right)^{9-3}$$

$$= \left(\frac{-1}{12}\right)^6 \text{ Ans}$$

(g) $3^4 \div 3^2$

Sol $\boxed{a^m \div a^n = a^{m-n}}$

$$= 3^{4-2} = 3^2 \text{ Ans}$$

$$(h) \left(\frac{21}{37}\right)^{16} + \left(\frac{21}{37}\right)^{16}$$

$$\text{Sol } a^m + a^n = a^{m+n}$$

$$= \left(\frac{21}{37}\right)^{16+16}$$

$$= \left(\frac{21}{37}\right)^0 \quad [c^0 = 1]$$

$$= 1 \text{ Ans}$$

$$(i) (x)^a \div (x)^b$$

$$\text{Sol } a^m \div a^n = a^{m-n}$$

$$= (x)^{a-b} \text{ Ans}$$

$$(j) \left(\frac{-4}{5}\right)^3 \div \left(\frac{-4}{5}\right)^3$$

$$\text{Sol } a^m \div a^n = a^{m-n}$$

$$= \left(\frac{-4}{5}\right)^{3-3}$$

$$= \left(\frac{-4}{5}\right)^0 \quad [c^0 = 1]$$

$$= 1 \text{ Ans}$$

Q3. Express the following as single exponents.

$$(a) [(-n)^6]^3$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= (-n)^{6 \times 3}$$

$$= (-n)^{18} \text{ Ans}$$

$$(b) [(-3)^4]^2$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= (-3)^{4 \times 2}$$

$$= (-3)^8 \text{ Ans}$$

$$(c) \left[\left(\frac{3}{7}\right)^4\right]^7$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= \left(\frac{3}{7}\right)^{4 \times 7} = \left(\frac{3}{7}\right)^{28}$$

$$(d) (6^3)^4$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= 6^{3 \times 4}$$

$$= 6^{12} \text{ Ans}$$

$$(e) [-(4)^2]^7$$

$$\text{Sol } [-(4)^2]^7$$

$$= -(4)^{2 \times 7}$$

$$= -(4)^{14} \text{ Ans}$$

$$(f) \left[\left(\frac{4}{6}\right)^2\right]^3$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= \left(\frac{4}{6}\right)^{2 \times 3}$$

$$= \left(\frac{4}{6}\right)^6 \text{ Ans}$$

$$(g) [(-a)^8]^3$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= (-a)^{8 \times 3}$$

$$= (-a)^{24}$$

$$(h) (a^b)^c$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= (a)^{bc} \text{ Ans}$$

$$(i) \left[\left(\frac{a}{b}\right)^c\right]^d$$

$$\text{Sol } (a^m)^n = a^{m \times n}$$

$$= \left(\frac{a}{b}\right)^{cd} \text{ Ans}$$

Q4. Simplify using laws of exponents:

$$(a) \left(\frac{-a}{b}\right)^{13} \div \left(\frac{-a}{b}\right)^9$$

$$\text{sol } a^m \div a^n = a^{m-n}$$

$$= \left(\frac{-a}{b} \right)^{13-9} = \left(\frac{-a}{b} \right)^4$$

$$= + \frac{a^4}{b^4} \text{ or } \left(\frac{a}{b} \right)^4$$

(b) $(-3^2)^4$
 Sol $= + (3^2)^4$
 $= 3^{2 \times 4} = 3^8 = 6561 \text{ Ans}$

(c) $(2)^0 \times (2)^6$
 Sol $\boxed{a^m \times a^n = a^{m+n}}$
 $= 2^{0+6}$
 $= 2^6$
 $= 64 \text{ Ans}$

(d) $\left(\frac{2}{4} \right)^{-8} \times \left(\frac{12}{5} \right)^{-1} \times (671)^0$
 $= \left(\frac{4^2}{2} \right)^8 \times \left(\frac{5}{12} \right)^{+1} \times 1$
 Sol $= (2)^8 \times \frac{5}{12}$
 $= 256 \times \frac{5}{12}$
 $= \frac{1280}{12} = \frac{320}{3} \text{ Ans}$

(e) $\frac{1}{9} \times \frac{1}{9} \times \frac{1}{9} \times \frac{1}{9}$
 $= \left(\frac{1}{9} \right)^{1+1+1+1}$
 $= \left(\frac{1}{9} \right)^4 = \frac{1}{6561} \text{ Ans}$

(f) $2^7 \times 2^5$
 Sol $\boxed{a^m \times a^n = a^{m+n}}$
 $= 2^{7+5} = 2^{12} = 4096 \text{ Ans}$

(g) $6^3 \times \frac{6^7}{6^2}$
 Sol $= 6^3 \times 6^{7-2}$
 $= 6^3 \times 6^5$
 $= 6^{3+5}$
 $= 6^8$
 $= 1679616 \text{ Ans}$

(h) $\frac{6^{-3} \times 5^{-3}}{5^{-4} \times 6^{-4}}$

Sol $= \frac{6^{-3}}{6^{-4}} \times \frac{5^{-3}}{5^{-4}}$
 $= 6^{-3+4} \times 5^{-3+4}$
 $= 6^1 \times 5^1 = 30 \text{ Ans}$

(i) $xy^9 \times xy^7$
 Sol $= (x^1 \times x^1) \times (y^9 \times y^7)$
 $= (x^{1+1}) \times (y^{9+7})$
 $= x^2 \times y^{16}$
 $= x^2 y^{16} \text{ Ans}$

(j) $(4^0 \times 5^0 \times 6^0) + (7^0 \times 8^0 \times 9^0)$
 Sol $\boxed{C^0 = 1}$
 $= (1 \times 1 \times 1) + (1 \times 1 \times 1)$
 $= 1 + 1 = 2 \text{ Ans}$

(k) $(-4)^3 \times (-4)^2$
 Sol $\boxed{a^m \times a^n = a^{m+n}}$
 $= (-4)^{3+2}$
 $= (-4)^5 = -1024 \text{ Ans}$

(l) $\left[\left(\frac{-3}{4} \right)^4 \right]^2$
 Sol $\boxed{(a^m)^n = a^{mn}}$
 $= \left(\frac{-3}{4} \right)^{4 \times 2} = \left(\frac{-3}{4} \right)^8$
 $= \frac{(-3)^8}{(4)^8} = \frac{6561}{65536} \text{ Ans}$

(m) $(7^4)^2$
 Sol $\boxed{(a^m)^n = a^{mn}}$
 $= 7^{4 \times 2} = 7^8$
 $= 5764801 \text{ Ans}$

(n) $\left(\frac{2}{5} \right)^{-4} \div \left(\frac{6}{4} \right)^{-3}$
 Sol $\boxed{\left(\frac{a}{b} \right)^{-m} = \left(\frac{b}{a} \right)^m}$

$$= \left(\frac{5}{2}\right)^4 + \left(\frac{2}{3}\right)^3$$

$$= \left(\frac{5}{2}\right)^4 + \left(\frac{2}{3}\right)^3$$

$$= \frac{5^4}{2^4} + \frac{2^3}{3^3}$$

$$= \frac{625}{16} + \frac{8}{27}$$

$$= \frac{625}{16} \times \frac{27}{8}$$

$$= \frac{16875}{128} = 131.8359 \text{ Ans}$$

$$(o) \left(\frac{3}{7}\right)^{-2} \div \left(\frac{6}{5}\right)^{-1}$$

$$\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m$$

$$= \left(\frac{7}{3}\right)^2 \div \left(\frac{5}{6}\right)^{-1}$$

$$= \frac{49}{9} \div \frac{5}{6}$$

$$= \frac{49}{9} \times \frac{6}{5}$$

$$= \frac{49}{3} \times \frac{2}{5}$$

$$= \frac{98}{15} \text{ Ans}$$

$$(p) (-4)^6 \times (-4)^8$$

$$\text{Sol } a^m \times a^n = a^{m+n}$$

$$= (-4)^{6+8}$$

$$= (-4)^{14}$$

$$= +268435456 \text{ Ans}$$

$$(q) (-7)^4 \times (-7)^6$$

$$\text{Sol } a^m \times a^n = a^{m+n}$$

$$= (-7)^{4+6}$$

$$= (-7)^{10}$$

$$= +282475249 \text{ Ans}$$

Exercise 7.3

(Tb 159)

Q1. Simplify the following using laws of exponents.

$$(a) \frac{ab^{-2}}{b^{-3}}$$

$$\text{Sol } a \cdot \frac{b^{-2}}{b^{-3}} \quad \frac{a^m}{a^n} = a^{m-n}$$

$$= a \cdot b^{-2+3} = a \cdot b^1 = ab \text{ Ans}$$

$$(b) \frac{11ac^{-2}}{(abc)^{-1}}$$

$$\text{Sol } = \frac{11ac^{-2}}{a^{-1}b^{-1}c^{-1}}$$

$$= 11 \cdot \frac{a^1}{a^{-1}} \cdot \frac{1}{b^{-1}} \cdot \frac{c^{-2}}{c^{-1}}$$

$$= 11 \cdot a^{1+1} \cdot b^{+1} \cdot c^{-2+1}$$

$$11 \cdot a^2 \cdot b \cdot c^{-1}$$

$$= \frac{11a^2b}{c} \text{ Ans}$$

$$(c) \frac{1}{6a} \times a^{-3}$$

$$\text{Sol } = \frac{1}{6} \times \frac{a^{-3}}{a^1}$$

$$= \frac{1}{6} \times a^{-3-1} = \frac{1}{6} \times a^{-4}$$

$$= \frac{1}{6a^4} \text{ Ans}$$

Book answer is wrong.

$$(d) \frac{5a^5}{3a^4}$$

$$\text{Sol } = \frac{5}{3} \cdot \frac{a^5}{a^4}$$

$$= \frac{5}{3} \cdot a^{5-4} = \frac{5}{3} a^1 \text{ Ans}$$

$$(e) \frac{8x^4 \times b^3 \times c^4}{16x^2 \times b^2 \times c^2}$$

$$\text{Sol } = \frac{8}{16} \times \frac{x^4}{x^2} \times \frac{b^3}{b^2} \times \frac{c^4}{c^2}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$= \frac{1}{2} \times x^{4-2} \times b^{3-2} \times c^{4-2}$$

$$= \frac{1}{2} \times x^2 \times b^1 \times c^2$$

$$= \frac{x^2bc^2}{2} \text{ Ans}$$

$$(f) \quad \left(\frac{16 \times 27}{x^4 \times y^3} \right)$$

$$\text{Sol} \quad = \frac{432}{x^4 y^3}$$

$$(g) \quad \left[\frac{x^3 \times b^4}{x^{-1} \times b^{-3}} \right] \times \left(\frac{a^{-2} \times b^{-3}}{a^{-1} \times b^{-2}} \right)$$

$$\text{Sol} \quad = \frac{x^3}{x^{-1}} \times \frac{b^4}{b^{-3}} \times \frac{a^{-2}}{a^{-1}} \times \frac{b^{-3}}{b^{-2}}$$

$$= x^{-3+1} \times b^{4+3} \times a^{-2+1} \times b^{-2+2}$$

$$= x^{-2} \times b^7 \times a^{-1} \times b^0$$

$$= \frac{b^7}{x^2 \times a^1} \times 1 \quad [c^0 = 1]$$

$$= \frac{b^7}{ax^2} \text{ Ans}$$

Q2. Prove the following by evaluating both sides.

$$(a) \quad 9^6 \div 9^2 = 9^4$$

$$\text{Sol} \quad \text{LHS} = 9^6 \div 9^2$$

$$\boxed{a^m \div a^n = a^{m-n}}$$

$$\text{LHS} = 9^{6-2}$$

$$\text{LHS} = 9^4$$

$$\text{LHS} = 6561$$

$$\text{RHS} = 9^4$$

$$\text{RHS} = 6561$$

$\Rightarrow \text{LHS} = \text{RHS}$ Hence Proved

$$(b) \quad 4^6 \div 6^6 = \left(\frac{4}{6} \right)^6$$

$$\text{Sol} \quad \text{LHS} = 4^6 \div 6^6$$

$$\boxed{a^m \div b^m = \left(\frac{a}{b} \right)^m}$$

$$\text{LHS} \left(\frac{4^2}{6^2} \right)^6 \quad \text{LHS} = \left(\frac{2}{3} \right)^6$$

$$\text{LHS} = \frac{64}{729} \quad \text{RHS} = \left(\frac{4^2}{6^2} \right)^6$$

$$\text{RHS} = \left(\frac{2}{3} \right)^6 \quad \text{RHS} = \frac{64}{729}$$

$\Rightarrow \text{LHS} = \text{RHS}$ Hence Proved

$$(c) \quad (-6)^4 \div (7)^4 = \left(\frac{-4}{7} \right)^4$$

$$\text{Sol} \quad \text{LHS} = (-6)^4 \div (7)^4$$

$$\boxed{a^m + b^m = \left(\frac{a}{b} \right)^m}$$

$$\text{LHS} \left(\frac{-6}{7} \right)^4 \quad \text{LHS} = \frac{(-6)^4}{(7)^4}$$

$$\text{LHS} = \frac{1296}{2401} \quad \text{RHS} = \left(\frac{-6}{7} \right)^4$$

$$\text{RHS} = \frac{1296}{2401}$$

$\Rightarrow \text{LHS} = \text{RHS}$ Hence Proved

$$(d) \quad \left(\frac{-22}{23} \right)^9 + \left(\frac{-22}{23} \right)^4 = \left(\frac{-22}{23} \right)^5$$

$$\text{Sol} \quad \text{LHS} = \left(\frac{-22}{23} \right)^9 + \left(\frac{-22}{23} \right)^4$$

$$\boxed{a^m \div a^n = a^{m-n}}$$

$$\text{LHS} \left(\frac{-22}{23} \right)^{9-4} \quad \text{LHS} = \left(\frac{-22}{23} \right)^5$$

$$\text{LHS} = \frac{(-22)^5}{(23)^5} \quad \text{LHS} = \frac{5153632}{6436343}$$

$$\text{RHS} = \left(\frac{-22}{23} \right)^5 \quad \text{RHS} = \frac{5153632}{6436343}$$

$\text{LHS} = \text{RHS}$ Hence Proved

$$(e) \quad \left(\frac{-4}{12} \right)^9 \div \left(\frac{-4}{12} \right)^3 = \left(\frac{-4}{12} \right)^6$$

$$\text{Sol} \quad \text{LHS} = \left(\frac{-4}{12} \right)^9 \div \left(\frac{-4}{12} \right)^3$$

$$\boxed{a^m \div a^n = a^{m-n}}$$

$$\text{LHS} \left(\frac{-4}{12} \right)^{9-3} \quad \text{LHS} = \left(\frac{-4}{12} \right)^6$$

$$\text{LHS} = \left(\frac{-1}{3} \right)^6 \quad \text{LHS} = \frac{(-1)^6}{(3)^6}$$

$$\text{LHS} = \frac{1}{729} \quad \text{RHS} = \left(\frac{-4}{12} \right)^6$$

$$\text{RHS} = \left(\frac{-1}{3} \right)^6 \quad \text{RHS} = \frac{1}{729}$$

$\Rightarrow \text{LHS} = \text{RHS}$ Hence Proved

$$(f) \quad x^2 \div y^2 = \left(\frac{x}{y} \right)^2$$

Sol $LHS = x^2 + y^2$

$$a^m + b^m = \left(\frac{a}{b}\right)^m$$

$$LHS = \left(\frac{x}{y}\right)^2$$

$$LHS = \frac{x^2}{y^2}$$

$$RHS = \left(\frac{x}{y}\right)^2$$

$$RHS = \frac{x^2}{y^2}$$

$\Rightarrow LHS = RHS$ Hence Proved

Q3. Evaluate the following using the laws of exponents.

(a) $\frac{6^5 \times 6^4}{6^8}$

Sol $= \frac{6^{5+4}}{6^8}$

$$= \frac{6^9}{6^8}$$

$$= 6^{9-8}$$

$$= 6^1 = 6 \text{ Ans}$$

(b) $\frac{2^3 \times 4^4 \times 3^9}{2^6 \times 4^5 \times 3^8}$

Sol $\frac{2^3 \times 4^4 \times 3^9}{2^6 \times 4^5 \times 3^8}$

$$= 2^{3+6} \times 4^{4-5} \times 3^{9-8}$$

$$= 2^9 \times 4^{-1} \times 3^1$$

$$= \frac{2^9}{4^1 \times 3^1}$$

$$= \frac{2^9}{(2 \times 2)^1 \times 3}$$

$$= \frac{2^9}{2^2 \times 2^1 \times 3}$$

$$= \frac{1}{2^3 \times 3}$$

$$= \frac{1}{512 \times 3}$$

$$= \frac{1}{1536} \text{ Ans}$$

(c) $\frac{1}{6} \times \frac{2}{2^2} \div 3$

Sol $= \frac{1}{6} \times \frac{2^1}{2^2} \div \frac{3}{1}$

$$= \frac{1}{6} \times 2^{1-2} \times \frac{1}{3}$$

$$= \frac{1}{6} \times 2^{-1} \times \frac{1}{3}$$

$$= \frac{1}{6} \times \frac{1}{2} \times \frac{1}{3}$$

$$= \frac{1}{3} \times \frac{1}{4} \times \frac{1}{3}$$

$$= \frac{4}{9} \text{ Ans}$$

(d) $\left(\frac{1}{3^2}\right)^3$

Sol $\frac{(1)^{-3}}{(3^{12})^{-3}} = \frac{1}{3^6} = \frac{1}{729} \text{ Ans}$

(e) $\left(\frac{3^2}{5^2}\right) \times 3 \times 5^{-1}$

Sol $= (3^2 \times 3^1) \times \left(\frac{5^{-1}}{5^2}\right)$

$$= (3^{2+1}) \times (5^{-1-2})$$

$$= 3^3 \times 5^1$$

$$= 27 \times 5$$

$$= 135 \text{ Ans}$$

(f) $4(-2)^2 \times \frac{(-2)^5 \times 36}{(-2)^{-1} \times 3^2}$

Sol $= 4(-2)^2 \times \frac{(-2)^5 \times 3^6}{(-2)^{-1} \times 3^2}$

$$= 4(-2)^2 \times (-2)^{5+2} \times 3^{6-2}$$

$$= 4(-2)^2 \times (-2)^7 \times 3^4$$

$$= 4(-2)^{2+7} \times 3^4$$

$$= 4(-2)^9 \times 3^4$$

$$= 4(-512) \times 81$$

$$= -165888 \text{ Ans}$$

(g) $\frac{(4^{-1} \times 3^3)}{(4^4 \times 3^2)}$

Sol: $\frac{4^{-1} \times 3^3}{4^4 \times 3^2}$

$$= 4^{-1-4} \times 3^{3-2}$$

$$= 4^{-5} \times 3^1$$

$$= \frac{1}{64} \times 3$$

$$= \frac{3}{64}$$

Book answer is wrong.

(h) $\frac{(2 \times y^{-3})^0}{(x^4 \times y^{-5} \times z^{-3})^{-2}}$

Sol $\frac{1}{(x^4)^{-2} \times (y^{-5})^{-2} \times (z^{-3})^{-2}}$

$$= \frac{1}{x^{-8} \times y^{10} \times z^{-15}} = \frac{x^8 z^{15}}{y^{10}} \text{ Ans}$$

(i) $(4^4 \times 2^{-2} \times 7^{-2}) \div (4^3 \times 2^{-4} \times 7)$

Sol $= \frac{4^4 \times 2^{-2} \times 7^{-2}}{4^3 \times 2^{-4} \times 7}$

$$\begin{aligned}
 &= \frac{4^4}{4^1} \times \frac{2^{-5}}{2^{-4}} \times \frac{7^{-2}}{7^1} \\
 &= 4^{4-1} \times 2^{-5+4} \times 7^{-2-1} \\
 &= 4^1 \times 2^{-1} \times 7^{-3} = \frac{4}{2 \times 7^3} \\
 &= \frac{1}{2 \times 343} = \frac{1}{686} \text{ Ans}
 \end{aligned}$$

(j) $-(4^6 \times 5^2 \times 4^3 \times 5^1)^0$

Sol $\boxed{c^0 = 1}$
 $= -1 \text{ Ans}$

(k) $(6^0 + 3^0) \div (2^0 + 10^0)$

Sol $= (1+1) \div (1+1)$
 $= 2 \div 2 = \frac{2}{2} = 1 \text{ Ans}$

Q4: Prove that:

(a) $3a^{3(x+y)} \div 3a^{3(y+x)} = 1$

Sol: $LHS = 3a^{3(x+y)} \div 3a^{3(y+x)}$

$$LHS = \frac{3a^{3(x+y)}}{3a^{3(y+x)}}$$

$$LHS = \frac{a^{3x+3y}}{a^{3y+3x}}$$

$$LHS = a^{3x+3y-3y-3x}$$

$$LHS = a^0$$

$$LHS = 1$$

$$LHS = RHS$$

Hence Proved

(b) $P^{(a-b)} \times P^{(b-c)} \times P^{(c-a)} = 1$

Sol: $LHS = P^{(a-b)} \times P^{(b-c)} \times P^{(c-a)}$

$$LHS = P^{a-b+b-c+c-a}$$

$$LHS = P^0$$

$$LHS = 1$$

$$LHS = RHS$$

Hence Proved.

(c) $\left(\frac{x^a}{x^b}\right)^c \times \left(\frac{x^b}{x^c}\right)^a \times \left(\frac{x^c}{x^a}\right)^b = 1$

Sol: $LHS = \left(\frac{x^a}{x^b}\right)^c \times \left(\frac{x^b}{x^c}\right)^a \times \left(\frac{x^c}{x^a}\right)^b$

$$LHS = (x^{a-b})^c \times (x^{b-c})^a \times (x^{c-a})^b$$

$$LHS = x^{ac-bc+ab-ac+bc-ab}$$

$$LHS = x^0$$

$$LHS = 1$$

$$LHS = RHS$$

Hence Proved

(d) $(x^6 y^{-3}) \times (x^{-13} y^{-2}) \times (x^7 y^5) = 1$

Sol: $LHS = (x^6 y^{-3}) \times (x^{-13} y^{-2}) \times (x^7 y^5)$

$$LHS = (x^6 \times x^{-13} \times x^7) \times (y^{-3} \times y^{-2} \times y^5)$$

$$LHS = (x^{6-13+7}) \times (y^{-3-2+5})$$

$$LHS = (x^{13-13}) \times (y^{-5+5})$$

$$LHS = x^0 \times y^0$$

$$LHS = 1 \times 1$$

$$LHS = 1$$

$$LHS = RHS$$

Hence Proved.

Q5. Express the following expressions having only possible exponents.

(a) $(-9)^5 \times (-4)^7$

Sol $\frac{1}{(-9)^5 \times (-4)^7} \text{ Ans}$

(b) $\left(\frac{2}{3}\right)^{-5}$

Sol $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n = \left(\frac{3}{2}\right)^5 \text{ Ans}$

(c) $\frac{1}{x^{-6} \times y^{-8}} \quad \boxed{\frac{1}{a^{-m}} = a^m}$

Sol $x^6 \times y^8 \text{ Ans}$

(d) $\frac{x^4 \times y^{-5} \times z^{-7}}{x^{-4} \times y^{-7} \times z^{5-9}}$

Sol $\frac{x^4 \times y^{-5} \times z^{-7}}{x^{-4} \times y^{-7} \times z^{-4}}$

$$\begin{aligned}
 &= \frac{x^{-4}}{x^{-4}} \times \frac{y^{-5}}{y^{-7}} \times \frac{z^{-7}}{z^{-4}} \\
 &= x^{-4+4} \times y^{-5+7} \times z^{-7+4} \\
 &= x^0 \times y^2 \times z^{-3}
 \end{aligned}$$

$$= \frac{1 \times y^2}{z^3} = \frac{y^2}{z^3} \text{ Ans}$$

(e) $(4^{-3} \times 5^{-7})$

$$= \frac{1}{4^3 \times 5^7} \text{ Ans}$$

(f) $(-6rs)^{-6} \quad \boxed{a^{-m} = \frac{1}{a^m}}$

Sol $= \frac{1}{-(6rs)^6}$ Ans

REVIEW EXERCISE

(Tb pg 161)

Q1. Choose the correct option.

- (a) $a^n \times b^n =$
 i. $(ab)^n$ ✓ ii. $(b)^n$
 iii. $(a+b)^{m+n}$ iv. $(a+b)^n$
- (b) $4^3 =$
 i. 16 ii. 12
 iii. 64 ✓ iv. 32

- (c) $x^{-3} \times x^4 =$
 i. x^{-7} ii. x^{-1}
 iii. $\frac{1}{x}$ iv. x ✓

- (d) $(7)^0 =$
 i. 0 ✓ ii. 1
 iii. 7 iv. 0.7

- (e) $5^{-3} =$
 i. $\frac{1}{125}$ ✓ ii. $\frac{1}{225}$
 iii. $\frac{1}{325}$ iv. $\frac{1}{425}$

- (f) $(-4a^2)^3 =$
 i. $16a^6$ ✓ ii. $-64a^6$
 iii. $64a^5$ iv. $-16a^4$

- (g) The reciprocal of $\left(\frac{a}{b}\right)^{-2}$ is
 i. $\left(\frac{b}{a}\right)^{-2}$ ii. $\frac{1}{a}$
 iii. $\left(\frac{b}{a}\right)^2$ ✓ iv. 0

Q2. Define exponent, base and value using examples.

Ans. In, $2^4 = 16$ where 2 is called base, 4 is called exponent and 16 is called the value.

Q3. Find the value of the following exponential expressions.

(a) 4^3
 Sol $= 4 \times 4 \times 4 = 64$ Ans

(b) 5^7
 Sol $= 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 = 78,125$ Ans

(c) 7^2
 Sol $7 \times 7 = 49$ Ans

(d) 11^0 $\boxed{c^0 = 1}$
 Sol $= 1$ Ans

(e) $\left(\frac{6}{9}\right)^4$

Sol $\left(\frac{6^2}{9}\right)^4 = \left(\frac{2}{3}\right)^4 = \frac{16}{81}$ Ans

(f) 3^{-5}
 $= \frac{1}{3^5} = \frac{1}{243}$ Ans

$$\boxed{a^{-m} = \frac{1}{a^m}}$$

Q4. Apply the law of exponents to simplify the following.

(a) $7^3 \times 7^4$

Sol $\boxed{a^m \times a^n = a^{m+n}}$
 $= 7^{3+4}$
 $= 7^7$ Ans

(b) $(x^2 \times y^{-1})^3$

Sol $= (x^2)^3 \times (y^{-1})^3$
 $= x^6 \times y^{-3} = \frac{x^6}{y^3}$ Ans

(c) $(4b^3)(4b^4)$
 Sol $= (4 \times 4)(b^3 \times b^4)$
 $= (16)(b^{3+4})$
 $= 16b^7$ Ans

(d) $\left(\frac{4}{3}xy^{-3}\right)^2$
 $= \frac{(4)^2(x)^2(y^{-3})^2}{(3)^2}$
 $= \frac{16x^2y^{-6}}{9}$
 $= \frac{16x^2}{9y^6}$

Q5. Evaluate the following using laws of exponents.

(a) $(4^4 \div 4^3) \times 2^2$

Sol $\boxed{a^m \div a^n = a^{m-n}}$
 $= 4^{4-3} \times 2^2$
 $= 4^1 \times 2^2$
 $= 2^2 \times 2^2$

$\boxed{a^m \times a^n = a^{m+n}}$
 $= 2^{2+2} = 2^4 = 16$ Ans

(b) $\left(\frac{4}{3}\right)^3 \times \left(\frac{4}{3}\right)^3 \times \left(\frac{4}{7}\right)^5 \times \left(\frac{4}{7}\right)^4$

Sol $\boxed{a^m \times a^n = a^{m+n}}$

$$= \left(\frac{4}{3}\right)^{-3+3} \times \left(\frac{4}{7}\right)^{3-4}$$

$$= \left(\frac{4}{3}\right)^0 \times \left(\frac{4}{7}\right)^{-1}$$

$$= 1 \times \frac{4}{7} = \frac{4}{7} \text{ Ans}$$

(c) $\left(\frac{-2}{5}\right)^6 \times \left(\frac{-2}{5}\right)^{-3} \times \left[\left(\frac{5}{-2}\right)^{-1}\right]^4$

Sol $= \left(\frac{-2}{5}\right)^6 \times \left(\frac{-2}{5}\right)^{-3} \times \left[\left(\frac{-2}{5}\right)^{-1}\right]^4$

$$= \left(\frac{-2}{5}\right)^6 \times \left(\frac{-2}{5}\right)^{-3} \times \left(\frac{-2}{5}\right)^{-4}$$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= \left(\frac{-2}{5}\right)^{-1} = \left(\frac{-2}{5}\right)^{-1}$$

$$= \frac{-2}{5} \text{ Ans}$$

(d) $\left[\left(\frac{1}{100}\right)^2\right]^3 \times \left[\left(\frac{1}{100}\right)^3\right]^2 \div \left(\frac{1}{100}\right)^{15}$

Sol $\boxed{(a^m)^n = a^{mn}}$

$$= \left(\frac{1}{100}\right)^6 \times \left(\frac{1}{100}\right)^6 \div \left(\frac{1}{100}\right)^{15}$$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= \left(\frac{1}{100}\right)^{6+6} \div \left(\frac{1}{100}\right)^{15}$$

$$= \left(\frac{1}{100}\right)^{12} \div \left(\frac{1}{100}\right)^{15}$$

$$\boxed{a^m \div a^n = a^{m-n}}$$

$$= \left(\frac{1}{100}\right)^{12-15} = \left(\frac{1}{100}\right)^{-3}$$

$$= \left(\frac{100}{1}\right)^3 = 1000000 \text{ Ans}$$

(e) $\left[\left(\frac{1}{9}\right)^4\right]^3 \times \left[\left(\frac{1}{9}\right)^8\right]^6 + \left(\frac{1}{9}\right)^{21}$

Sol $\boxed{(a^m)^n = a^{mn}}$

$$= \left(\frac{1}{9}\right)^{12} \times \left(\frac{1}{9}\right)^{48} + \left(\frac{1}{9}\right)^{21}$$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= \left(\frac{1}{9}\right)^{12+48} + \left(\frac{1}{9}\right)^{21}$$

$$= \left(\frac{1}{9}\right)^{60} + \left(\frac{1}{9}\right)^{21}$$

$$\boxed{a^m + a^n = a^{m+n}}$$

$$= \left(\frac{1}{100}\right)^{60-21} = \left(\frac{1}{9}\right)^{39} \text{ Ans}$$

$$\text{or} = \frac{1}{9^{39}} \text{ Ans}$$

(f) $\left(\frac{4}{6}\right)^8 \div \left(\frac{4}{6}\right)^4$

Sol $\boxed{(a^m)^n = a^{mn}}$

$$= \left(\frac{4}{6}\right)^{8-4} = \left(\frac{4^2}{6^2}\right)^4$$

$$= \left(\frac{2}{3}\right)^4 = \frac{(2)^4}{(3)^4}$$

$$= \frac{16}{81} \text{ Ans}$$

Unit No 08

Simultaneous Linear Equations

Exercise 8.1

(Tb Pg 165)

Q.1 The cost of a bag is three times the cost of a geometry box. The cost of 2 bags and 3 geometry boxes is Rs 3960. Construct simultaneous linear equations for these conditions.

Sol: Let cost of a bag = x and cost of a geometry box = y

1st condition:

$$x = 3y \Rightarrow x - 3y = 0 \longrightarrow (1)$$

2nd Condition:

$$2x + 3y = 3960 \longrightarrow (2)$$

Q.2 The volume of apple juice is 3 litres less than the volume of orange juice and the total volume of apple and orange juice is 11 litres. Construct simultaneous linear equations for these conditions.

Sol: Let volume of apple juice = x
volume of orange juice = y

1st condition:

$$\begin{aligned} x &= y - 3 \\ x - y &= -3 \end{aligned} \longrightarrow (1)$$

2nd Condition:

$$x + y = 11 \longrightarrow (2)$$

Q.3 The sum of two numbers is 82 and their difference is 23. Construct simultaneous linear equations for these conditions.

Sol: Let " x " & " y " be the required two numbers.

1st condition:

$$x + y = 82 \longrightarrow (1)$$

2nd Condition:

$$x - y = 23 \longrightarrow (2)$$

Exercise 8.2

(Tb Pg 169)

Q.1 In each of the following questions, you have been given a pair of linear equations in one variable. Solve both equations separately and tell which of them are simultaneous equations and which are not.

(a) $a + 3 = 9$

$a - 2 = 5$

Sol: $a + 3 = 9, \quad a - 2 = 5$

$$a = 9 - 3$$

$$a = 6$$

$$a = 5 + 2$$

$$a = 7$$

Not a pair of simultaneous equations

$$b + 2 = 11$$

$$b - 5 = 4$$

(b)

Sol:

$$b + 2 = 11$$

$$b = 11 - 2$$

$$b = 9$$

$$b - 5 = 4$$

$$b = 4 + 5$$

$$b = 9$$

A pair of simultaneous equations

$$p - 15 = 15$$

$$p + 7 = 37$$

(c)

Sol:

$$p - 15 = 15$$

$$p = 15 + 15$$

$$p = 30$$

$$p + 7 = 37$$

$$p = 37 - 7$$

$$p = 30$$

A pair of simultaneous equations

(d)

$$x - 3 = 10$$

$$x - 7 = 6$$

Sol:

$$x - 3 = 10$$

$$x = 10 + 3$$

$$x = 13$$

$$x - 7 = 6$$

$$x = 6 + 7$$

$$x = 13$$

A pair of simultaneous equations

(e)

$$z - 8 = 12$$

$$z - 4 = 11$$

Sol:

$$z - 8 = 12$$

$$z = 12 + 8$$

$$z = 20$$

$$z - 4 = 11$$

$$z = 11 + 4$$

$$z = 15$$

Not a pair of simultaneous equations

Q.2 Solve the following simultaneous equations by using the elimination method.

(a) $a + b = 7$

$a - b = 3$

Sol:

$$a + b = 7 \quad \text{--- (1)}$$

$$a - b = 3 \quad \text{--- (2)}$$

$$2a = 10 \quad \text{by addition}$$

$$a = \frac{10}{2}$$

$$a = 5$$

Put $a = 5$ in Eqn (1)

$$5 + b = 7$$

$$b = 7 - 5$$

$$\boxed{b = 2}$$

$$\therefore a = 5, b = 2 \quad \text{Ans}$$

$$(b) \quad m + n = 10$$

$$m - n = 4$$

$$\text{Sol: } m + n = 10 \quad (1)$$

$$m - n = 4 \quad (2)$$

$$2m = 14 \quad \text{by addition}$$

$$m = \frac{14}{2}$$

$$\boxed{m = 7}$$

Putting $m = 7$ in Eqn (1)

$$7 + n = 10$$

$$n = 10 - 7$$

$$\boxed{n = 3}$$

$$\therefore m = 7, n = 3 \quad \text{Ans}$$

$$(c) \quad p + q = 14$$

$$p - q = 4$$

$$\text{Sol: } p + q = 14 \quad (1)$$

$$p - q = 4 \quad (2)$$

$$2p = 18 \quad \text{by addition}$$

$$p = \frac{18}{2}$$

$$\boxed{p = 9}$$

Putting $p = 9$ in Eqn (1)

$$9 + q = 14$$

$$q = 14 - 9$$

$$\boxed{q = 5}$$

$$\therefore p = 9, q = 5 \quad \text{Ans}$$

$$(d) \quad x + y = 25$$

$$x - y = 5$$

$$\text{Sol: } x + y = 25 \quad (1)$$

$$x - y = 5 \quad (2)$$

$$2x = 30 \quad \text{by addition}$$

$$x = \frac{30}{2}$$

$$\boxed{x = 15}$$

Putting $x = 15$ in Eqn (1)

$$15 + y = 25$$

$$y = 25 - 15$$

$$\boxed{y = 10}$$

$$\therefore x = 15, y = 10 \quad \text{Ans}$$

$$(e) \quad x + y = 11$$

$$x + 3y = 25$$

$$\text{Sol: } x + 3y = 25 \quad \longrightarrow (1)$$

$$x + y = 11$$

$$2y = 14 \quad \text{by addition} \quad (2)$$

$$y = \frac{14}{2}$$

$$\boxed{y = 7}$$

Putting $y = 7$ in (2)

$$x + 7 = 11$$

$$x = 11 - 7$$

$$\boxed{x = 4}$$

$$\therefore x = 4, y = 7 \quad \text{Ans}$$

$$(f) \quad 2x + 3y = 65$$

$$5x + 3y = 95$$

$$\text{Sol: } 5x + 3y = 95 \quad (1)$$

$$\pm 2x \pm 3y = \pm 65 \quad (2)$$

$$3x = 30$$

$$x = \frac{30}{3}$$

$$\boxed{x = 10}$$

Putting $x = 10$ in (1)

$$5(10) + 3y = 95$$

$$50 + 3y = 95$$

$$3y = 95 - 50$$

$$3y = 45$$

$$y = \frac{45}{3}$$

$$\boxed{y = 15}$$

$$\therefore x = 10, y = 15 \quad \text{Ans}$$

$$(g) \quad 2p - 3q = 13$$

$$7p + 2q = 8$$

$$\text{Sol: } 2p - 3q = 13 \quad \longrightarrow (1)$$

$$7p + 2q = 8 \quad \longrightarrow (2)$$

$$2 \times \text{Eqn (1)} \Rightarrow 4p - 6q = 26$$

$$3 \times \text{Eqn (2)} \Rightarrow 21p + 6q = 24$$

$$25p = 50 \quad \text{Addition}$$

$$p = \frac{50}{25}$$

$$\boxed{p = 2}$$

Putting $p = 2$ in Eqn (2)

$$7(2) + 2q = 8$$

$$14 + 2q = 8$$

$$2q = 8 - 14$$

$$2q = -6$$

$$q = \frac{-6}{2}$$

$$q = -3$$

$$\therefore p = 2, q = -3 \quad \text{Ans}$$

$$\begin{aligned} \text{(h)} \quad 5a + 2b &= 23 \\ 2a + 7b &= 3 \end{aligned}$$

$$\text{Sol: } \begin{array}{rcl} 5a + 2b &= & 23 \quad (1) \\ 2a + 7b &= & 3 \quad (2) \end{array}$$

$$\begin{array}{rcl} 7 \times \text{Eqn (1)} &\Rightarrow & 35a + 14b = 161 \\ 2 \times \text{Eqn (2)} &\Rightarrow & 4a + 14b = 6 \end{array}$$

$$31a = 155 \quad \text{by subtraction}$$

$$a = \frac{155}{31}$$

$$\boxed{a=5}$$

Putting $a = 5$ in Eqn (1)

$$5(5) + 2b = 23$$

$$25 + 2b = 23$$

$$2b = 23 - 25$$

$$2b = -2$$

$$b = \frac{-2}{2}$$

$$\boxed{b=-1}$$

$$\therefore a = 5, b = -1 \quad \text{Ans}$$

$$\text{(j)} \quad \begin{array}{rcl} 7x - 6y &= & 54 \\ 2x + 3y &= & 39 \end{array}$$

$$\text{Sol: } \begin{array}{rcl} 7x - 6y &= & 54 \quad (1) \\ 2x + 3y &= & 39 \quad (2) \end{array}$$

$$3 \times \text{Eqn (1)} \Rightarrow 21x - 18y = 162$$

$$6 \times \text{Eqn (2)} \Rightarrow 12x + 18y = 234$$

$$33x = 396$$

$$x = \frac{396}{33}$$

$$\boxed{x=12}$$

Putting $x = 12$ in Eqn (2)

$$2(12) + 3y = 39$$

$$24 + 3y = 39$$

$$3y = 39 - 24$$

$$3y = 15$$

$$y = \frac{15}{3}$$

$$\boxed{y=5}$$

$$\therefore x = 12, y = 5 \quad \text{Ans}$$

Exercise 8.3 (Tb Pg 171)

Q.1 Solve the following simultaneous equations by using the substitution method.

$$\text{(a)} \quad a + b = 9$$

$$a - b = 5$$

$$\text{Sol: } a + b = 9 \quad (1)$$

$$a - b = 5 \quad (2)$$

From Eqn (2)

$$a = 5 + b \quad (3)$$

Put this value of "a" in Eqn (1)

$$5 + b + b = 9$$

$$2b = 9 - 5$$

$$2b = 4$$

$$b = \frac{4}{2}$$

$$\boxed{b=2}$$

Putting $b = 2$ in Eqn (3)

$$a = 5 + 2$$

$$\boxed{a=7}$$

$$\therefore a = 7, b = 2 \quad \text{Ans}$$

$$\text{(b)} \quad \begin{array}{rcl} 2a + b &= & 6 \\ a - 3b &= & 17 \end{array}$$

$$\text{Sol: } \begin{array}{rcl} 2a + b &= & 6 \quad (1) \\ a - 3b &= & 17 \quad (2) \end{array}$$

From Eqn (2)

$$a = 17 + 3b \quad (3)$$

Put this value of "a" in Eqn (1)

$$2(17 + 3b) + b = 6$$

$$34 + 6b + b = 6$$

$$7b = 6 - 34$$

$$7b = -28$$

$$b = \frac{-28}{7}$$

$$\boxed{b=-4}$$

Putting $b = -4$ in Eqn (3)

$$a = 17 + 3(-4)$$

$$a = 17 - 12$$

$$\boxed{a=5}$$

$$\therefore a = 5, b = -4 \quad \text{Ans}$$

$$\text{(c)} \quad \begin{array}{rcl} x + y &= & 7 \\ x - y &= & 3 \end{array}$$

$$\text{Sol: } x + y = 7 \quad (1)$$

$$x - y = 3 \quad (2)$$

From Eqn (2)

$$x = 3 + y \quad (3)$$

Put this value of "x" in Eqn (1)

$$3 + y + y = 7$$

$$2y = 7 - 3$$

$$2y = 4$$

$$y = \frac{4}{2}$$

$$\boxed{y=2}$$

Putting $y = 2$ in Eqn (3)

$$x = 3 + 2$$

$$\boxed{x = 5}$$

Ans

(d) $x + y = 16$

Sol: $x - y = 4$ (1)

$x + y = 16$ (2)

$x - y = 4$ (3)

From Eqn (2)

$$x = 4 + y$$

Put this value of "x" in Eqn (1)

$$4 + y + y = 16$$

$$2y = 16 - 4$$

$$2y = 12$$

$$y = \frac{12}{2}$$

$$\boxed{y = 6}$$

Putting $y = 6$ in Eqn (3)

$$x = 4 + y$$

$$x = 4 + 6$$

$$\boxed{x = 10}$$

Ans

(e) $x + y = 4$

$$x - y = -10$$

Sol: $x + y = 4$ (1)

$x - y = -10$ (2)

From Eqn (2)

$$x = -10 + y$$

(3)

Put this value of "x" in Eqn (1)

$$-10 + y + y = 4$$

$$2y = 4 + 10$$

$$2y = 14$$

$$y = \frac{14}{2}$$

$$\boxed{y = 7}$$

Putting $y = 7$ in Eqn (3)

$$x = -10 + 7$$

$$\boxed{x = -3}$$

Ans

(f) $p + q = -12$

$$p - q = 2$$

Sol: $p + q = -12$ (1)

$p - q = 2$ (2)

From Eqn (2)

$$p = 2 + q$$

(3)

Put this value of "p" in Eqn (1)

$$2 + q + q = -12$$

$$2q = -12 - 2$$

$$2q = -14$$

$$q = \frac{-14}{2}$$

$$\boxed{q = -7}$$

Put $q = -7$ in Eqn (3)

$$p = 2 + (-7)$$

$$p = 2 - 7$$

$$\boxed{p = -5}$$

Ans

(g) $2u + 3v = 52$

$$5u - 2v = 16$$

Sol: $2u + 3v = 52$ (1)

$5u - 2v = 16$ (2)

From Eqn (2)

$$5u = 16 + 2v$$

$$u = \frac{16 + 2v}{5}$$

(3)

Putting this value of "u" in Eqn (1)

$$2\left(\frac{16 + 2v}{5}\right) + 3v = 52$$

$$\frac{32 + 4v + 15v}{5} = 52$$

$$32 + 19v = 5 \times 52$$

$$19v = 260 - 32$$

$$19v = 228$$

$$v = \frac{228}{19}$$

$$\boxed{v = 12}$$

Put $v = 12$ in Eqn (3)

$$u = \frac{16 + 2(12)}{5}$$

$$u = \frac{16 + 24}{5}$$

$$u = \frac{40}{5}$$

$$\boxed{u = 8}$$

Ans

(h) $15x + 6y = 9$

$$10x - 18y = 28$$

Sol: $15x + 6y = 9$ (1)

$10x - 18y = 28$ (2)

From Eqn (2)

$$10x = 28 + 18y$$

$$x = \frac{28 + 18y}{10}$$

$$x = \frac{2(14+9y)}{10}$$

$$x = \frac{14+9y}{5} \quad (3)$$

Put this value of "x" in Eqn (1)

$$3\left(\frac{14+9y}{5}\right) + 6y = 9$$

$$3(14+9y) + 6y = 9$$

$$42 + 27y + 6y = 9$$

$$27y + 6y = 9 - 42$$

$$33y = -33$$

$$y = \frac{-33}{33}$$

$$\boxed{y = -1}$$

Put $y = -1$ in Eqn (3)

$$x = \frac{14+9(-1)}{5}$$

$$x = \frac{14-9}{5}$$

$$x = \frac{5}{5}$$

$$\boxed{x = 1}$$

$\therefore x = 1, y = -1$ Ans

Q.2 Solve the following simultaneous equations by using either the elimination or substitution method.

$$(a) \quad \begin{aligned} 12p - 7q &= 20 \\ 17p + 13q &= 16 \end{aligned}$$

$$\text{Sol: } \begin{aligned} 12p - 7q &= 20 & (1) \\ 17p + 13q &= 16 & (2) \end{aligned}$$

$$13 \times \text{Eqn (1)} \Rightarrow 156p - 91q = 260$$

$$7 \times \text{Eqn (2)} \Rightarrow 119p + 91q = 112$$

$$\underline{275p = 372} \quad (\text{Addition})$$

$$\boxed{p = \frac{372}{275}}$$

Put $p = \frac{372}{275}$ in Eqn (2)

$$17\left(\frac{372}{275}\right) + 13q = 16$$

$$\frac{6324}{275} + 13q = 16$$

$$13q = \frac{16}{1} - \frac{6324}{275}$$

$$13q = \frac{4400 - 6324}{275}$$

$$13q = \frac{-1924}{275}$$

$$q = \frac{-1924}{13 \times 275}$$

$$\boxed{q = \frac{-148}{275}}$$

$$\therefore p = \frac{372}{275}, q = \frac{-148}{275} \quad \text{Ans}$$

$$(b) \quad 5l + 2m = 54$$

$$3l + 5m = 59$$

$$\text{Sol: } \begin{aligned} 5l + 2m &= 54 & (1) \\ 3l + 5m &= 59 & (2) \end{aligned}$$

$$5 \times \text{Eqn (1)} \Rightarrow 25l + 10m = 270$$

$$2 \times \text{Eqn (2)} \Rightarrow 6l + 10m = 118$$

$$\underline{19l = 152}$$

$$l = \frac{152}{19}$$

$$\boxed{l = 8}$$

Put $l = 8$ in Eqn (1)

$$5(8) + 2m = 54$$

$$40 + 2m = 54$$

$$2m = 54 - 40$$

$$2m = 14$$

$$m = \frac{14}{2}$$

$$\boxed{m = 7}$$

$\therefore l = 8, m = 7$ Ans

$$(c) \quad 13u - 10v = 1$$

$$5u - 7v = 20$$

$$\text{Sol: } \begin{aligned} 13u - 10v &= 1 & (1) \\ 5u - 7v &= 20 & (2) \end{aligned}$$

$$7 \times \text{Eqn (1)} \Rightarrow 91u - 70v = 7$$

$$10 \times \text{Eqn (2)} \Rightarrow 50u + 70v = 200$$

$$\underline{41u = 123} \quad \text{Subtraction}$$

$$u = \frac{123}{41}$$

$$u = \frac{123}{41}$$

$$\boxed{u = -3}$$

Put $u = -3$ in Eqn (1)

$$13(-3) - 10v = 1$$

$$-39 - 10v = 1$$

$$-10v = 1 - 39$$

$$-10v = 50$$

$$v = \frac{5}{-1}$$

$$y = -5$$

$$u = -3, v = -5 \text{ Ans}$$

$$(d) \quad 2y + z = 30$$

$$3y - 2z = 17$$

$$\text{Sol: } 2y + z = 30 \quad \longrightarrow \quad (1)$$

$$3y - 2z = 17 \quad \longrightarrow \quad (2)$$

From Eqn (1)

$$z = 30 - 2y \quad \longrightarrow \quad (3)$$

Put the value of z in Eqn (2)

$$3y - 2(30 - 2y) = 17$$

$$3y - 60 + 4y = 17$$

$$3y + 4y = 17 + 60$$

$$7y = 77$$

$$y = \frac{77}{7}$$

$$y = 11$$

Put $y = 11$ in Eqn (3)

$$z = 30 - 2(11)$$

$$z = 30 - 22$$

$$z = 8$$

$$\therefore y = 11, z = 8 \text{ Ans}$$

$$(e) \quad 5x + 3y = 95$$

$$3x - 5y = 105$$

$$\text{Sol: } 5x + 3y = 95 \quad \longrightarrow \quad (1)$$

$$3x - 5y = 105 \quad \longrightarrow \quad (2)$$

From Eqn (1)

$$3y = 95 - 5x$$

$$y = \frac{95 - 5x}{3} \quad \longrightarrow \quad (3)$$

Put this value of y in Eqn (2)

$$3x + 5\left(\frac{95 - 5x}{3}\right) = 105$$

$$\frac{3x}{1} + \frac{475 - 25x}{3} = 105$$

$$\frac{9x + 475 - 25x}{3} = 105$$

$$\frac{475 - 16x}{3} = 105$$

$$475 - 16x = 3 \times 105$$

$$475 - 16x = 315$$

$$475 - 315 = 16x$$

$$16x = 160$$

$$x = \frac{160}{16}$$

$$x = 10$$

Put $x = 10$ in Eqn (3)

$$y = \frac{95 - 5(10)}{3}$$

$$y = \frac{95 - 50}{3}$$

$$y = \frac{45}{3}$$

$$y = 15$$

$$\therefore x = 10, y = 15 \text{ Ans}$$

$$(f) \quad 8x - 3y = 6$$

$$15x - 7y = -8$$

$$\text{Sol: } 8x - 3y = 6 \quad \longrightarrow \quad (1)$$

$$15x - 7y = -8 \quad \longrightarrow \quad (2)$$

$$7 \times \text{Eqn (1)} \Rightarrow 56x - 21y = 42$$

$$3 \times \text{Eqn (2)} \Rightarrow 45x - 21y = -24$$

$$11x = 66$$

$$x = \frac{66}{11}$$

$$x = 6$$

Put $x = 6$ in Eqn (1)

$$8(6) - 3y = 6$$

$$48 - 3y = 6$$

$$48 - 6 = 3y$$

$$3y = 42$$

$$y = \frac{42}{3}$$

$$y = 14$$

$$\therefore x = 6, y = 14 \text{ Ans}$$

$$(g) \quad 11x + 2y = 73$$

$$15x - 7y = 12$$

$$\text{Sol: } 11x + 2y = 73 \quad \longrightarrow \quad (1)$$

$$15x - 7y = 12 \quad \longrightarrow \quad (2)$$

$$7 \times \text{Eqn (1)} \Rightarrow 77x + 14y = 511$$

$$2 \times \text{Eqn (2)} \Rightarrow 30x - 14y = 24$$

$$\text{Addition } 107x = 535$$

$$x = \frac{535}{107}$$

$$x = 5$$

Put $x = 5$ in Eqn (1)

$$11(5) + 2y = 73$$

$$55 + 2y = 73$$

$$2y = 73 - 55$$

$$2y = 18$$

$$y = \frac{18}{2}$$

$$y = 9$$

$$\therefore x = 5, y = 9 \quad \text{Ans}$$

$$(h) \quad 4x + 3y = -31$$

$$3x + 15y = 15$$

$$\text{Sol: } \begin{array}{l} 4x + 3y = -31 \quad \text{--- (1)} \\ 3x + 15y = 15 \quad \text{--- (2)} \end{array}$$

From Eqn (1)

$$3y = -31 - 4x$$

$$y = \frac{-31 - 4x}{3} \quad \text{--- (3)}$$

Put this value of "y" in Eqn (2)

$$3x + 15 \left(\frac{-31 - 4x}{3} \right) = 15$$

$$3x - 155 - 20x = 15$$

$$3x - 20x = 15 + 155$$

$$-17x = 170$$

$$x = \frac{170}{-17}$$

$$x = -10$$

Put $x = -10$ in Eqn (3)

$$y = \frac{-31 - 4(-10)}{3}$$

$$y = \frac{-31 + 40}{3}$$

$$y = \frac{9}{3}$$

$$y = 3$$

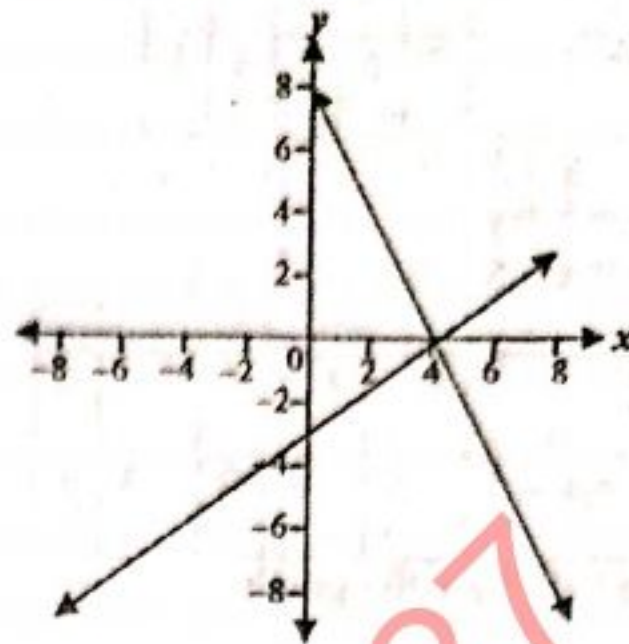
$$\therefore x = -10, y = 3 \quad \text{Ans}$$

To solve Simultaneous Linear Equations Using Graphical Method, follow these steps:

1. Write the first linear equation.
2. Use Trial and error method and put any value of x (or y) and solve the equation. This will give the value of y (or x). This will give us the values of the coordinates of the first point.
3. Similarly, put a few more values of x or y and get corresponding values of y or x .
4. In the same way, find coordinates of at least 3 points for the second equation.
5. Plot the points for both equations and if needed, extend the length of the lines until they meet.
6. Look at the point at which the 2 lines meet. These coordinates of this point will give us the solution of the given simultaneous linear equations.

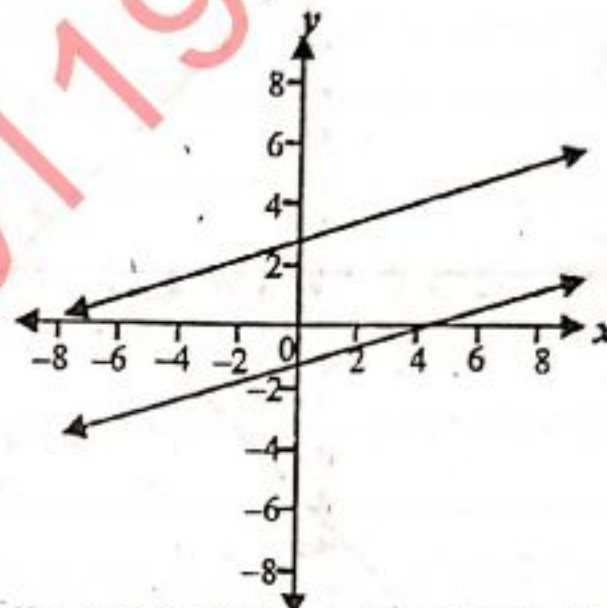
One point of intersection—One solution

If the lines intersect at one common point, this shows that there is only one solution for the simultaneous linear equations.



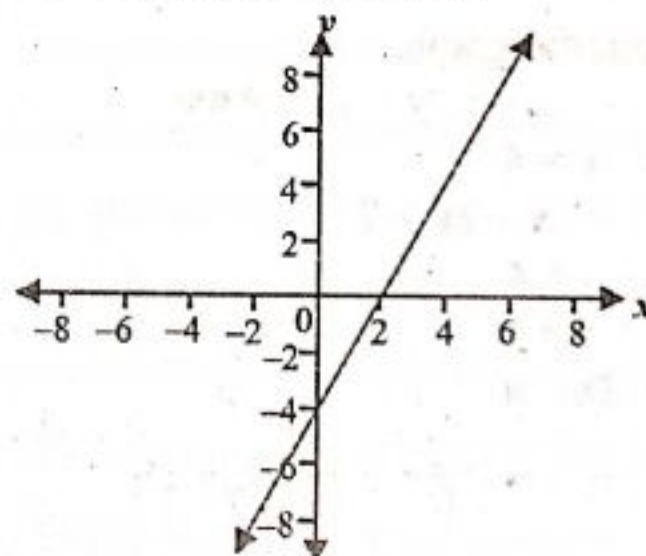
No point of Intersection (parallel lines) – No Solution

If the lines do not intersect at all i.e. they are parallel to each other, then there is no solution.



If same line (coincide) – Many Solutions

Both equations give the same line, then there are infinitely many solutions.



Exercise 8.4

(Tb Pg 180)

Q.1 Solve the following system of Linear equations graphically.

$$(a) \quad x + y = 7$$

$$x - y = 5$$

$$\text{Sol: } x + y = 7$$

$$y = 7 - x$$

Table 1:

X	0	1	2	3	6
$y = 7 - x$	7	6	5	4	1

$$x - y = 5$$

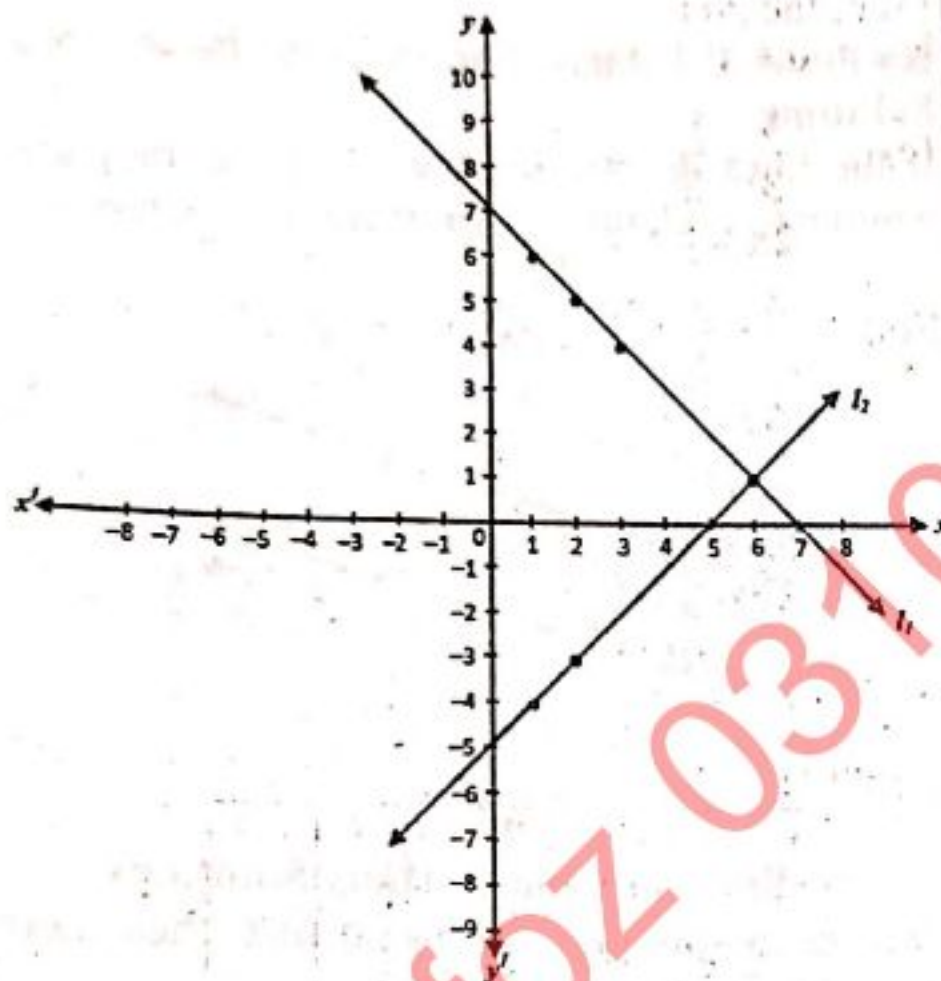
$$x = 5 + y$$

$$y = x - 5$$

Table 2:

X	0	1	5	2	6
$y = x - 5$	-5	-4	0	-3	1

Now, we will draw the graph



From the graph,

$$x = 6, y = 1 \quad \text{Ans}$$

(b) $2x - y = 4$

$$x - 2y = 7$$

Sol: $2x - y = 4$

$$2x = 4 + y$$

$$y = 2x - 4$$

Table 1:

X	0	1	2	3
$y = 2x - 4$	-4	-2	0	2

$$x - 2y = 7$$

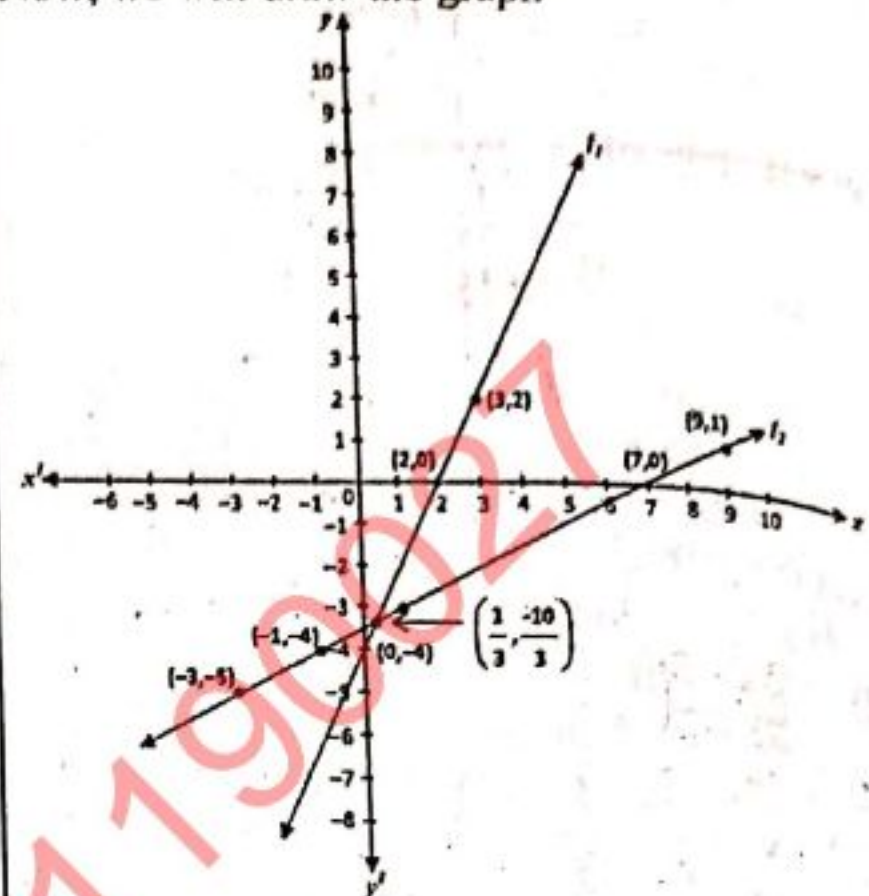
$$x - 7 = 2y$$

$$y = \frac{x - 7}{2}$$

Table 2:

x	7	9	-1	-3
$y = \frac{x - 7}{2}$	0	1	-4	-5

Now, we will draw the graph



From the graph,

$$x = \frac{1}{3}, y = -\frac{10}{3} \quad \text{Ans}$$

(c) $3x - y = 0$

$$2x + y = 5$$

Sol: $3x - y = 0$

$$3x = y$$

or $y = 3x$

Table 1:

x	0	1	2	-1
$y = 3x$	0	3	6	-3

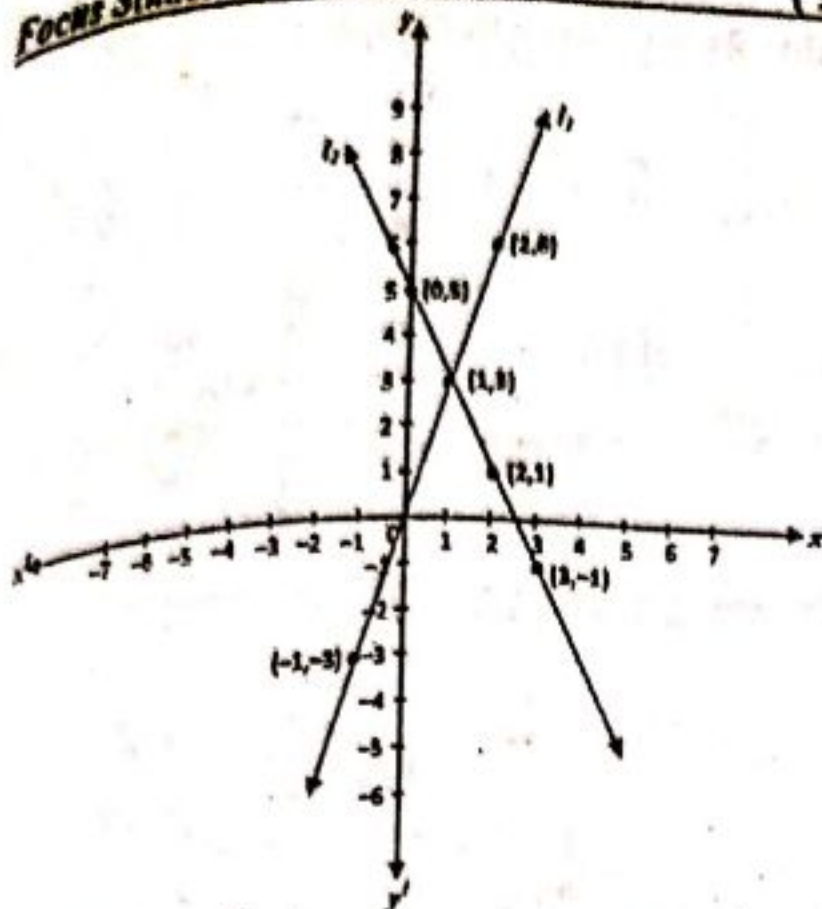
$$2x + y = 5$$

$$y = 5 - 2x$$

Table 2:

x	0	1	2	3
$y = 5 - 2x$	5	3	1	-1

Now, we will draw the graph



From the graph,
 $x = 1, y = 3$ Ans

(d) $3x - 5y = 6$

$2x - 3y = 5$

Sol: $3x - 5y = 6$

$3x = 6 + 5y$

$3x - 6 = 5y$

$y = \frac{3x-6}{5}$

Table 1:

x	7	6	3	4
$y = \frac{3x-6}{2}$	3	2.4	0.6	1.2

$2x - 3y = 5$

$2x = 5 + 3y$

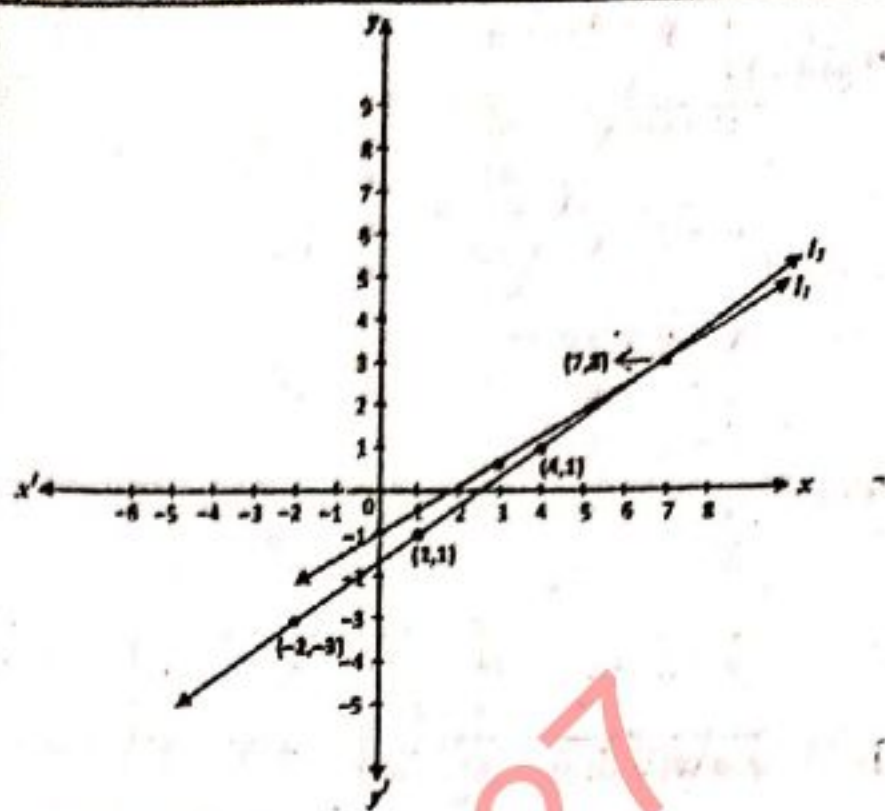
$2x - 5 = 3y$

$y = \frac{2x-5}{3}$

Table 2:

x	1	4	-2	7
$y = \frac{x-7}{2}$	-1	1	-3	3

Now, we will draw the graph



From the graph,
 $x = 7, y = 3$ Ans

(e) $\frac{x}{3} + \frac{y}{5} = 2$

$2x - y = 1$

Sol: $\frac{x}{3} + \frac{y}{5} = 2$

$\frac{5x+3y}{15} = 2$

$5x + 3y = 2 \times 15$

$3y = 30 - 5x$

$y = \frac{30-5x}{3}$

Table 1:

x	0	3	6	-3
$y = \frac{30-5x}{3}$	10	5	0	15

$2x - y = 1$

$2x = 1 + y$

$2x - 1 = y$

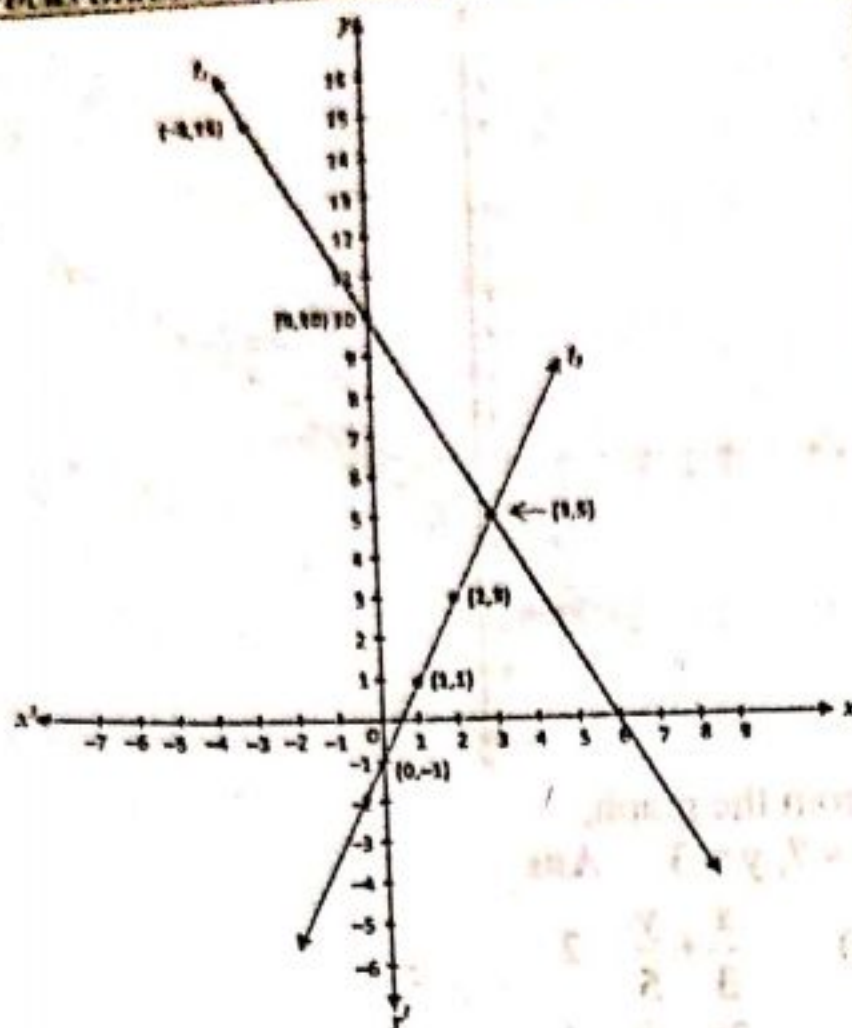
or $y = 2x - 1$

Table 2:

x	0	1	2	3
$y = 2x - 1$	-1	1	3	5

Now, we will draw the graph

Now, we will draw the graph



From the graph,
 $x = 3, y = 5$ Ans

(f) $\frac{x}{3} + 5y = 16$
 $x + y = 6$

Sol: $\frac{x}{3} + 5y = 16$
 $\frac{x + 15y}{3} = 16$
 $x + 15y = 3 \times 16$
 $15y = 48 - x$
 $y = \frac{48 - x}{15}$

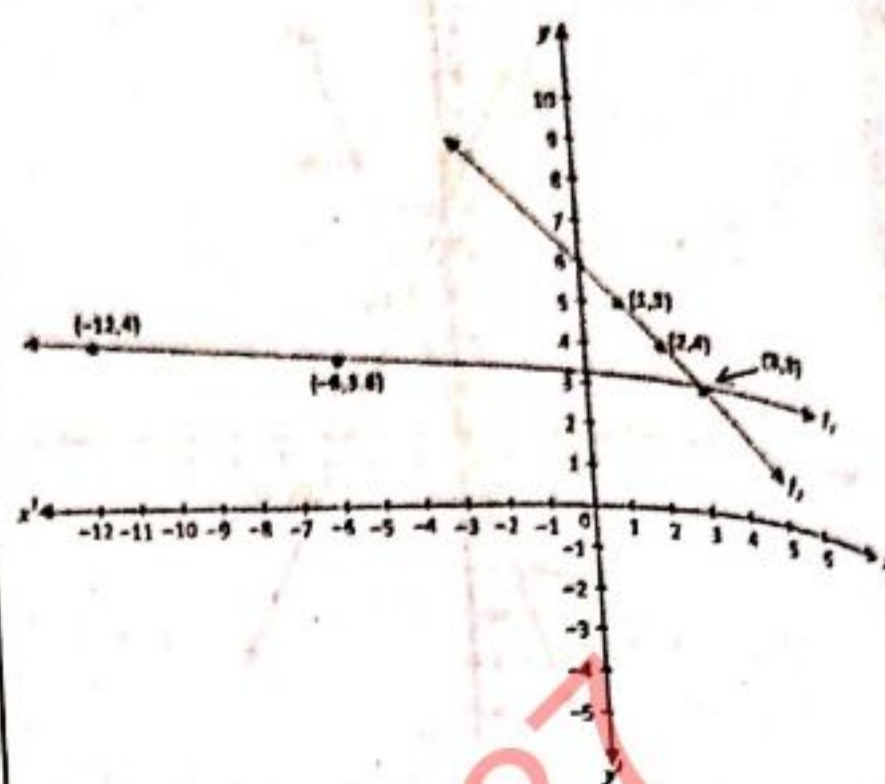
Table 1:

x	3	18	-12	-6
y = $\frac{48-x}{15}$	3	2	4	3.6

$x + y = 6$
 $y = 6 - x$

Table 2:

x	0	1	2	3
y = $6 - x$	6	5	4	3



From the graph,
 $x = 3, y = 3$ Ans

(g) $2x + 5y = 12$
 $4x + 3y = -4$

Sol: $2x + 5y = 12$
 $5y = 12 - 2x$
 $y = \frac{12 - 2x}{5}$

Table 1:

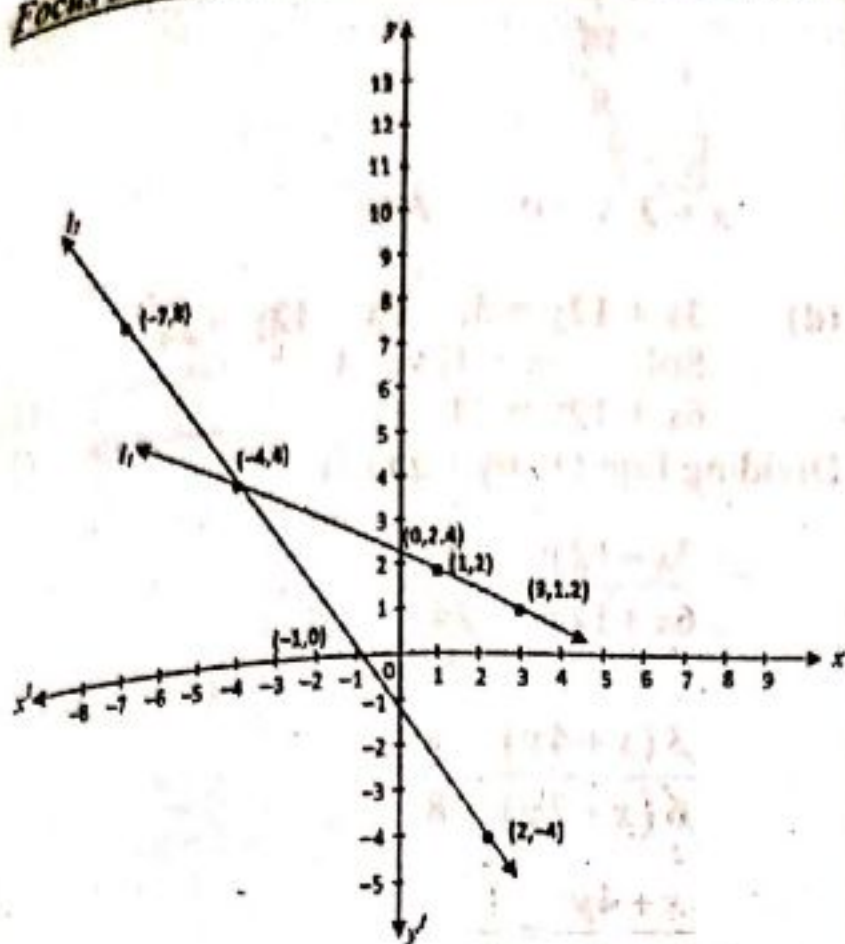
x	1	-4	0	3
y = $\frac{12-2x}{5}$	2	4	2.4	1.2

$4x + 3y = -4$
 $3y = -4 - 4x$
 $y = \frac{-4 - 4x}{3}$

Table 2:

x	2	-1	-4	-7
y = $\frac{-4-4x}{3}$	-4	0	4	8

Now, we will draw the graph



From the graph,

$$x = -4, y = 4 \quad \text{Ans}$$

(h) $5x - y = 4$
 $10x - 4y = 6$

Sol: $5x - y = 4$
 $5x = 4 + y$
 $5x - 4 = y$
 $y = 5x - 4$

Table 1:

x	0	1	2	-1
y = 5x - 4	-4	1	6	-9

$$10x - 4y = 6$$

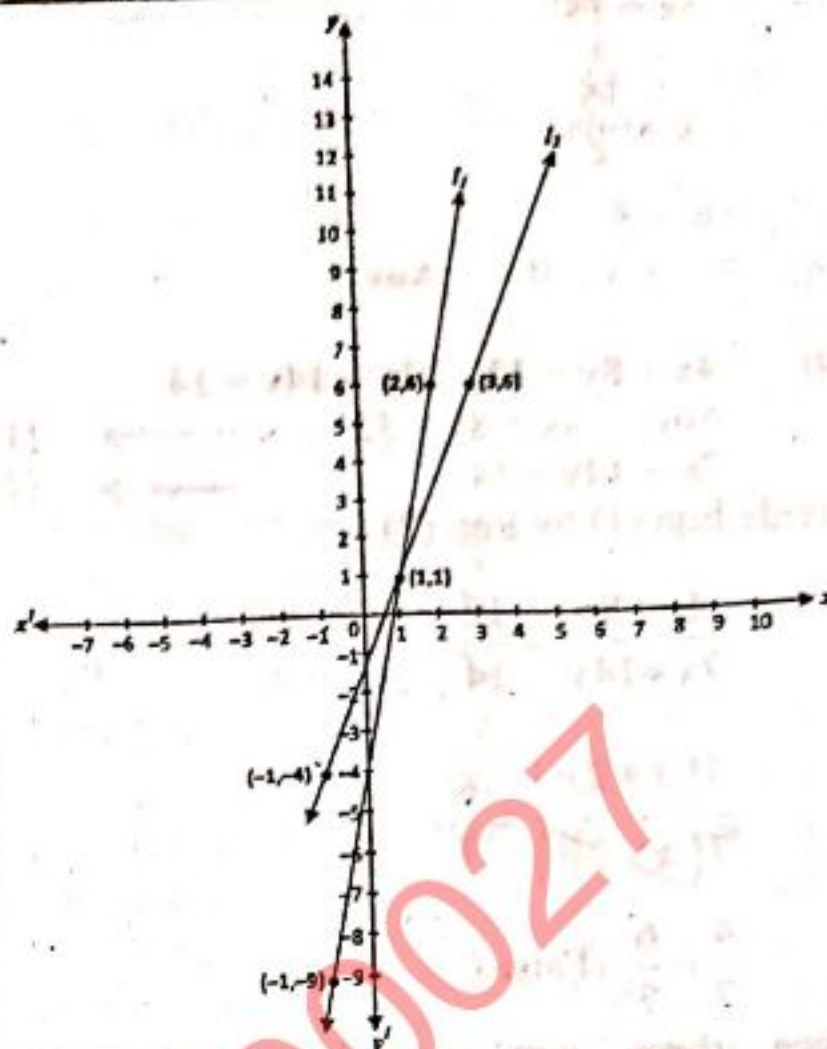
$$10x - 6 = 4y$$

$$y = \frac{10x - 6}{4}$$

Table 2:

x	-1	1	3	5
y = $\frac{10x - 6}{4}$	-4	1	6	11

Now, we will draw the graph



From the graph,

$$x = 1, y = 1 \quad \text{Ans}$$

Exercise 8.5 (Tb Pg 181)

Q.1 Solve the following simultaneous linear equations using division method.

(a) $5x + 10y = 15$, $3x + 12y = 9$

Sol: $5x + 10y = 15$ ————— (1)

$3x + 12y = 9$ ————— (2)

Divide Eqn (1) by Eqn (2)

$$\frac{5x + 10y}{3x + 12y} = \frac{15}{9}$$

$$\frac{5(x + 2y)}{3(x + 4y)} = \frac{5}{3}$$

$$\frac{x + 2y}{x + 4y} = \frac{1}{1}$$

$$\frac{x + 2y}{x + 4y} = \frac{1}{1}$$

By cross multiplication, we get

$$x + 4y = x + 2y$$

$$x + 4y - x - 2y = 0$$

$$2y = 0$$

$$y = \frac{0}{2}$$

$$y = 0$$

Put $y = 0$ in Eqn (1)

$$5x + 10(0) = 15$$

$$5x + 0 = 15$$

$$5x = 15$$

$$x = \frac{15}{5}$$

$$\boxed{x = 3}$$

$$\therefore x = 3, y = 0 \quad \text{Ans}$$

(b) $4x + 8y = 12, \quad 7x + 14y = 14$

Sol: $4x + 8y = 12 \quad \longrightarrow (1)$

$7x + 14y = 14 \quad \longrightarrow (2)$

Divide Eqn (1) by Eqn (2)

$$\frac{4x+8y}{7x+14y} = \frac{12}{14}$$

$$\frac{4(\cancel{x+2y})}{7(\cancel{x+2y})} = \frac{6}{7}$$

$$\frac{4}{7} = \frac{6}{7} \quad (\text{False})$$

Hence these equations have no solution
Ans

(c) $9x + 9y = 18, \quad 2x + 8y = 4$

Sol: $9x + 9y = 18 \quad \longrightarrow (1)$

$2x + 8y = 4 \quad \longrightarrow (2)$

Dividing Eqn (1) by Eqn (2)

$$\frac{9x+9y}{2x+8y} = \frac{18}{4}$$

$$\frac{9(x+y)}{2(x+4y)} = \frac{9}{2}$$

$$\frac{x+y}{x+4y} = \frac{9}{2} \times \frac{2}{9}$$

$$\frac{x+y}{x+4y} = 1$$

By cross multiplication, we get

$$1(x+4y) = 1(x+y)$$

$$x+4y = x+y$$

$$\cancel{x} + 4y - \cancel{x} - y = 0$$

$$3y = 0$$

$$y = \frac{0}{3}$$

$$\boxed{y = 0}$$

Put $y = 0$ in Eqn (1)

$$9x + 9(0) = 18$$

$$9x + 0 = 18$$

$$9x = 18$$

$$x = \frac{18}{9}$$

$$\boxed{x = 2}$$

$$\therefore x = 2, y = 0 \quad \text{Ans}$$

(d) $3x + 12y = 3, \quad 6x + 12y = 24$

Sol: $3x + 12y = 3 \quad \longrightarrow (1)$

$6x + 12y = 24 \quad \longrightarrow (2)$

Dividing Eqn (1) by Eqn (2)

$$\frac{3x+12y}{6x+12y} = \frac{3}{24}$$

$$\frac{\cancel{3}(x+4y)}{\cancel{6}(x+2y)} = \frac{1}{8}$$

$$\frac{x+4y}{2x+4y} = \frac{1}{8}$$

By cross multiplication, we get

$$8(x+4y) = 1(2x+4y)$$

$$8x + 32y = 2x + 4y$$

$$8x - 2x = 4y - 32y$$

$$6x = -28y$$

$$x = \frac{-28y}{6}$$

$$x = \frac{-14y}{3}$$

Put equation (3) in equation (1)

$$\cancel{3}\left(\frac{-14y}{\cancel{3}}\right) + 12y = 3$$

$$-14y + 12y = 3$$

$$-2y = 3$$

$$y = \frac{-3}{2}$$

Put $y = \frac{-3}{2}$ in (3)

$$x = \frac{-14}{3}\left(\frac{-\cancel{3}}{\cancel{2}}\right)$$

$$\boxed{x = 7}$$

$$\therefore x = 7, y = \frac{-3}{2} \quad \text{Ans}$$

(e) $11x + 33y = 44, \quad 5x + 15y = 30$

Sol: $11x + 33y = 44 \quad \longrightarrow (1)$

$5x + 15y = 30 \quad \longrightarrow (2)$

Dividing Eqn (1) by Eqn (2)

$$\frac{11x+33y}{5x+15y} = \frac{44}{30}$$

$$\frac{11(\cancel{x+3y})}{5(\cancel{x+3y})} = \frac{44}{30}$$

$$\frac{11}{5} = \frac{22}{15} \text{ (False)}$$

So, solution does not exist. Ans

$$\begin{aligned} \text{(i)} \quad x+y &= 2, & 4x+2y &= 4 \\ \text{Sol: } x+y &= 2 & \longrightarrow (1) \\ 4x+2y &= 4 & \longrightarrow (2) \end{aligned}$$

Dividing Eqn (1) by Eqn (2)

$$\frac{x+y}{4x+2y} = \frac{2}{4}$$

$$\frac{x+y}{2(2x+y)} = \frac{1}{2}$$

$$\frac{x+y}{2x+y} = \frac{1}{2} \times 2$$

$$\frac{x+y}{2x+y} = 1$$

By cross multiplication, we get

$$1(2x+y) = 1(x+y)$$

$$2x+y = x+y$$

$$2x-x = y-y$$

$$x=0$$

Put $x=0$ in Eqn (1)

$$0+y=2$$

$$y=2$$

$\therefore x=0, y=2$ Ans

Q.2 Solve the following simultaneous linear equations using factorization method.

- $x+y=4, \quad xy=8$
- $3x+5y=10, \quad 4x-3y=5$
- $x+4y=1, \quad 3x-7y=5$
- $6x+7y=10, \quad 2x-5y=7$
- $7x+3y=5, \quad 2x-9y=3$
- $5x+y=6, \quad 8x-3y=12$

Equation are not appropriate. Ans

Exercise 8.6 (Tb Pg 186)

Q.1 The sum of two numbers is 15 and their difference is 3. Find the number.

Sol: Let "x" & "y" be the required two numbers

1st condition:

$$x+y=15 \longrightarrow (1)$$

2nd Condition:

$$x-y=3 \longrightarrow (2)$$

Adding Eqn (1) and Eqn (2)

$$x+y=15$$

$$x-y=3$$

$$\hline 2x=18$$

$$x=9$$

$$x=9$$

Put $x=9$ in Eqn (1)

$$x+y=15$$

$$9+y=15$$

$$y=15-9$$

$$y=6$$

$\therefore$ The required two numbers are 9 and 6. Ans

Q.2 There is a certain pair of numbers such that the sum of twice the first number and thrice the second number is 61. However, when we subtract five times the second number from four times the first number, the answer is 45. Find the numbers.

Sol: Let 1st number = x and 2nd number = y

1st Condition

$$2x+3y=61 \longrightarrow (1)$$

2nd Condition

$$4x-5y=45 \longrightarrow (2)$$

$$5 \times \text{Eqn (1)} \Rightarrow 10x+15y=305$$

$$3 \times \text{Eqn (2)} \Rightarrow 12x-15y=135$$

$$\hline 22x=440$$

$$x = \frac{440}{22}$$

$$x=20$$

Put $x=20$ in Eqn (1)

$$2(20)+3y=61$$

$$40+3y=61$$

$$3y=61-40$$

$$3y=21$$

$$y = \frac{21}{3}$$

$$y=7$$

So, the required two numbers are 20 and 7. Ans

Q.3 Zara bought five pencils and two sharpeners for Rs.62 while Madeeha bought eight pencils and two sharpeners for Rs.92. Find the price of a pencil and a sharpener.

Sol: Let price of a pencil = x and price of a sharpener = y

1st Condition

$$5x + 2y = 62$$

2nd Condition

$$8x + 2y = 92$$

Subtracting Eqn (1) from Eqn (2)

$$\begin{array}{r} 8x + 2y = 92 \\ - 5x + 2y = 62 \\ \hline 3x = 30 \end{array}$$

$$x = \frac{30}{3}$$

$$x = 10$$

Put $x = 10$ in Eqn (1)

$$5(10) + 2y = 62$$

$$50 + 2y = 62$$

$$2y = 62 - 50$$

$$2y = 12$$

$$y = \frac{12}{2}$$

$$y = 6$$

∴ Price of a pencil = Rs 10

Price of a sharpener = Rs 6 Ans

Q.4 Ahmad bought 6 chairs and 2 tables for Rs.6399 while Ali bought 2 chairs and one table of the same shop for Rs.2600. Find the price of a chair and a table.

Sol: Let price of a chair = x and price of a table = y 1st Condition

$$6x + 2y = 6300$$

2nd Condition

$$2x + y = 2600$$

$$2 \times \text{Eqn (2)} \Rightarrow 4x + 2y = 5200$$

Subtracting Eqn (3) from Eqn (1)

$$\begin{array}{r} 6x + 2y = 6300 \\ - 4x + 2y = 5200 \\ \hline 2x = 1100 \end{array}$$

$$x = \frac{1100}{2}$$

$$x = 550$$

Put $x = 550$ in Eqn (2)

$$2(550) + y = 2600$$

$$1100 + y = 2600$$

$$y = 2600 - 1100$$

$$y = 1500$$

∴ Price of a chair = Rs 550

Price of a table = Rs 1500 Ans

Note: Book answer is wrong.

Q.5 A shopkeeper has prepared bags of potatoes and carrots. The bag "A" contains 5kg potatoes and 2 kg carrots while the bag

"B" contains 7 kg potatoes and 3 kg carrots. If the cost of the packet "A" is Rs.850 and that of the packet "B" is Rs.1200. Find the price of 1kg of potatoes and 1kg of carrots.

Sol: Let the price of 1kg of potatoes = x and price of 1kg of carrots = y 1st Condition

$$5x + 2y = 850$$

(1)

2nd Condition

$$7x + 3y = 1200$$

(2)

$$3 \times \text{Eqn (1)} \Rightarrow 15x + 6y = 2550$$

$$2 \times \text{Eqn (2)} \Rightarrow 14x + 6y = 2400$$

$$x = 150 \quad (\text{Subtraction})$$

Put $x = 150$ in Eqn (1)

$$5(150) + 2y = 850$$

$$750 + 2y = 850$$

$$2y = 850 - 750$$

$$2y = 100$$

$$y = \frac{100}{2}$$

$$y = 50$$

∴ Price of 1kg of potatoes = Rs 150

Price of 1kg of carrots = Rs 50 Ans

Q.6 The present age of a man is four times that of his son. In five years. The man's age will be three times that of his son. Find the present age of the son and the father

Sol: Let Present age of the son = x and present age of the father = y 1st Condition

$$y = 4x$$

(1)

In five years

Present age of the son = $x + 5$ Present age of the father = $y + 5$ 2nd Condition

$$y + 5 = 3(x + 5)$$

$$y + 5 = 3x + 15$$

$$y - 3x = 15 - 5$$

$$y - 3x = 10$$

Put Eqn (1) in Eqn (2)

$$4x - 3x = 10$$

$$x = 10$$

Put $x = 10$ in Eqn (1)

$$y = 4x$$

$$y = 4 \times 10$$

$$y = 40$$

∴ Present age of father = 40 years

Present age of son = 10 years Ans

Important Table (TB Pg 186)

Algebraic Statement	Equivalent Statement	Geometric Statement
$a < b$	a is less than b	a lies to the left of b
$a > b$	a is greater than b	a lies to the right of b
$a \leq b$	a is less than or equal to b	a coincides with b or lies to the left
$a \geq b$	a is greater than or equal to b	a coincides with b or lies to the right

Quick Check (Pg 188)

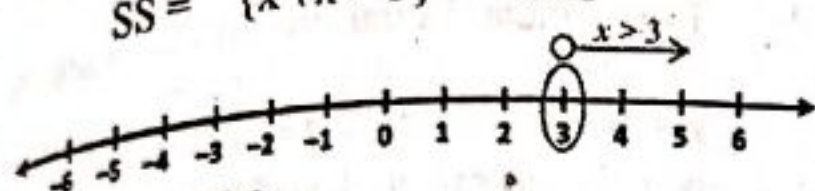
Solve and represent the solution using a number line.

(a) $3x - 2 > 7$
Sol: $3x > 7 + 2$
 $3x > 9$

$$x > \frac{9}{3}$$

$$x > 3$$

SS = $\{x \mid x > 3\}$ Ans

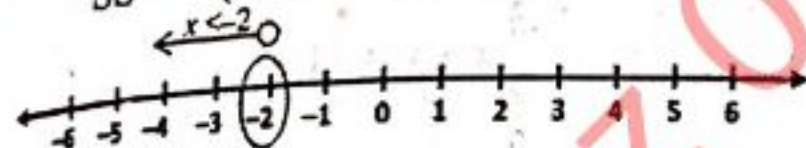


(b) $-5x > 10$
Sol: Multiplying both sides "-1"
 $5x < -10$

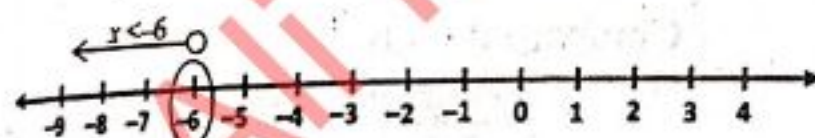
$$x < \frac{-10}{5}$$

$$x < -2$$

SS = $\{x \mid x < -2\}$ Ans



(c) $x + 2 < -4$
Sol: $x < -4 - 2$
 $x < -6$
SS = $\{x \mid x < -6\}$ Ans



Exercise 8.7 (Tb Pg 189)

Q.1 Solve the following linear inequalities. Also represent the solution on a number line.

(a) $-3x - 2 > 8$

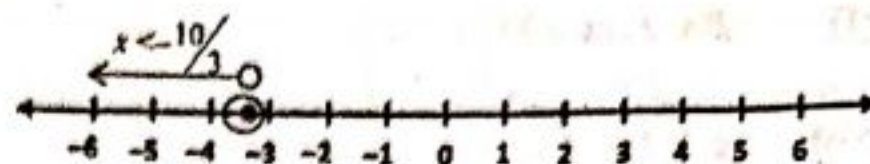
Sol: $-3x > 8 + 2$

$$-3x > 10$$

Multiplying both sides by "-1"

$$3x < -10 \Rightarrow x < \frac{-10}{3}$$

SS = $\{x \mid x < -\frac{10}{3}\}$ Ans

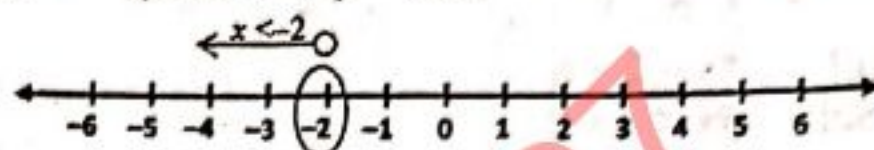


(b) $4x < -8$

Sol: $x < -\frac{8}{4}$

$$x < -2$$

SS = $\{x \mid x < -2\}$ Ans



(c) $6x - 2 > 12$

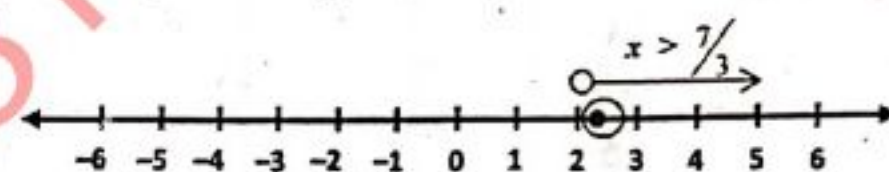
Sol: $6x > 12 + 2$

$$6x > 14$$

$$x > \frac{14}{6}$$

$$x > \frac{7}{3}$$

SS = $\{x \mid x > \frac{7}{3}\}$ Ans



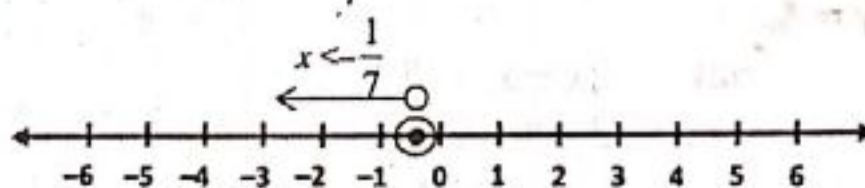
(d) $7x + 3 < 2$

Sol: $7x < 2 - 3$

$$7x < -1$$

$$x < -\frac{1}{7}$$

SS = $\{x \mid x < -\frac{1}{7}\}$ Ans

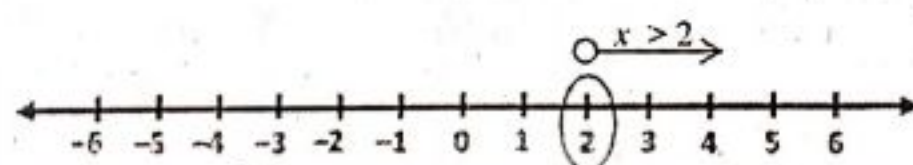


(e) $8x > 16$

Sol: $x > \frac{16}{8}$

$$x > 2$$

SS = $\{x \mid x > 2\}$ Ans



(f) $2(x + 2) > 10$

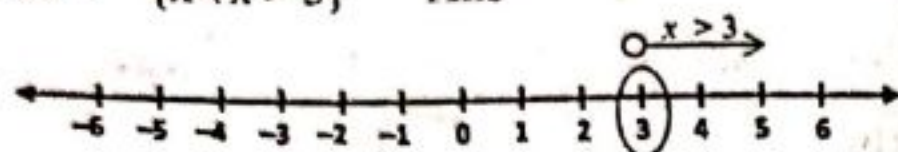
Sol: $x + 2 > \frac{10}{2}$

$x + 2 > 5$

$x > 5 - 2$

$x > 3$

SS = $\{x \mid x > 3\}$ Ans



(g) $5x - 2 < 8$

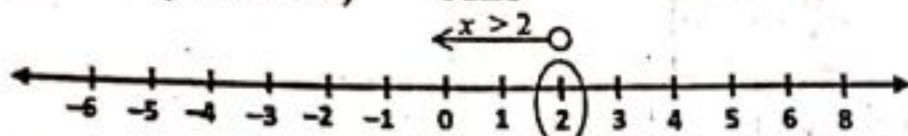
Sol: $5x < 8 + 2$

$5x < 10$

$x < \frac{10}{5}$

$x < 2$

SS = $\{x \mid x < 2\}$ Ans



(h) $-5x > 15$

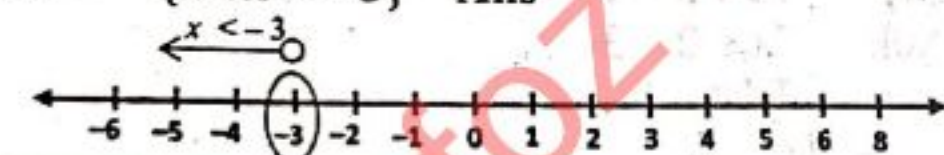
Sol: Multiplying both sides by "-1"

$5x < -15$

$x < -\frac{15}{5}$

$x < -3$

SS = $\{x \mid x < -3\}$ Ans



PKC: (Tb Pg 190)

Q.2 Draw a graph of linear equation $2x + 3y = 5$.

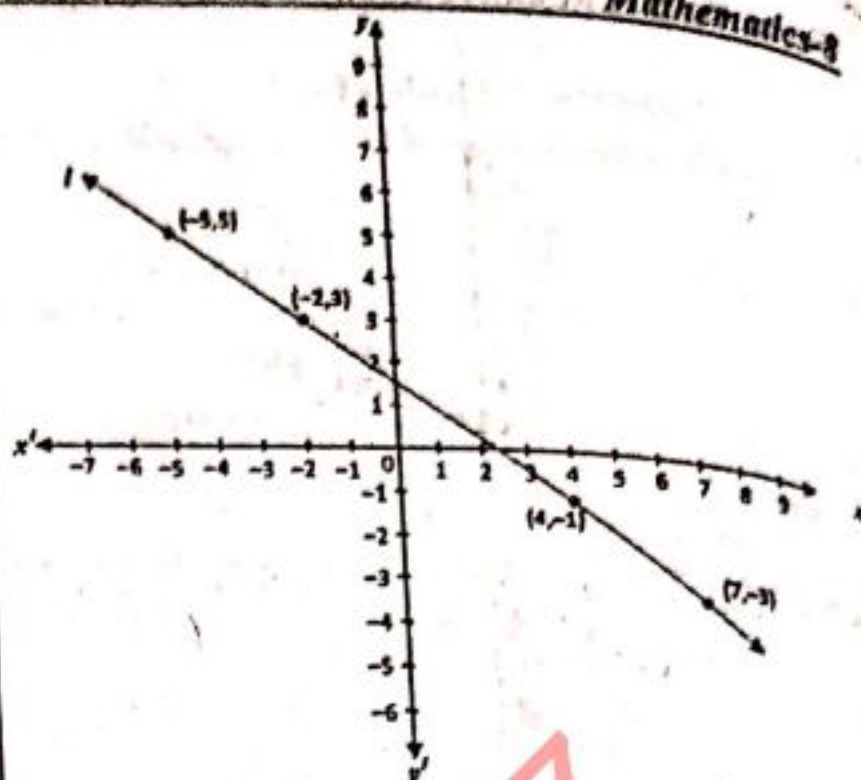
Sol: $2x + 3y = 5$

$3y = 5 - 2x$

$y = \frac{5 - 2x}{3}$

x	-2	4	7	-5
$y = \frac{5 - 2x}{3}$	3	-1	-3	5

Now, we will draw the graph



Q.3 Write two linear equations in one and two variables.

Sol: Two Linear Equations in one Variable are

$x + 5 = 9, \quad 2y - 7 = 3$

Two Linear Equations in Two Variables are

$2x + 3y = 5, \quad 4x - 3y = 3$

Quick Check: (Tb Pg 192)

Draw a line for the equation $\frac{3}{2}x - y = -1$ and find its gradient.

Sol: Gradient = ?

Give Equation:

$\frac{3}{2}x - y = -1$

$\frac{3}{2}x + 1 = y$

Or

$y = \frac{3}{2}x + 1$

Compare it with

$y = mx + c$, So

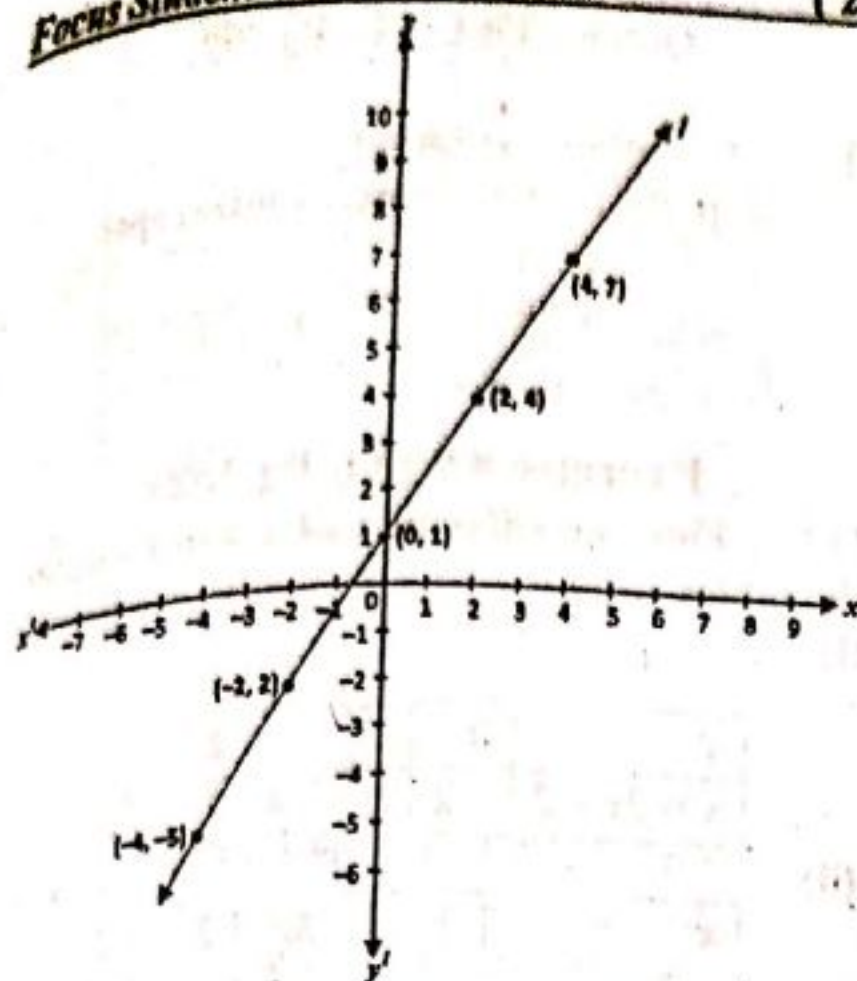
$m = \frac{3}{2}$

Ans

Table:

x	0	2	-2	4	-4
$y = \frac{3}{2}x + 1$	1	4	-2	7	-5

Now, we will draw the graph

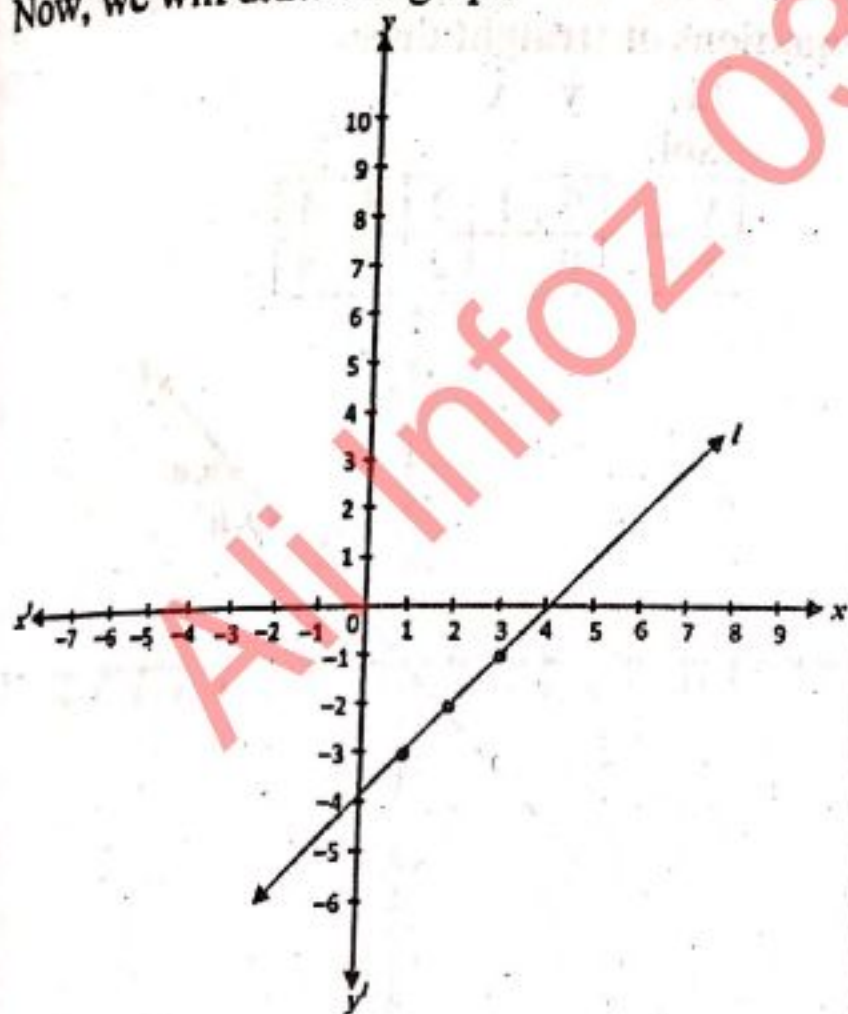


Quick Check: (Tb Pg 194)
Plot the graph for $y = x - 4$ and verify the intercepts graphically.

Sol:

x	0	1	2	3	4
$y = x - 4$	-4	-3	-2	-1	0

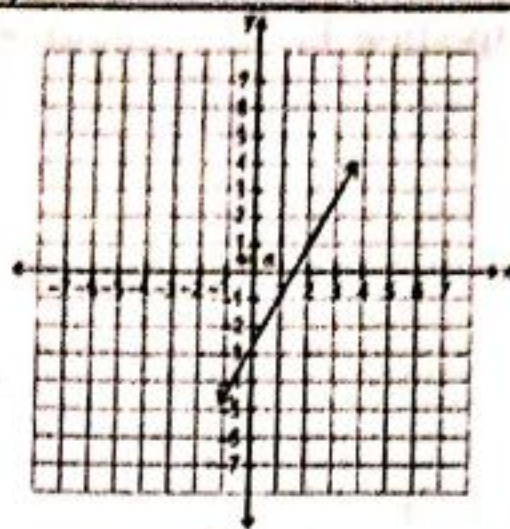
Now, we will draw the graph



Exercise 8.8 (Tb Pg 196)

Q.1 Find and interpret the gradient of the following straight lines. Also describe the y-intercept.

(a)



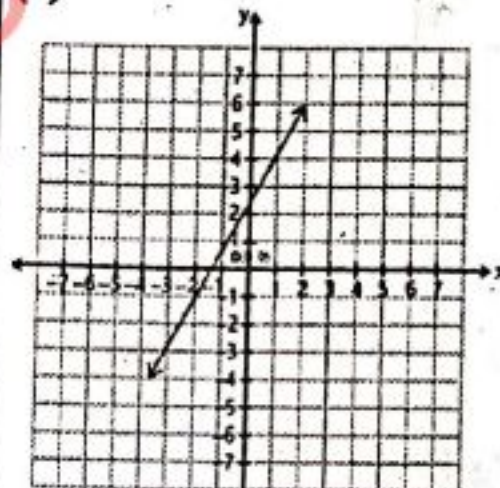
Sol: $m = \frac{5}{3}$ $c = -3$ **Ans**

(b)



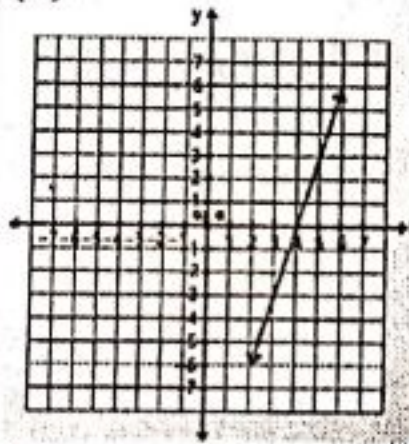
Sol: $m = -\frac{1}{4}$ $c = 3$ **Ans**

(c)



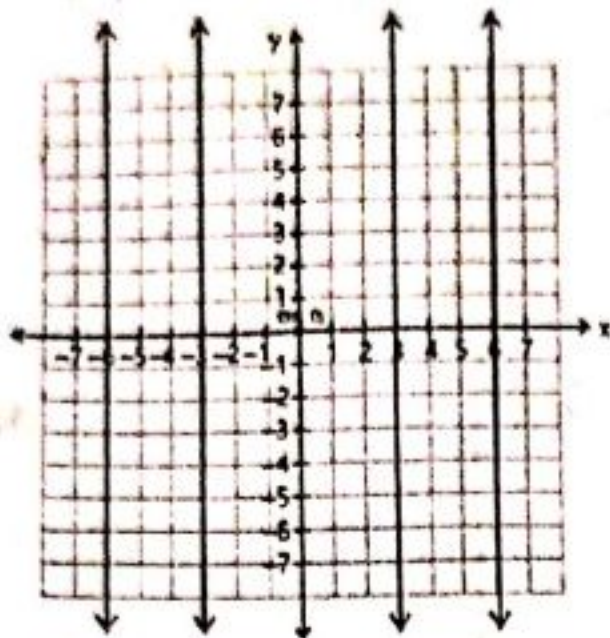
Sol: $m = \frac{3}{5}$ $c = 2.5$ **Ans**

(d)



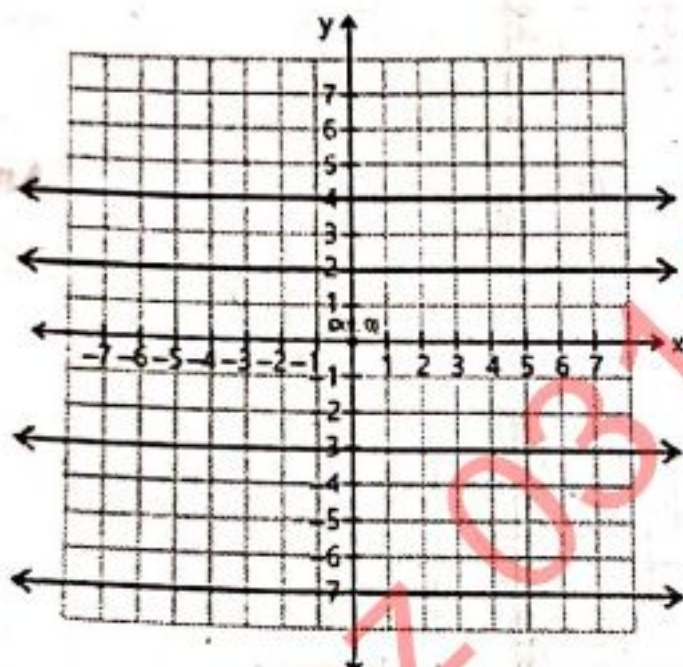
Sol: $m = 3$ $c = -9$ **Ans**

Q.2 Write the equation for the following vertical lines.



Sol: $x = 6, x = 3$
 $x = -6, x = -3$ Ans

Q.3 Write the equation for the following horizontal lines.



Sol: $y = 4, y = 2$
 $y = -3, y = -7$ Ans

Quick Check: (Tb Pg 199)

Use the formula:

$$\text{Gradient} = \frac{\text{Vertical change}}{\text{Horizontal change}}$$

And check the gradients of the lines:

(i) $y = x$

Sol: $y = mx + c$; So $m = 1$

(ii) $y = \frac{1}{2}x$

Sol: $y = \frac{1}{2}x + c$; So $m = \frac{1}{2}$

(iii) $y = 5x$

Sol: $y = mx + c$; So $m = 5$

Quick Check: (Tb Pg 199)

Q Complete the table:

Equation	Gradient	y - intercept
$y = 3x + 2$	3	2
$y = 5x - 2$	5	-2
$y = -2x + 4$	-2	4

Exercise 8.9 (Tb Pg 202)

Q.1 Find the value of x or y and complete the tables.

(i)

x	0	1	-1	2
$y = 2x - 2$	-2	0	-4	2

(ii)

x	0	$-\frac{3}{2}$	2	1
$y = \frac{1}{2x+3}$	$\frac{1}{3}$	-1	$\frac{1}{7}$	$\frac{1}{5}$

(iii)

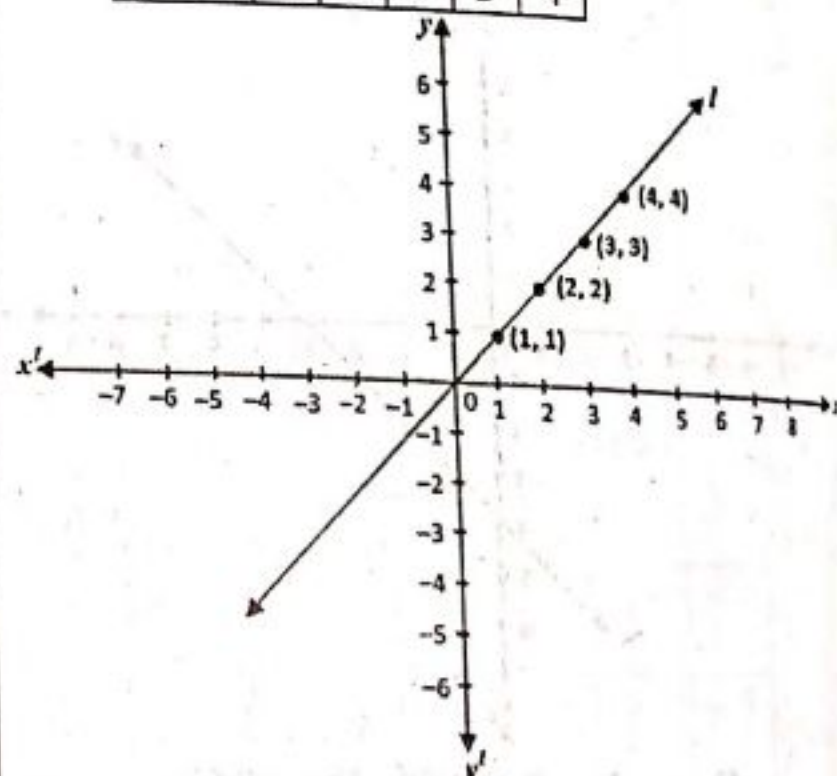
x	0	$-\frac{5}{3}$	-1	-1
$y = -3x - 5$	-5	0	-2	-2

Q.2 Plot the graphs for the following equations of straight lines

(a) $y = x$

Sol:

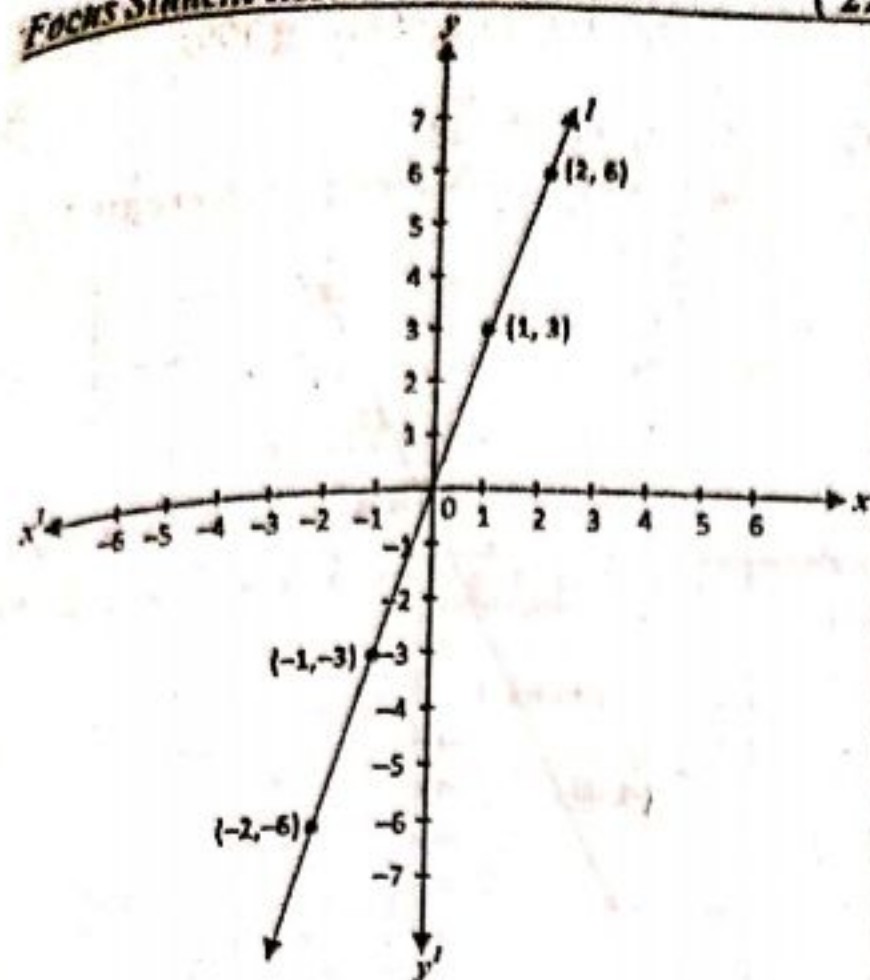
x	0	1	2	3	4
$y = x$	0	1	2	3	4



(b) $y = 3x$

Sol:

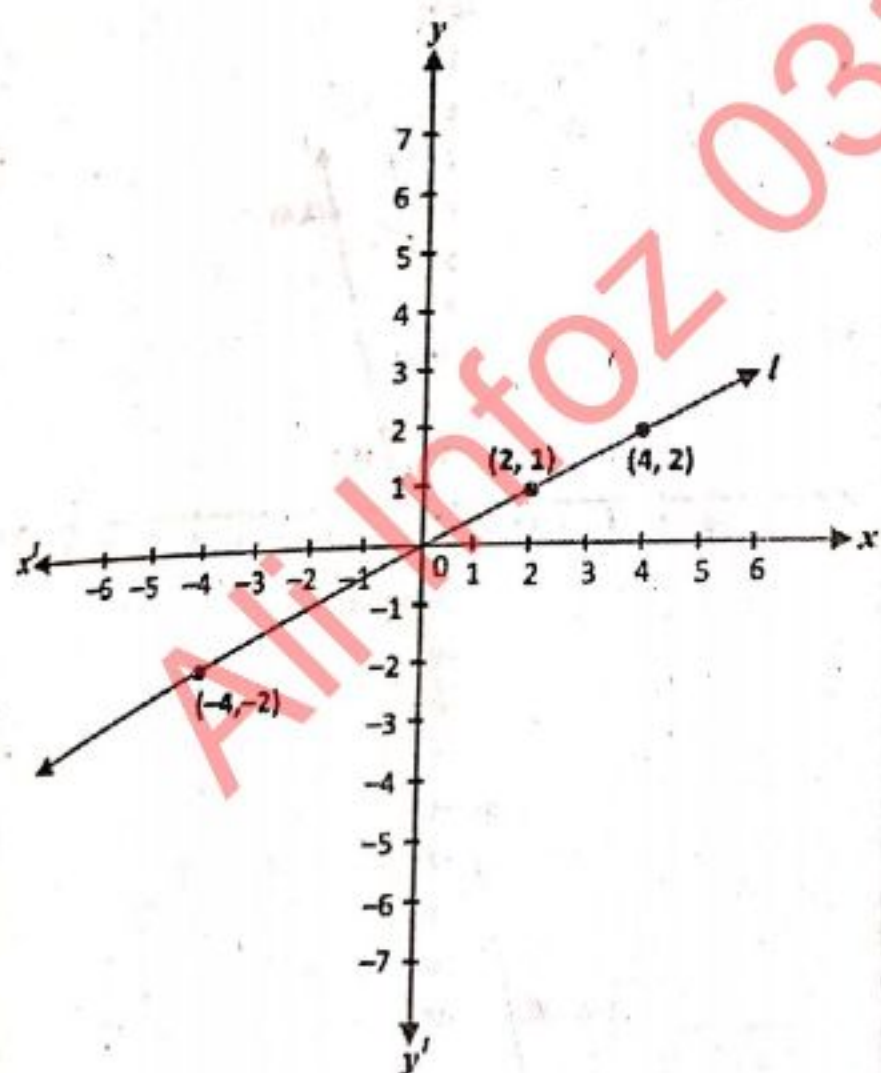
x	0	1	2	-1	-2
$y = 3x$	0	3	6	-3	-6



(c) $y = \frac{1}{2}x$

Sol:

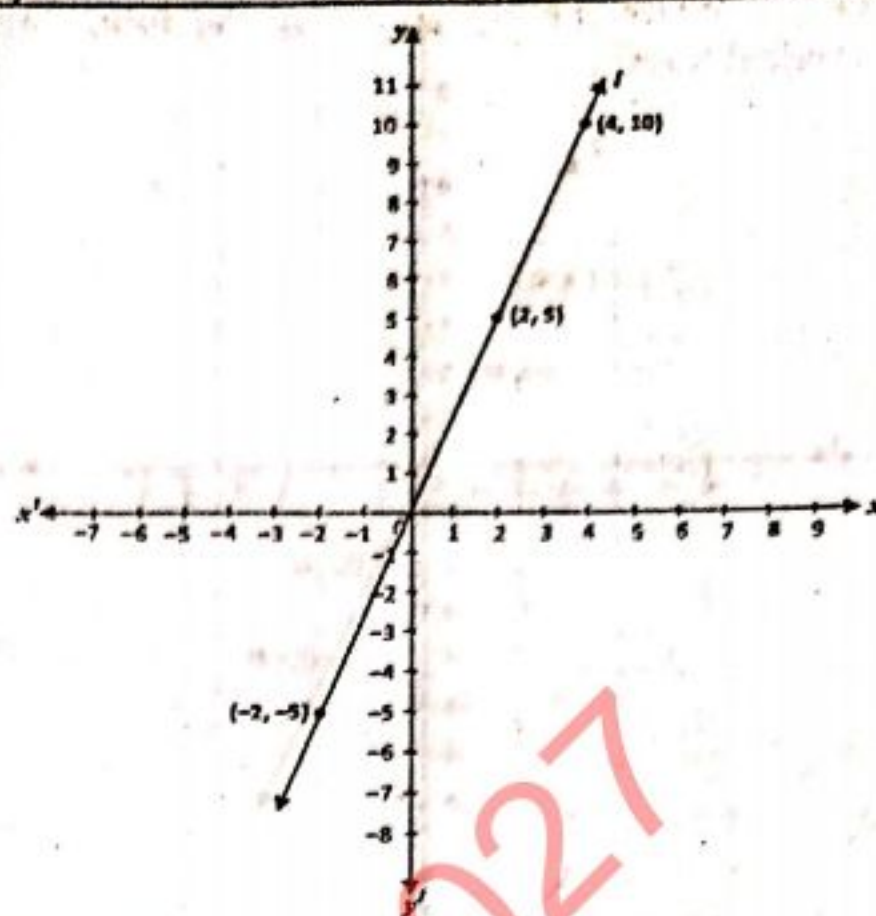
x	0	2	4	-4
$y = \frac{1}{2}x$	0	1	2	-2



(d) $y = \frac{5}{2}x$

Sol:

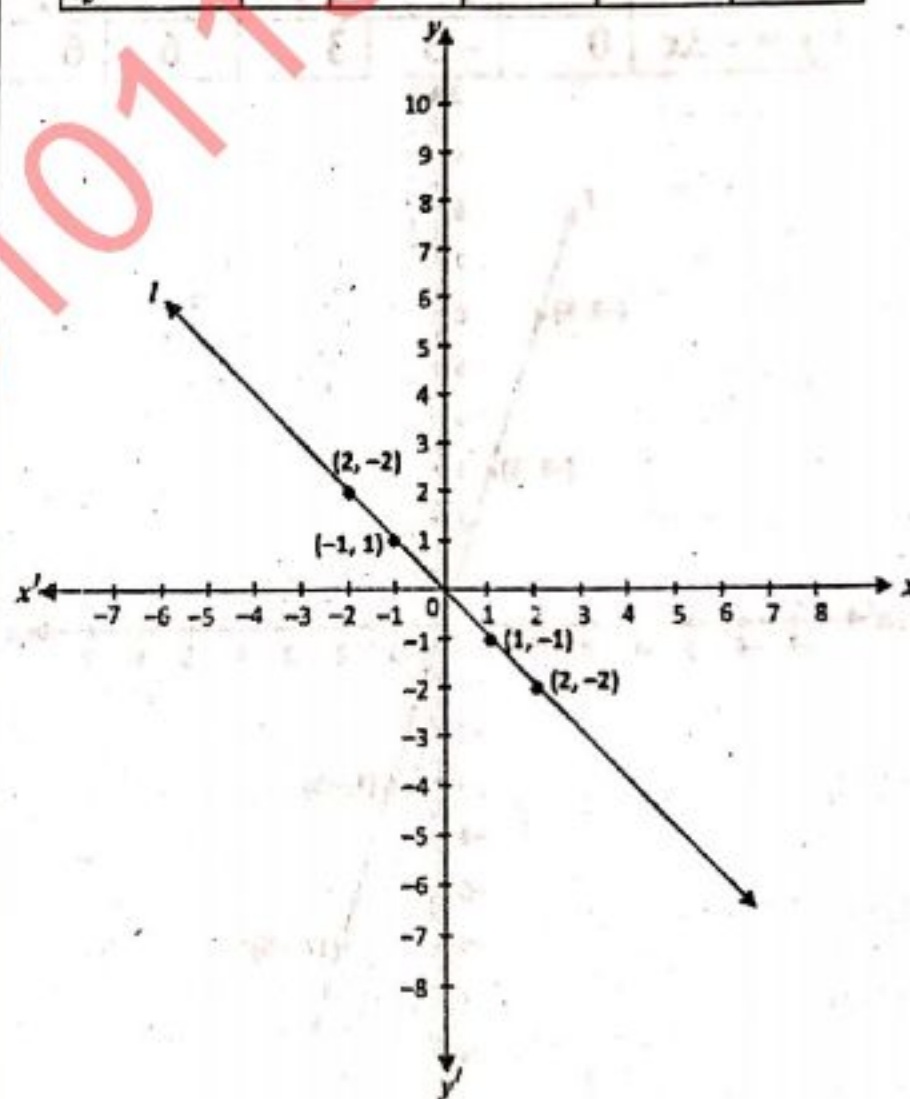
x	0	2	-2	4
$y = \frac{5}{2}x$	0	5	-5	10



(e) $y = -x$

Sol:

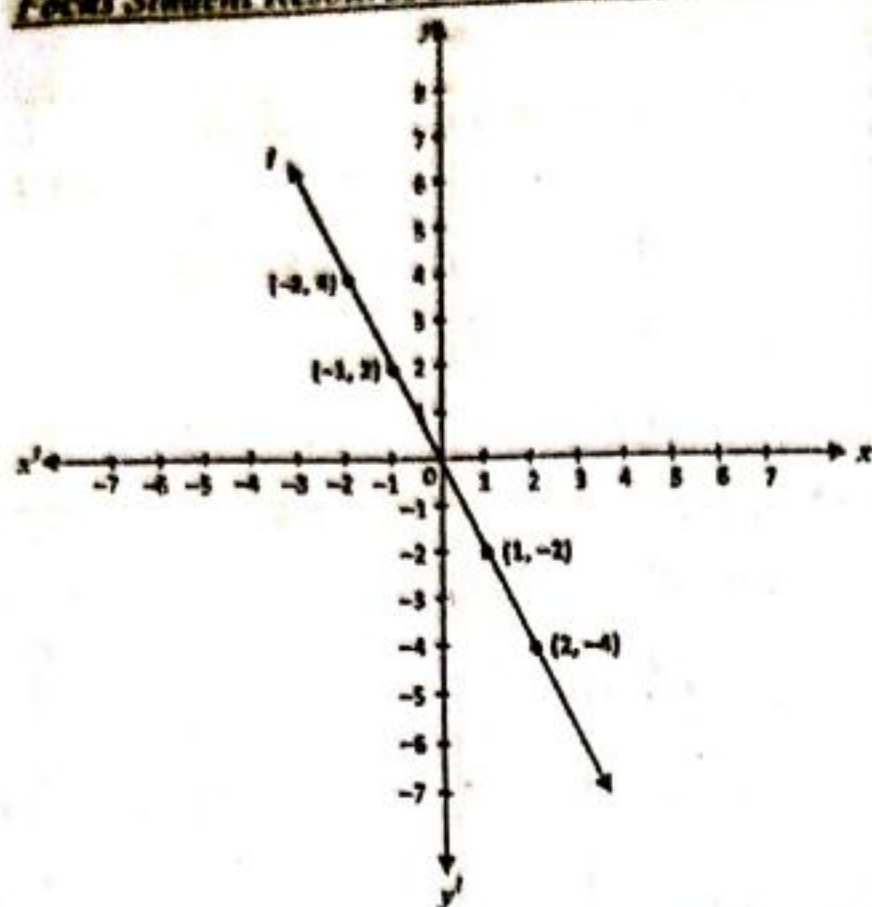
X	0	-1	1	2	-2
$y = -x$	0	1	-1	-2	2



(f) $y = -2x$

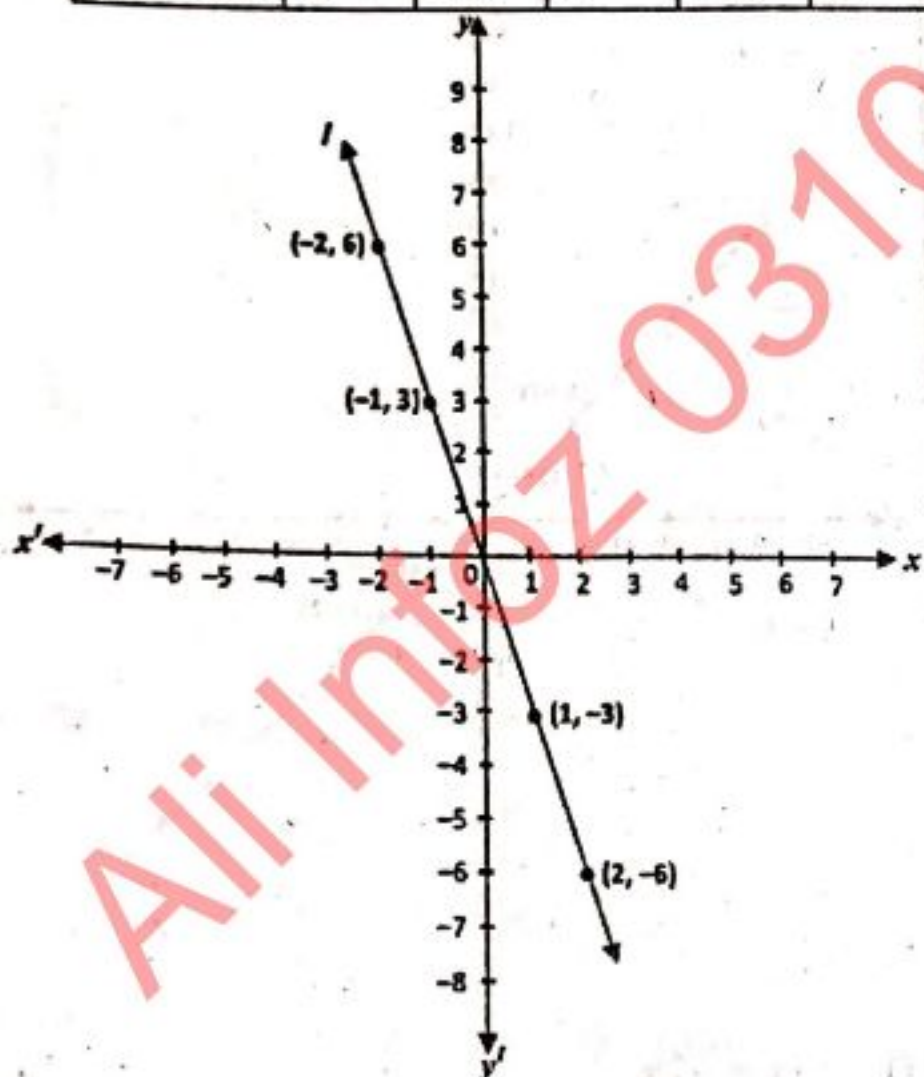
Sol:

X	0	1	-1	2	-2
$y = -2x$	0	-2	2	-4	4



(g) $y = -3x$
Sol:

x	0	1	-1	2	-2
$y = -3x$	0	-3	3	-6	6

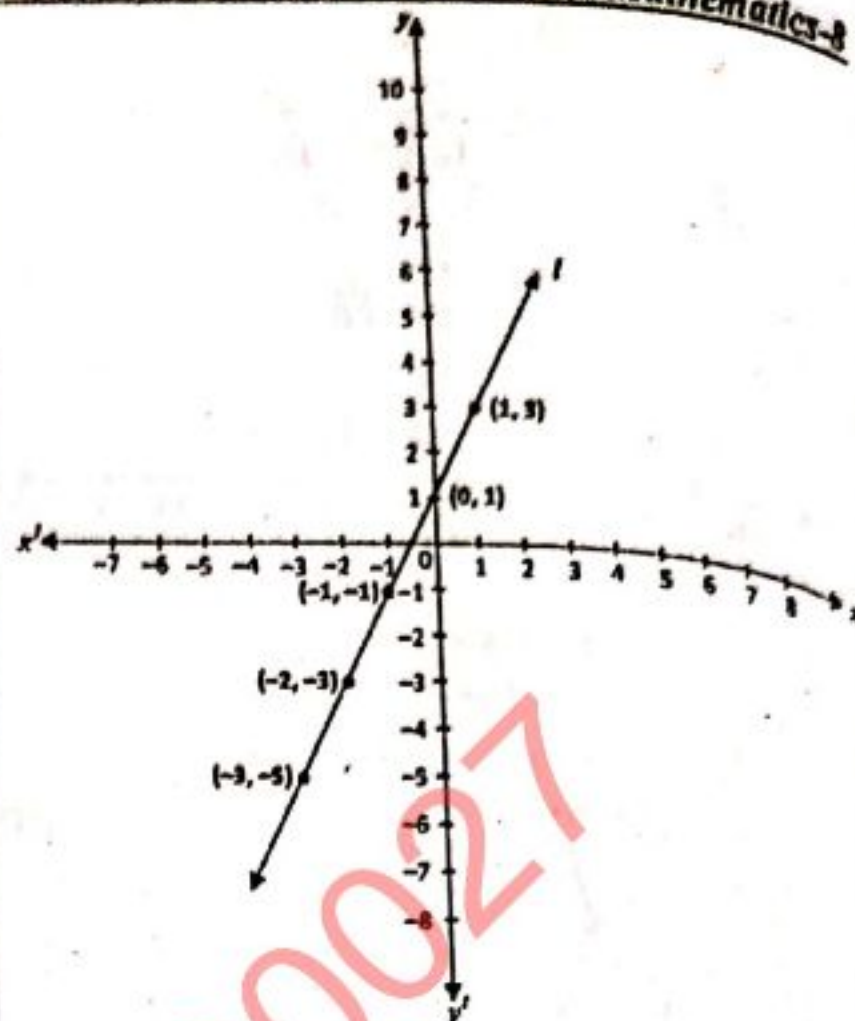


Q.3 Plot the graphs for the following equations of straight lines

(a) $y = 2x + 1$

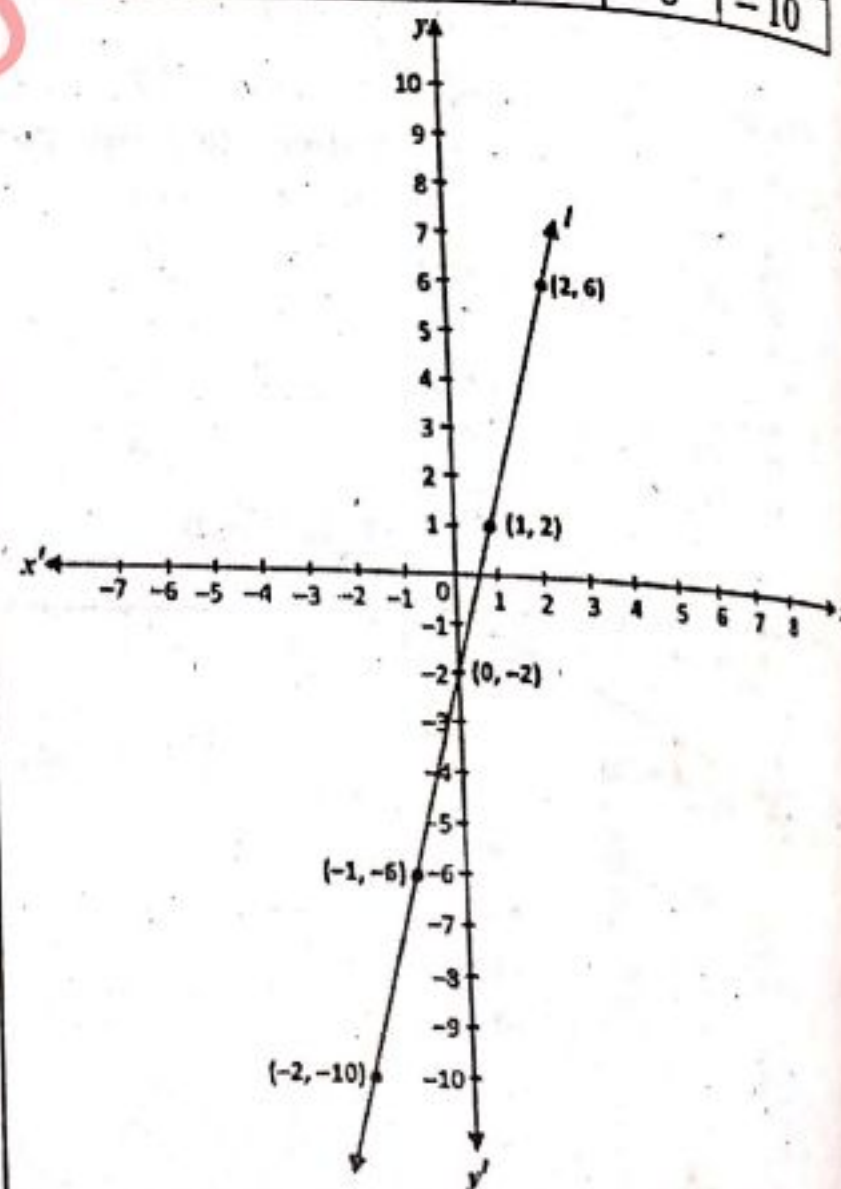
Sol:

x	0	1	-1	-2	-3
$y = 2x + 1$	1	3	-1	-3	-5



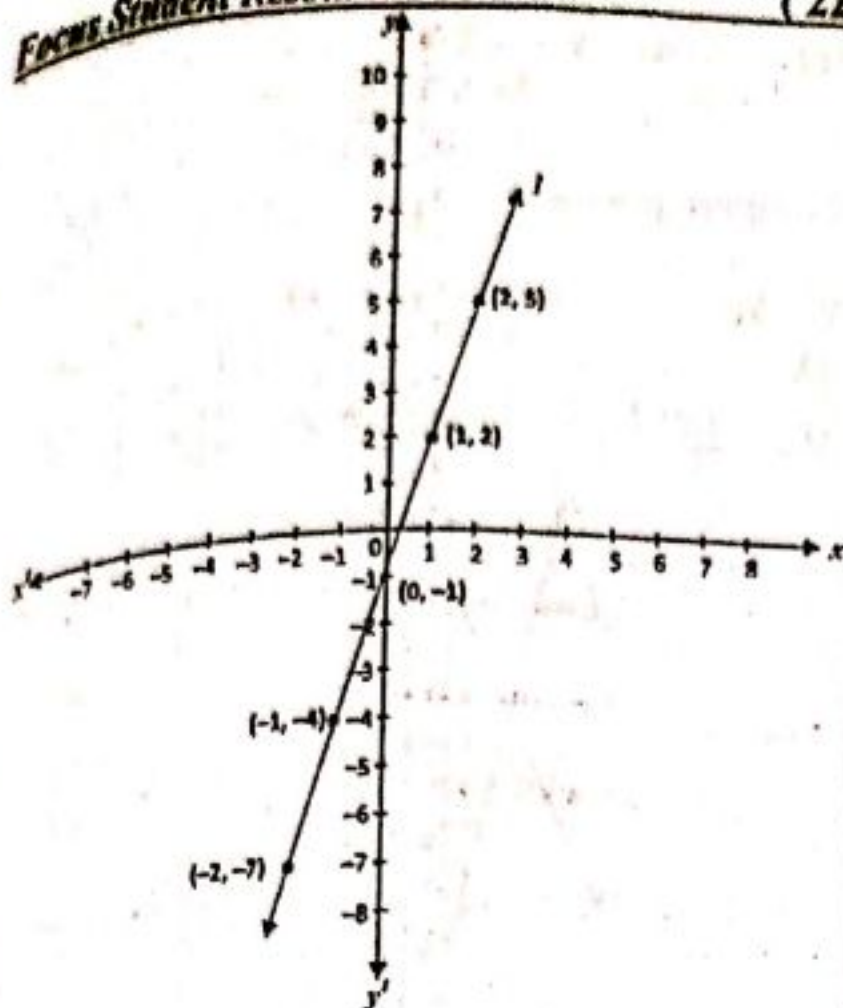
(b) $y = 4x - 2$
Sol:

X	0	1	2	-1	-2
$y = 4x - 2$	-2	2	6	-6	-10



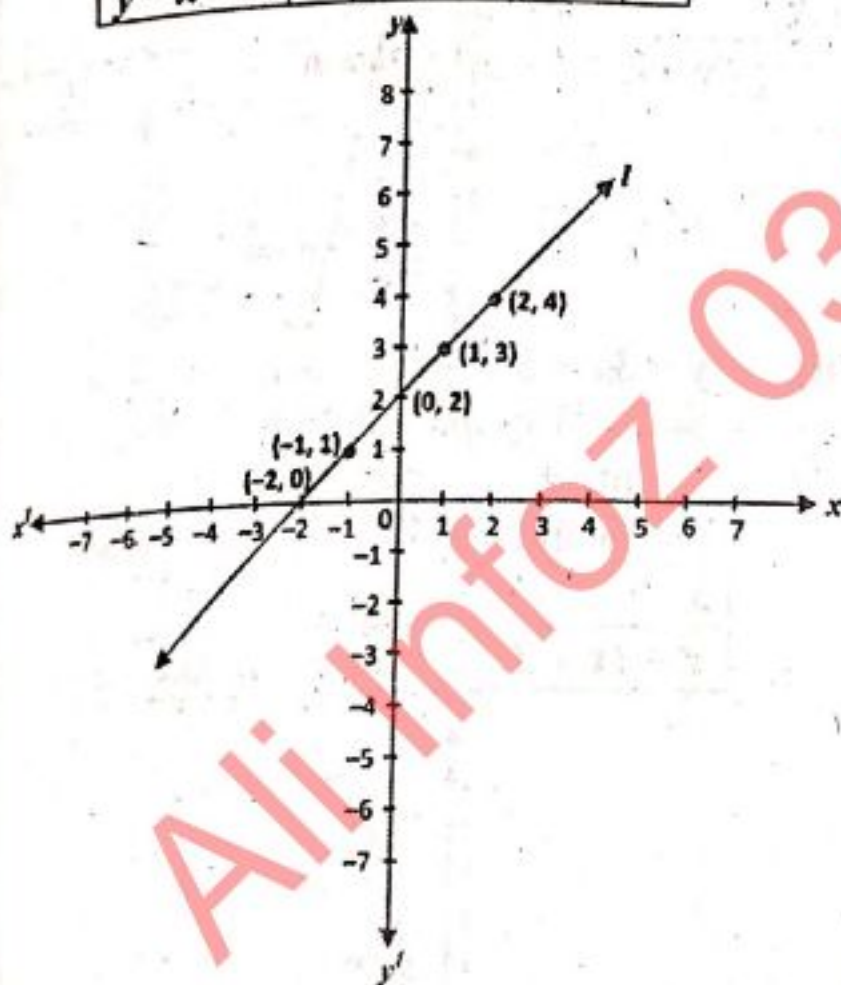
(c) $y = 3x - 1$
Sol:

X	0	1	2	-1	-2
$y = 3x - 1$	-1	2	5	-4	-7



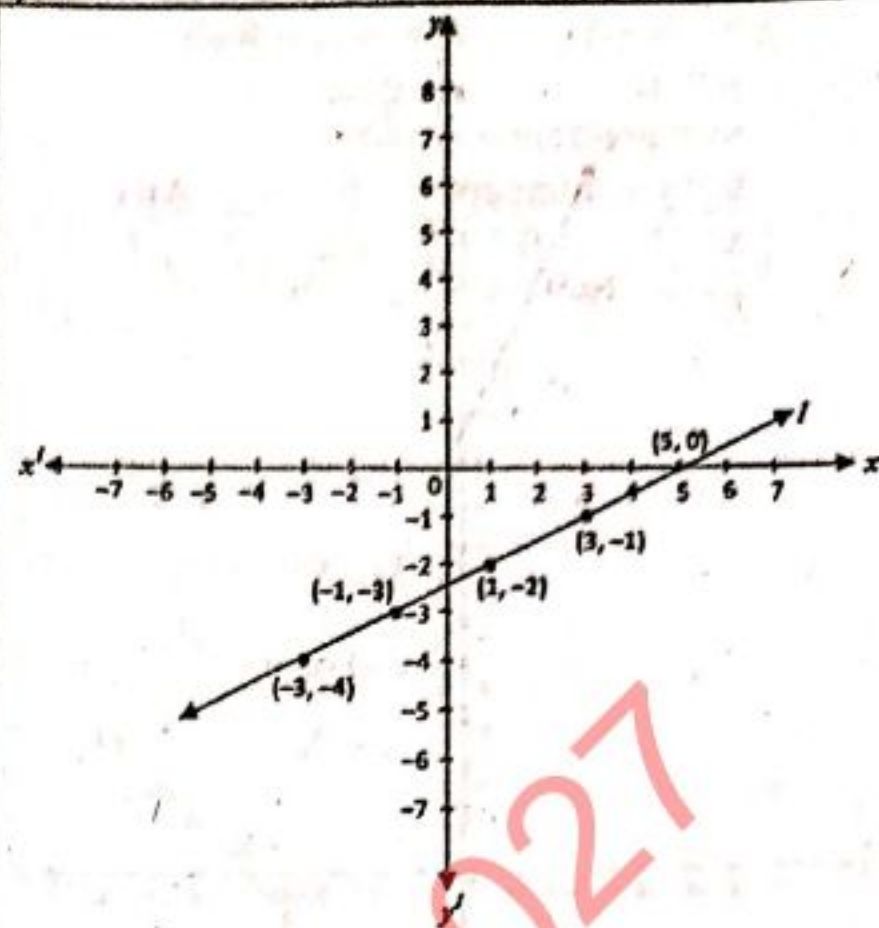
(d) $y = x + 2$
Sol:

x	0	1	-1	-2	2
$y = x + 2$	2	3	1	0	4



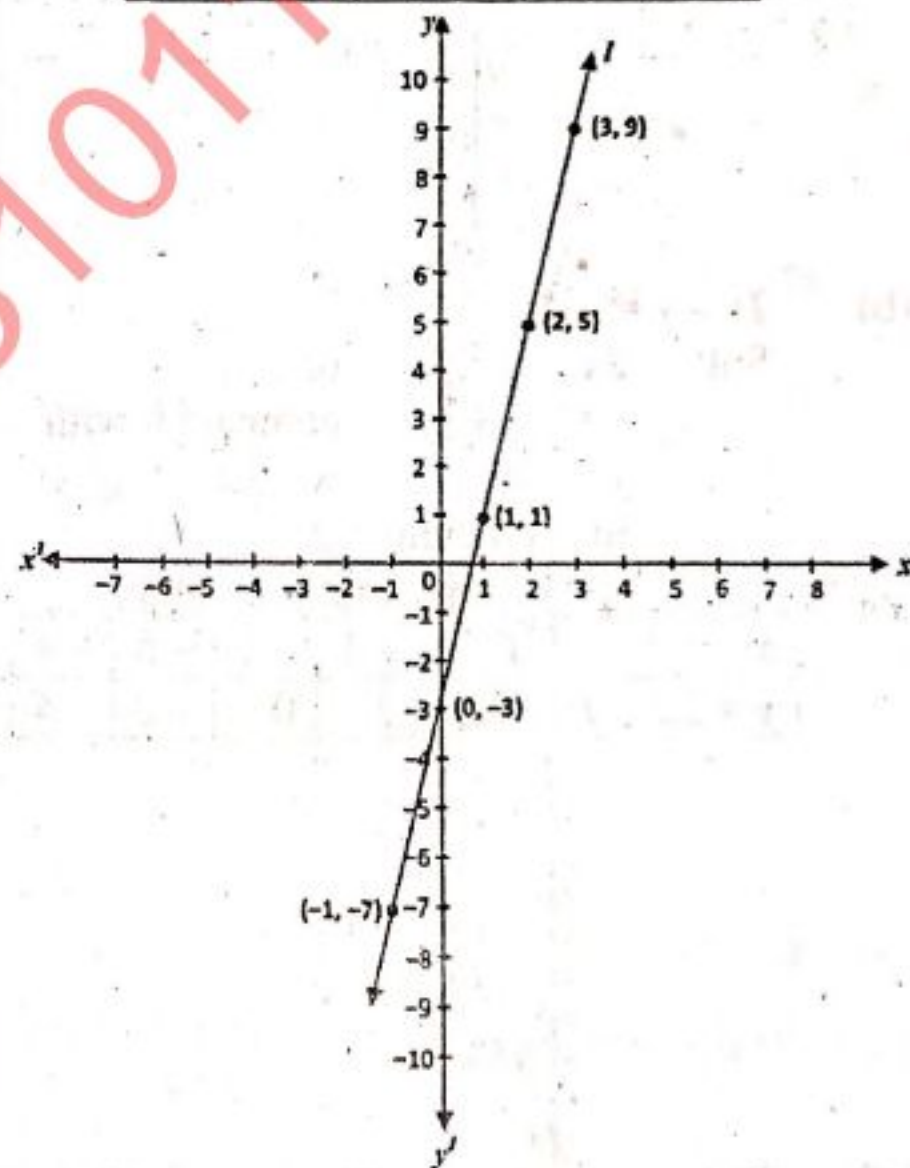
(e) $y = \frac{1}{2}x - \frac{5}{2}$
Sol:

x	1	3	5	-1	-3
$y = \frac{1}{2}x - \frac{5}{2}$	-2	-1	0	-3	-4



(f) $y = 4x - 3$
Sol:

x	0	1	2	-1	3
$y = 4x - 3$	-3	1	5	-7	9



Q.4 Identify the gradient and y - intercept for the following equations without plotting the graph. Then plot the graphs and verify the value of gradient and the y - intercept (if the equation is not in the slope intercept form, first write it in slope intercept form and then solve).

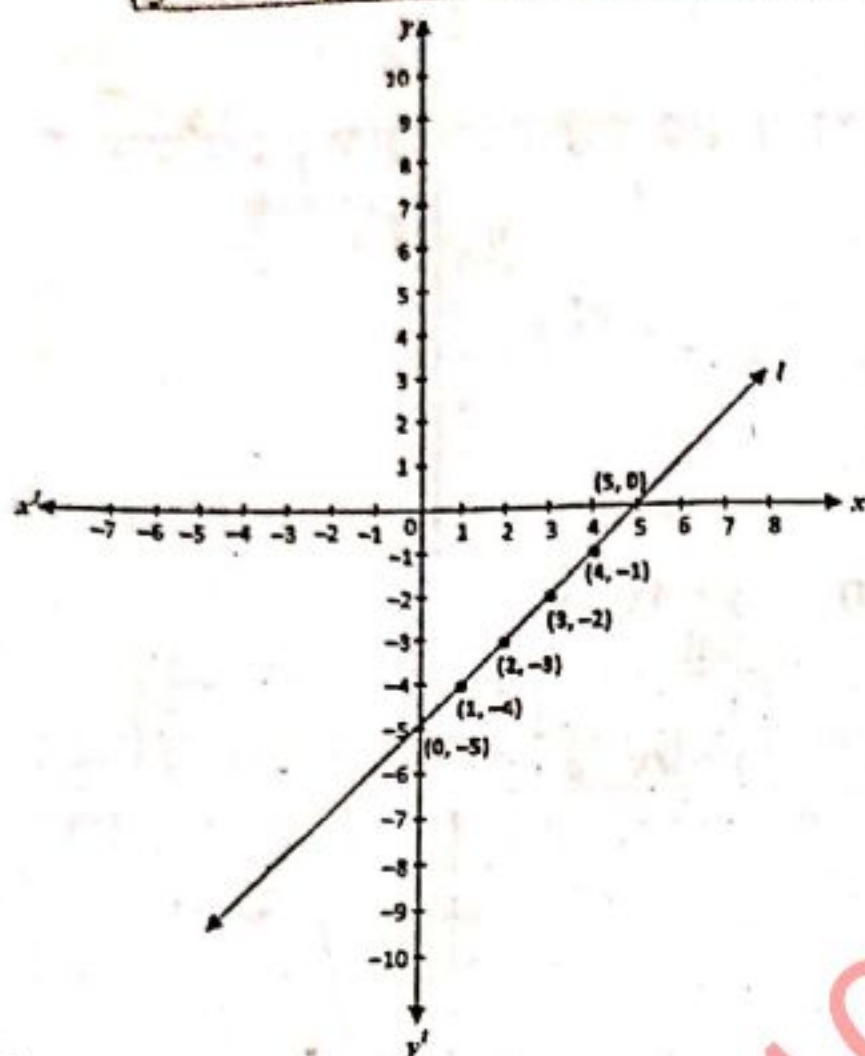
(a) $x - y = 5$

Sol: $x - 5 = y$ or

$y = x - 5$; compare it with
 $y = mx + c$; we get
 $m = \text{gradient} = 1$ and
 $c = y - \text{intercept} = -5$

Ans

x	0	1	2	3	4	5
$y = x - 5$	-5	-4	-3	-2	-1	0

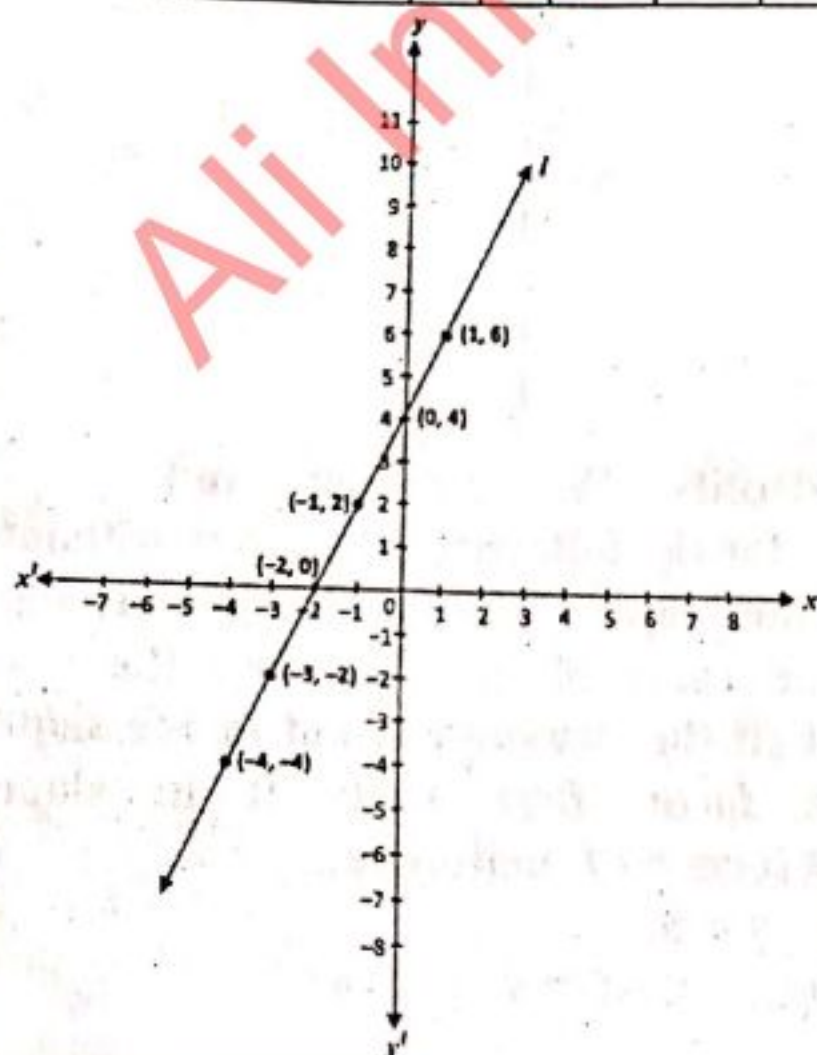


(b) $2x - y = -4$

Sol: $2x + 4 = y$ or
 $y = 2x + 4$; compare it with
 $y = mx + c$; we get
 $m = \text{gradient} = 2$
 $c = y - \text{intercept} = 4$

Ans

x	0	1	-1	-2	-3	-4
$y = 2x + 4$	4	6	2	0	-2	-4



(c) $-4x - y = -2$

Sol: $-4x + 2 = y$ or
 $y = -4x + 2$

Compare it with

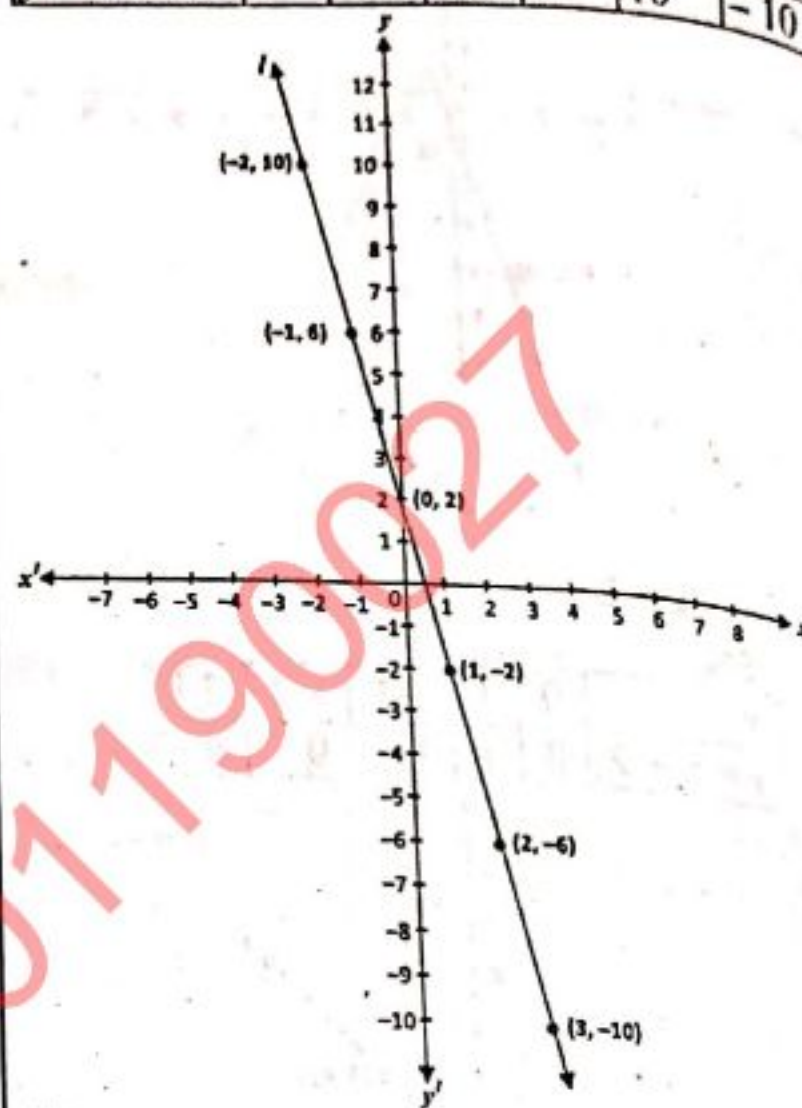
 $y = mx + c$;

We get

 $m = -4$ and $c = +2$

Ans

X	0	1	2	-1	-2	3
$y = -4x + 2$	2	-2	-6	6	10	-10

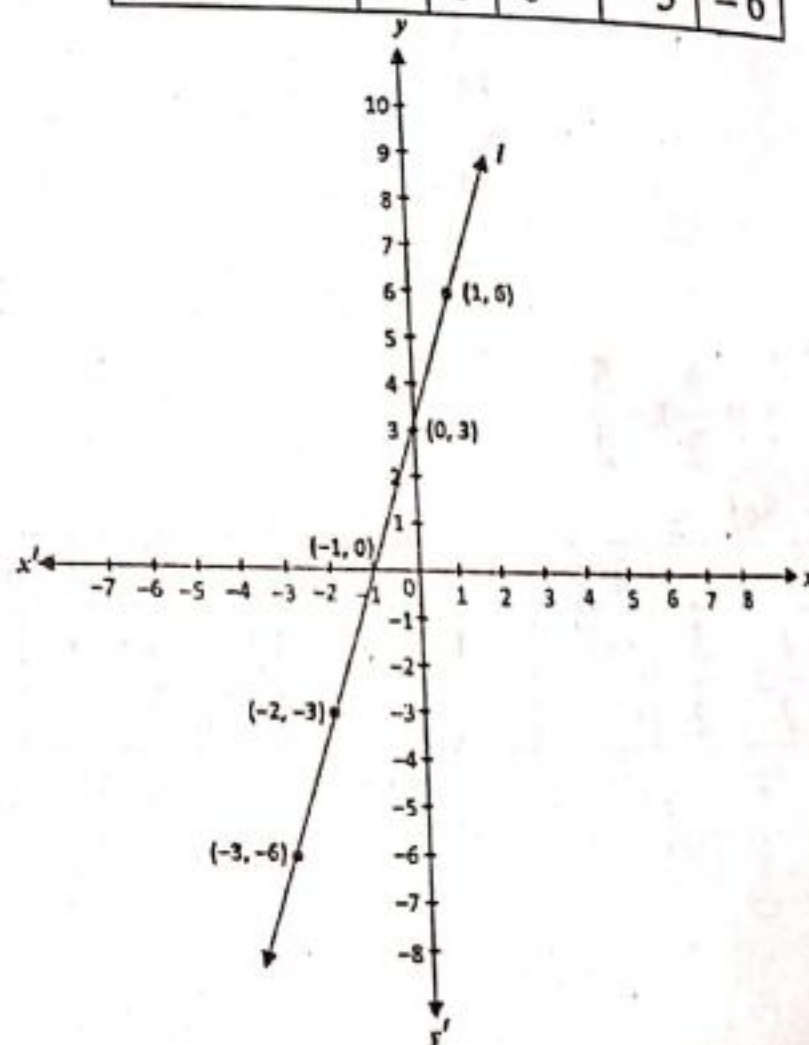


(d) $y = 3x + 3$

Sol: Compare it with
 $y = mx + c$; we get
 $m = 3$ and $c = 3$

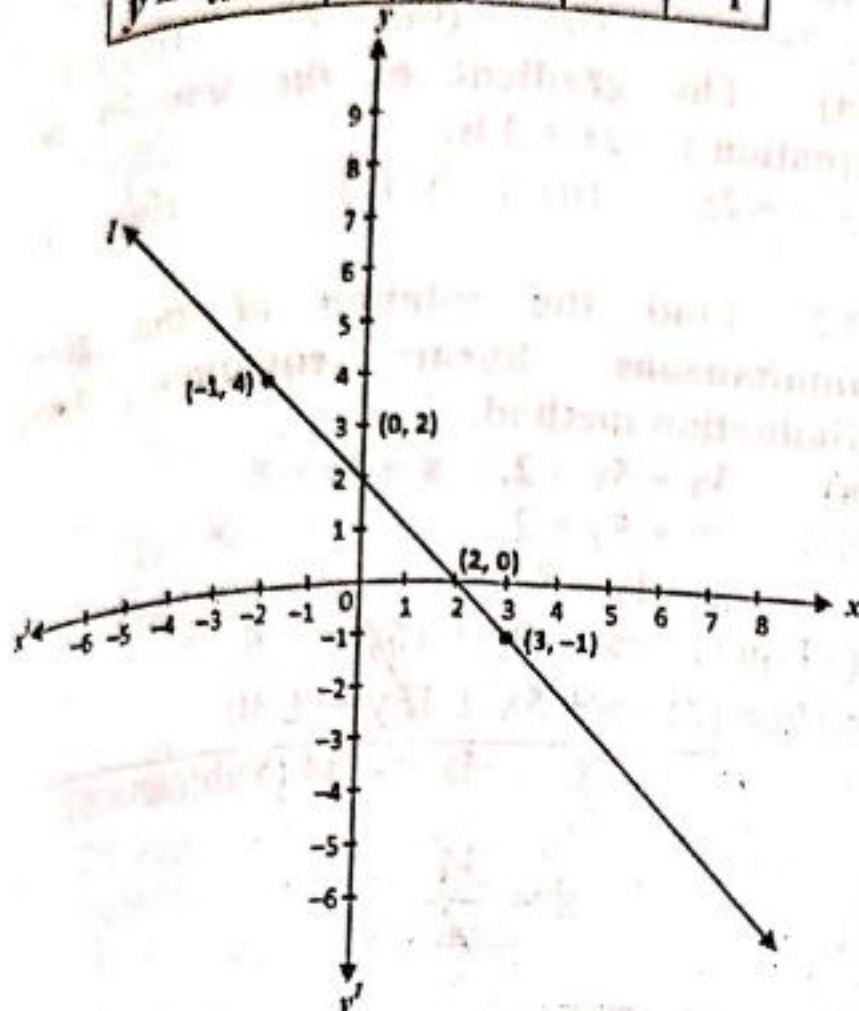
Ans

x	0	1	-1	-2	-3
$y = 3x + 3$	3	6	0	-3	-6



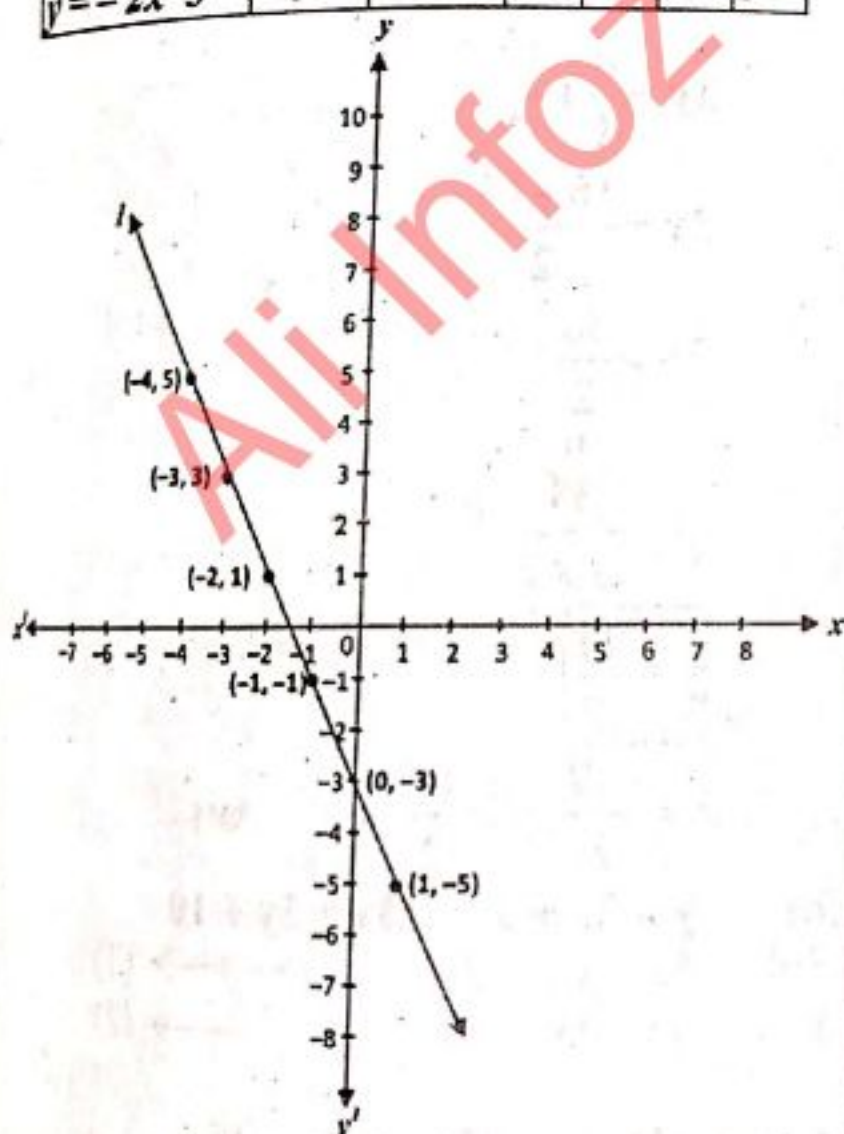
(e) $y + x = 2$
 Sol: $y = -x + 2$; Compare it with
 $y = mx + c$; we get
 $m = -1, c = 2$

	2	0	-1	-2	3
x	2	0	-1	-2	3
y = -x + 2	0	2	3	4	-1



(f) $y = -2x - 3$
 Sol: Compare it with
 $y = mx + c$; we get
 $m = -2, c = -3$

	0	1	-1	-2	-3	-4
x	0	1	-1	-2	-3	-4
y = -2x - 3	-3	-5	-1	1	3	5



Q.5 Find the slope intercept form of equation of the straight lines described below.

(a) gradient 2, y-intercept -1

Sol: Here $m = 2, c = -1$
 Slope intercept form is
 $y = mx + c$
 $y = 2x + (-1)$
 $y = 2x - 1$ **Ans**

(b) gradient -2, y-intercept 2

Sol: Here $m = -2, c = 2$
 Slope intercept form is
 $y = mx + c$
 $y = -2x + 2$ **Ans**

(c) gradient 2, y-intercept -1

Sol: Already done in Q5 (Part (a))

(d) gradient $-\frac{5}{2}$, y-intercept -2

Sol: Here $m = -\frac{5}{2}, c = -2$
 Slope intercept form is
 $y = mx + c$
 $y = -\frac{5}{2}x + (-2)$
 $y = -\frac{5}{2}x - 2$ **Ans**

(e) gradient $\frac{1}{2}$, passing through the origin

Sol: Here $m = \frac{1}{2}, c = 0$
 Slope intercept form is
 $y = mx + c$
 $y = \frac{1}{2}x + 0$
 $y = \frac{1}{2}x$ **Ans**

(f) gradient 3, passing through (0, 0)

Sol: Here $m = 3, c = 0$
 Slope intercept form is
 $y = mx + c$
 $y = 3x + 0$
 $y = 3x$ **Ans**

(g) gradient -3, y-intercept 1

Sol: Here $m = -3, c = 1$
 Slope intercept form is
 $y = mx + c$
 $y = -3x + 1$ **Ans**

Review Exercise (Tb Pg 204)

Q.1 Choose the correct option.

(a) The measure of steepness is known as:

- (i) Angle (ii) Gradient ✓
(iii) Run (iv) Rise

(b) The gradient is positive when:

- (i) The line moves downwards from left to right
(ii) The line moves downwards from right to left
(iii) The line moves upward from left to right ✓
(iv) The line moves upward from right to left

(c) If the horizontal change is 3 and the gradient is 2 then vertical change is

- (i) 2 (ii) 3 (iii) 5 ✓ (iv) 6

(d) If a straight line is crossing the y-axis at (0, -2), the y-intercept is

- (i) 0 (ii) 2 (iii) -2 ✓ (iv) -1

(e) To find x-intercept of a line, we put:

- (i) $x = 1$ (ii) $y = 0$ ✓
(iii) $x = 0$ (iv) $y = 1$

(f) In $ax + by + c = 0$, the line will be a horizontal line if:

- (i) $a = 0$ ✓ (ii) $b = 0$
(iii) $a = 1$ (iv) $b = 1$

(g) Which of these line passes through the origin?

- (i) $y = 2x + 6$ (ii) $y = 3x$ ✓ (iii) $y = 3x - 4$
(iv) $y = 4x - 1$

(h) The equation of horizontal line is:

- (i) $y = c$ ✓ (ii) $x = c$
(iii) $x = y$ (iv) $y = mx$

(i) The equation of a straight line is:

- (i) $x = y^2$ (ii) $y = mx + c$ ✓
(iii) $y^2 = \frac{x}{2} + c$ (iv) $x^2 = cy$

(j) The gradient of the given line is:

- (i) 2 (ii) $\frac{1}{2}$
(iii) $\frac{1}{3}$ (iv) -6

Note: It is an incomplete statement.

(k) "A number is $\frac{5}{4}$ of another number"

is shown by:

- (i) $y = \frac{5}{4} + x$ (ii) $y = \frac{5}{4} - x$
(iii) $y = \frac{5}{4}x$ ✓ (iv) $y = \frac{5}{4} \div x$

(l) The solution of the equations $3x + 2y = 1$ and $x + y = 2$ is:

- (i) $x = 5, y = -3$ (ii) $x = -3, y = 5$ ✓
(iii) $x = -3, y = -5$ (iv) $x = 3, y = 3$

(m) y-intercept in the equation $y = 3x + 7$ is:

- (i) 7 ✓ (ii) 3 (iii) -7 (iv) -3

(n) The gradient of the line in the equation $y = 2x + 3$ is:

- (i) $y = 2x$ (ii) 1 (iii) 3 (iv) 2 ✓

Q.2 Find the solution of the simultaneous linear equation given using elimination method.

(a) $3x + 5y = 2$, $x + 3y = 8$

$$\text{Sol: } \begin{array}{rcl} 3x + 5y = 2 & \longrightarrow & (1) \\ x + 3y = 8 & \longrightarrow & (2) \end{array}$$

$$3 \times \text{Eqn (1)} \Rightarrow 9x + 15y = 6$$

$$5 \times \text{Eqn (2)} \Rightarrow 5x + 15y = 40$$

$$4x = -34 \text{ (Subtraction)}$$

$$x = \frac{-34}{4} = \frac{-17}{2}$$

Put $x = \frac{-17}{2}$ in Eqn (2)

$$\frac{-17}{2} + 3y = 8$$

$$3y = 8 + \frac{17}{2}$$

$$3y = \frac{16+17}{2}$$

$$3y = \frac{33}{2}$$

$$y = \frac{33}{2 \times 3} = \frac{11}{2}$$

$$y = \frac{11}{2}$$

$$\therefore x = \frac{-17}{2}, y = \frac{11}{2} \quad \text{Ans}$$

(b) $y = 5x + 3$, $3x = 5y + 10$

$$\text{Sol: } \begin{array}{rcl} 5x - y = -3 & \longrightarrow & (1) \\ 3x - 5y = 10 & \longrightarrow & (2) \end{array}$$

$$5 \times \text{Eqn (1)} \Rightarrow 25x - 5y = -15$$

$$1 \times \text{Eqn (2)} \Rightarrow 3x - 5y = 10$$

$22x = -25$ (Subtraction)

$$x = \frac{-25}{22}$$

Put $x = \frac{-25}{22}$ in Eqn (1)

$$5\left(\frac{-25}{22}\right) - y = -3$$

$$\frac{125}{22} - y = -3$$

$$\frac{-125}{22} + \frac{3}{1} = y$$

$$\frac{-125 + 66}{22} = y$$

$$y = \frac{-59}{22}$$

$$\therefore x = \frac{-25}{22}, y = \frac{-59}{22} \quad \text{Ans}$$

$$\begin{aligned} \text{(c)} \quad & 9 + 2x = 6y, \quad 7x + 2y = 12 \\ \text{Sol:} \quad & 2x - 6y = -9 \quad \longrightarrow (1) \\ & 7x + 2y = 12 \quad \longrightarrow (2) \end{aligned}$$

$$2 \times \text{Eqn (1)} \Rightarrow 4x - 12y = -18$$

$$6 \times \text{Eqn (2)} \Rightarrow 42x + 12y = 72$$

$$46x = 54 \text{ (Addition)}$$

$$x = \frac{54}{46} = \frac{27}{23}$$

$$x = \frac{27}{23}$$

Put $x = \frac{27}{23}$ in Eqn (2)

$$7\left(\frac{27}{23}\right) + 2y = 12$$

$$\frac{189}{23} + 2y = 12$$

$$2y = \frac{12}{1} - \frac{189}{23}$$

$$2y = \frac{276 - 189}{23}$$

$$2y = \frac{87}{23}$$

$$y = \frac{87}{2 \times 23}$$

$$y = \frac{87}{46}$$

$$\therefore x = \frac{27}{23}, y = \frac{87}{46} \quad \text{Ans}$$

$$\text{(d)} \quad 4x + 5y = 3, \quad 4y + 5x = 6$$

$$\text{Sol:} \quad 4x + 5y = 3 \quad \longrightarrow (1)$$

$$5x + 4y = 6 \quad \longrightarrow (2)$$

$$5 \times \text{Eqn (2)} \Rightarrow 25x + 20y = 30$$

$$4 \times \text{Eqn (1)} \Rightarrow 16x + 20y = 12$$

$$9x = 18 \text{ (Subtraction)}$$

$$x = \frac{18}{9} = 2$$

$$x = 2$$

Put $x = 2$ in Eqn (1)

$$4(2) + 5y = 3$$

$$8 + 5y = 3$$

$$5y = 3 - 8$$

$$5y = -5$$

$$y = \frac{-5}{5} = -1$$

$$y = -1$$

$$\therefore x = 2, y = -1 \quad \text{Ans}$$

Q.3 Find the solution of the given simultaneous linear equation using substitution method.

$$\text{(a)} \quad 2y - 3x = -9, \quad 7 - 3x = 8y$$

$$\text{Sol:} \quad -3x + 2y = -9 \quad \longrightarrow (1)$$

$$3x + 8y = 7 \quad \longrightarrow (2)$$

From Eqn (1)

$$2y = 3x - 9$$

$$y = \frac{3x - 9}{2} \quad \longrightarrow (3)$$

Put this value of "y" in (2)

$$3x + 8\left(\frac{3x - 9}{2}\right) = 7$$

$$3x + 4(3x - 9) = 7$$

$$3x + 12x - 36 = 7$$

$$3x + 12x = 7 + 36$$

$$15x = 43$$

$$x = \frac{43}{15}$$

Put $x = \frac{43}{15}$ in Eqn (3)

$$y = \frac{1}{2}\left(\frac{43}{15} - 9\right)$$

$$y = \frac{43 - 135}{30} = \frac{-92}{30} = \frac{-46}{15}$$

$$y = \frac{1}{2} \left(\frac{43}{5} - \frac{9}{1} \right)$$

$$y = \frac{1}{2} \left(\frac{43-45}{5} \right)$$

$$y = \frac{1}{2} \left(\frac{-2}{5} \right)$$

$$y = \frac{-1}{5}$$

$$\therefore x = \frac{43}{15}, y = \frac{-1}{5} \text{ Ans}$$

$$(b) \quad 5x + y = -7, \quad 3x - \frac{1}{2}y = 5$$

$$\text{Sol: } 5x + y = -7 \quad \longrightarrow (1)$$

$$3x - \frac{1}{2}y = 5 \quad \longrightarrow (2)$$

From Eqn (2)

$$3x - 5 = \frac{1}{2}y$$

$$2(3x - 5) = y$$

$$y = 6x - 10 \quad \longrightarrow (3)$$

Put this value of "y" in Eqn (1)

$$5x + 6x - 10 = -7$$

$$5x + 6x = -7 + 10$$

$$11x = 3$$

$$\boxed{x = \frac{3}{11}}$$

Put $x = \frac{3}{11}$ in Eqn (3)

$$y = 6 \left(\frac{3}{11} \right) - 10$$

$$y = \frac{18}{11} - \frac{10}{1}$$

$$y = \frac{18-110}{11}$$

$$\boxed{y = \frac{-92}{11}}$$

$$\therefore x = \frac{3}{11}, y = \frac{-92}{11} \text{ Ans}$$

$$(c) \quad y - \frac{1}{2}x = 3, \quad 2x + 5y = 1$$

$$\text{Sol: } y - \frac{1}{2}x = 3 \quad (1)$$

$$2x + 5y = 1 \quad (2)$$

From Eqn (1)

$$y - \frac{1}{2}x = 3$$

$$y = \frac{1}{2}x + 3 \quad \longrightarrow (3)$$

Put this value of "y" in Eqn (2)

$$2x + 5 \left(\frac{1}{2}x + 3 \right) = 1$$

$$2x + \frac{5}{2}x + 15 = 1$$

$$\frac{2x}{1} + \frac{5}{2}x = 1 - 15$$

$$\frac{4x + 5x}{2} = -14$$

$$9x = -14 \times 2$$

$$9x = -28$$

$$\boxed{x = \frac{-28}{9}}$$

Put $x = \frac{-28}{9}$ in Eqn (3)

$$y = \frac{1}{2}x + 3$$

$$y = \frac{1}{2} \left(\frac{-28}{9} \right) + 3$$

$$y = \frac{-14}{9} + \frac{3}{1}$$

$$y = \frac{-14 + 27}{9}$$

$$\boxed{y = \frac{13}{9}}$$

$$\therefore x = \frac{-28}{9}, y = \frac{13}{9} \text{ Ans Book}$$

answer is wrong

$$(d) \quad x - y = 4, \quad x + y = 2$$

$$\text{Sol: } x - y = 4 \quad \longrightarrow (1)$$

$$x + y = 2 \quad \longrightarrow (2)$$

From Eqn (1)

$$x = 4 + y$$

$$y = x - 4 \quad \longrightarrow (3)$$

Put this value of "y" in Eqn (2)

$$x + x - 4 = 2$$

$$x + x = 2 + 4$$

$$2x = 6$$

$$x = \frac{6}{2}$$

$$\boxed{x = 3}$$

Put $x = 3$ in Eqn (3)

$$y = x - 4$$

$$y = 3 - 4$$

$$y = -1$$

$$x = 3, y = -1 \text{ Ans}$$

Q.4 Find the solution of the given simultaneous linear equation using graphical method

(a) $3x - y = 5, \quad x + 7y = 14$

Sol: $3x - y = 5$
 $3x - 5 = y$

X	0	2	1	3	4
$y = 3x - 5$	-5	1	-2	4	7

Now, similarly

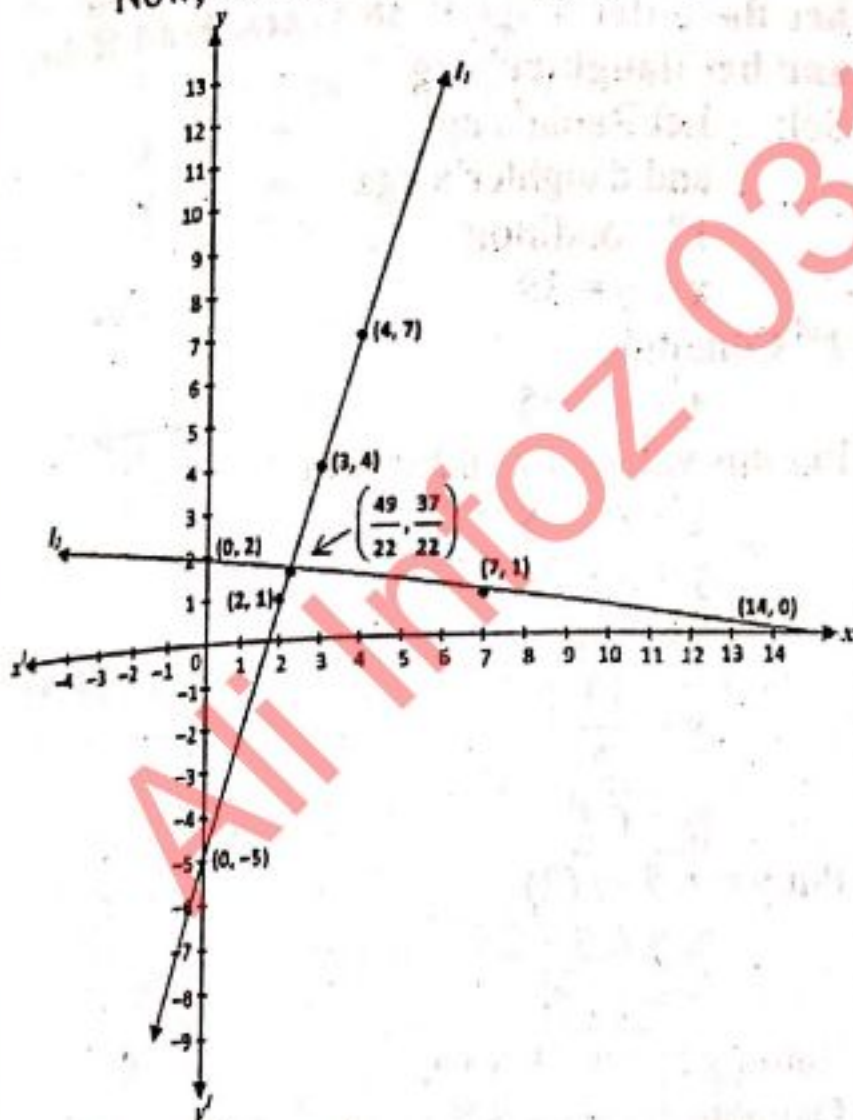
$$x + 7y = 14$$

$$7y = 14 - x$$

$$y = \frac{14 - x}{7}$$

x	0	7	14	-7
$y = \frac{14 - x}{7}$	2	1	0	3

Now, we will draw the graph



From the graph

$$x = \frac{49}{22}, y = \frac{37}{22}$$

Ans

(b) $x + 4y = 9, \quad 7x + 7y = 14$

Sol: $x + 4y = 9$

$$4y = 9 - x$$

$$y = \frac{9 - x}{4}$$

x	1	5	-3	9
$y = \frac{9 - x}{4}$	2	1	3	0

Similarly

$$7x + 7y = 14$$

$$7y = 14 - 7x$$

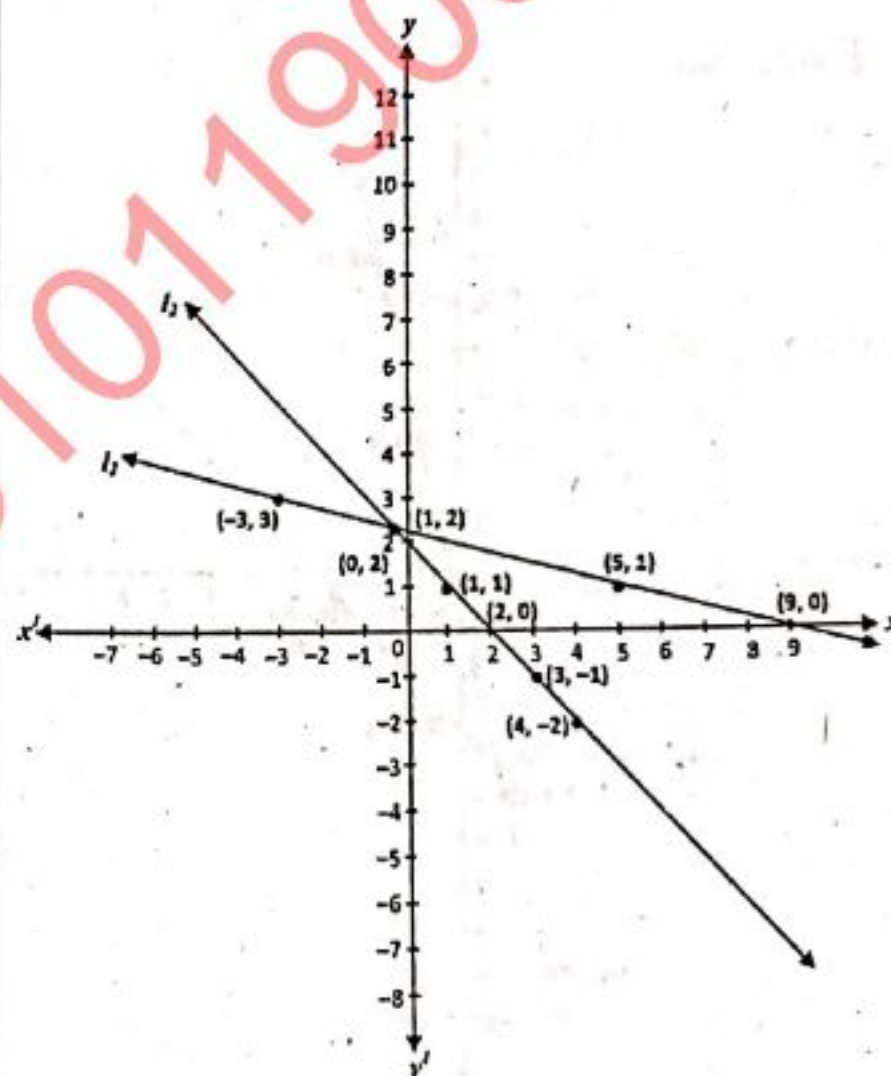
$$y = \frac{14 - 7x}{7}$$

$$y = \frac{2 - x}{1}$$

$$y = 2 - x$$

x	0	1	2	3	4
$y = 2 - x$	2	1	0	-1	-2

Now, we will draw the graph



From the graph

$$x = -\frac{1}{3}, y = \frac{7}{3}$$

(c) $2x - \frac{1}{2}y = \frac{1}{2}, \quad \frac{3x}{2} - \frac{5}{3}y = 6$

Sol: $\frac{2x}{1} - \frac{1}{2}y = \frac{1}{2}$

$$\frac{4x - y}{2} = \frac{1}{2}$$

$$4x - y = 1$$

$$4x - 1 = y$$

X	0	1	2	-1	-2
$y = 4x - 1$	-1	3	7	-5	-9

Similarly

$$\frac{3x}{2} - \frac{5}{3}y = 6$$

$$\frac{9x - 10y}{6} = 6$$

$$9x - 10y = 36$$

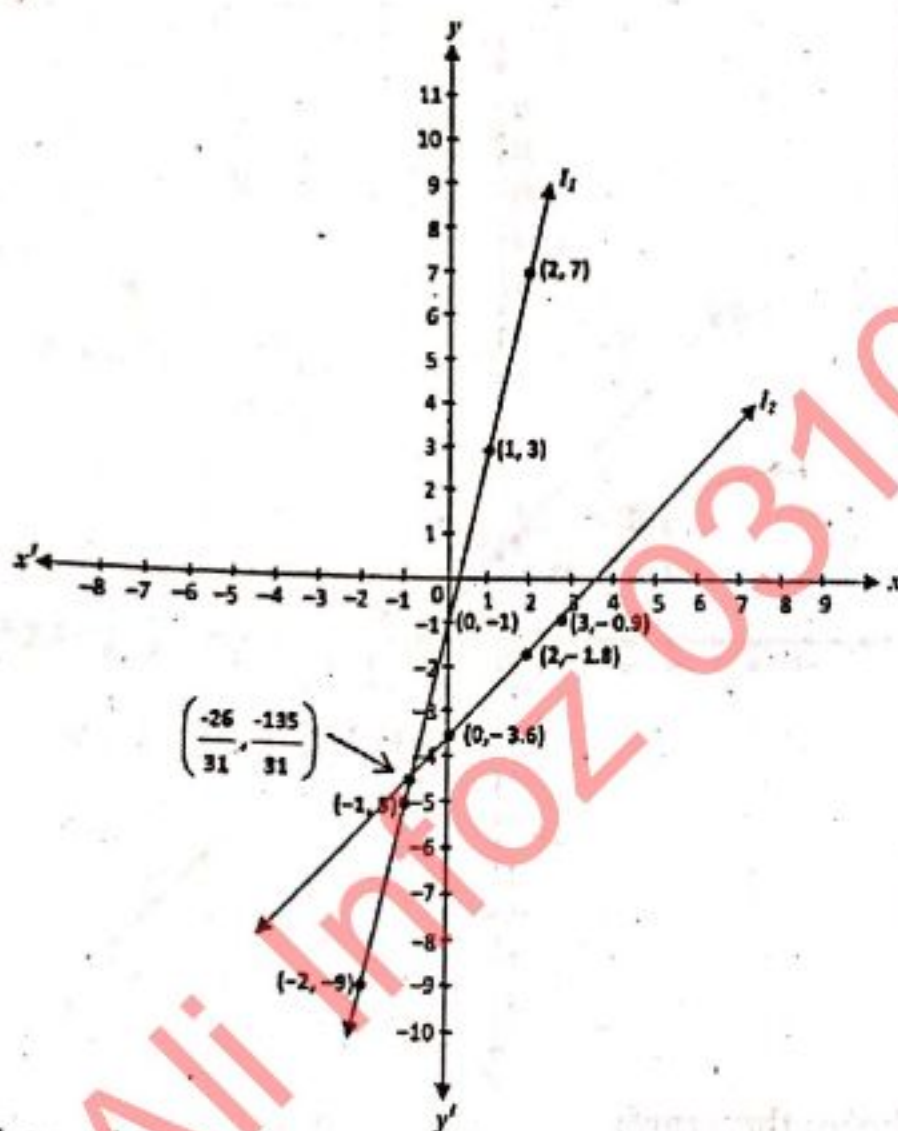
$$9x = 36 + 10y$$

$$9x - 36 = 10y$$

$$y = \frac{9x - 36}{10}$$

X	-1	0	2	3
$y = \frac{9x - 36}{10}$	-4.5	-3.6	-1.8	-0.9

Now, we will draw the graph



From the graph,

$$x = \frac{-26}{31}, y = \frac{-135}{31} \quad \text{Ans}$$

Q.5 The sum of weights of Hina and Ariba is 86kg. If difference between the weights of Hina and Ariba age is 22. What is weight of Hina and Ariba?

Sol: Let Hina's weight = x
and Ariba weight = y

1st Condition

$$x + y = 68 \quad \longrightarrow (1)$$

2nd Condition

$$x - y = 22 \quad \longrightarrow (2)$$

Adding (1) and (2)

$$x + y = 68$$

$$x - y = 22$$

$$2x = 90$$

(Subtraction)

$$x = \frac{90}{2}$$

$$x = 45$$

Put $x = 45$ in Eqn (1)

$$45 + y = 68$$

$$y = 68 - 45$$

$$y = 23$$

Hina's weight = 45kg

Ariba's weight = 23kg

Ans

Q.6 The cost of 2kg of potatoes and $\frac{1}{2}$ kg of tomatoes is Rs 70. If the potatoes cost is 1.2 times more than tomatoes. What is the cost of potatoes and tomatoes?

Sol: The statement of the given question is wrong.

Q.7 Rabia's age is 25 years more than her daughter's age. The sum of Rabia's age and her daughter's age is 38 years. Find Rabia's and her daughter's age?

Sol: Let Rabia's age = x
and daughter's age = y

1st Condition

$$x + y = 38$$

2nd Condition

$$x = y + 25$$

Put this value of x in Eqn (1)

$$y + 25 + y = 38$$

$$y + y = 38 - 25$$

$$2y = 13$$

$$y = \frac{13}{2}$$

$$y = 6.5$$

Put $y = 6.5$ in (2)

$$x = 6.5 + 25$$

$$x = 31.5$$

Rabia's age = 31.5 years

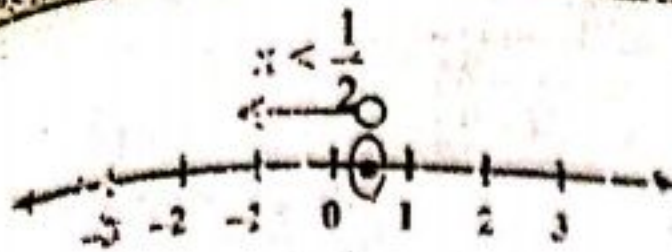
Daughter's age = 6.5 years Ans

Q.8 Solve the given inequalities and show on number line

(a) $5x > 2$

Sol: $x > \frac{2}{5}$

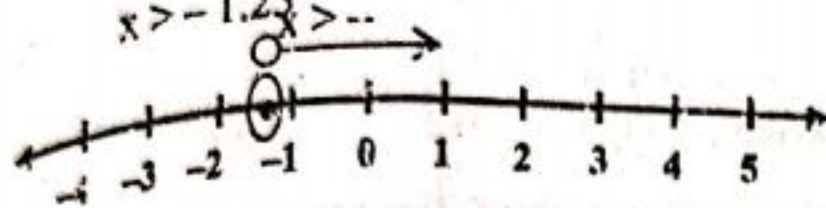
$$x > 0.4$$



(b) $-4x < 5$
 Sol: Multiplying both sides by " -1 "
 $4x > -5$

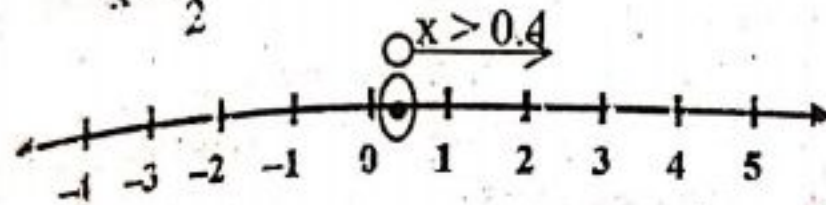
$x > \frac{-5}{4}$

$x > -1.25$



(c) $2x + 5 < 6$
 Sol: $2x < 6 - 5$
 $2x < 1$

$x < \frac{1}{2}$



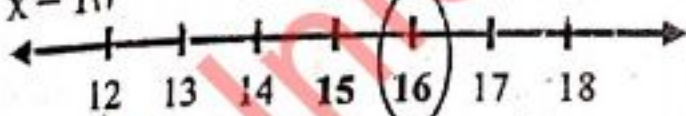
(d) $\frac{1}{2}x + 7 = 15$

Sol: $\frac{1}{2}x = 15 - 7$

$\frac{1}{2}x = 8$

$1x = 8 \times 2$

$x = 16$



Q.9 Find the value of x is $y = 3x - 5$, if $y = 2$

Sol: Required $x = ?$

$y = 3x - 5$

Put $y = 2$

$2 = 3x - 5$

$2 + 5 = 3x$

$7 = 3x$

or

$3x = 7$

$x = \frac{7}{3}$

Ans

Q.10 Find the value of y is $y = -2x + 6$, if $x = -1$

Sol: Required $y = ?$

$y = -2x + 6$ Put $x = -1$

$y = -2(-1) + 6$

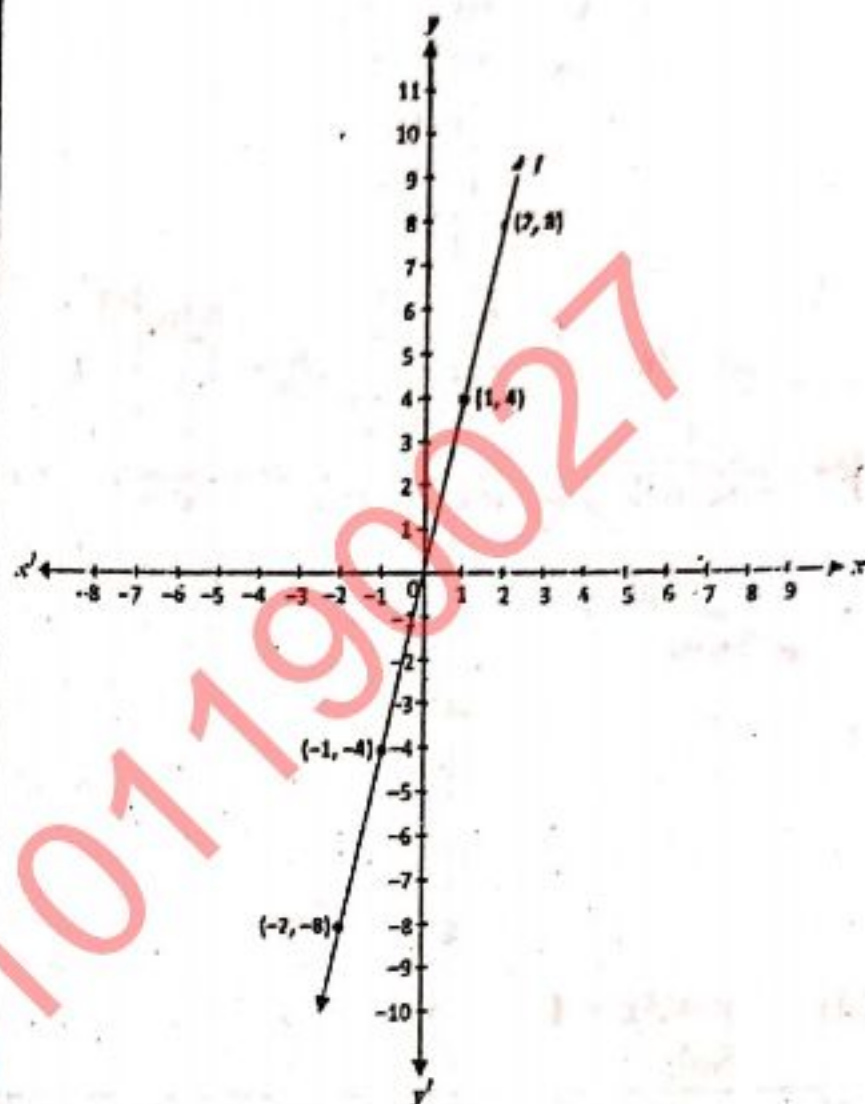
$y = 2 + 6$ $y = 8$ Ans

Q.11 Draw the graph for the following linear equations in two variables.

(a) $y = 4x$

Sol:

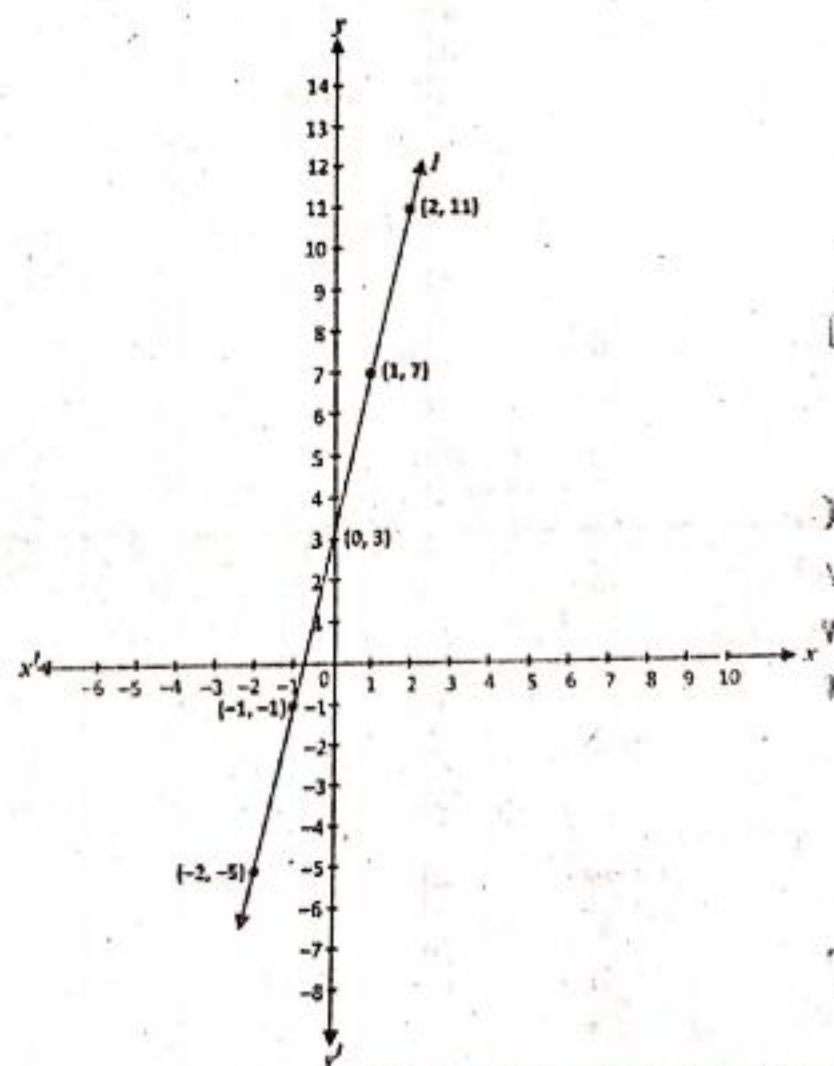
x	0	1	-1	2	-2
$y = 4x$	0	4	-4	8	-8



(b) $y = 4x + 3$

Sol:

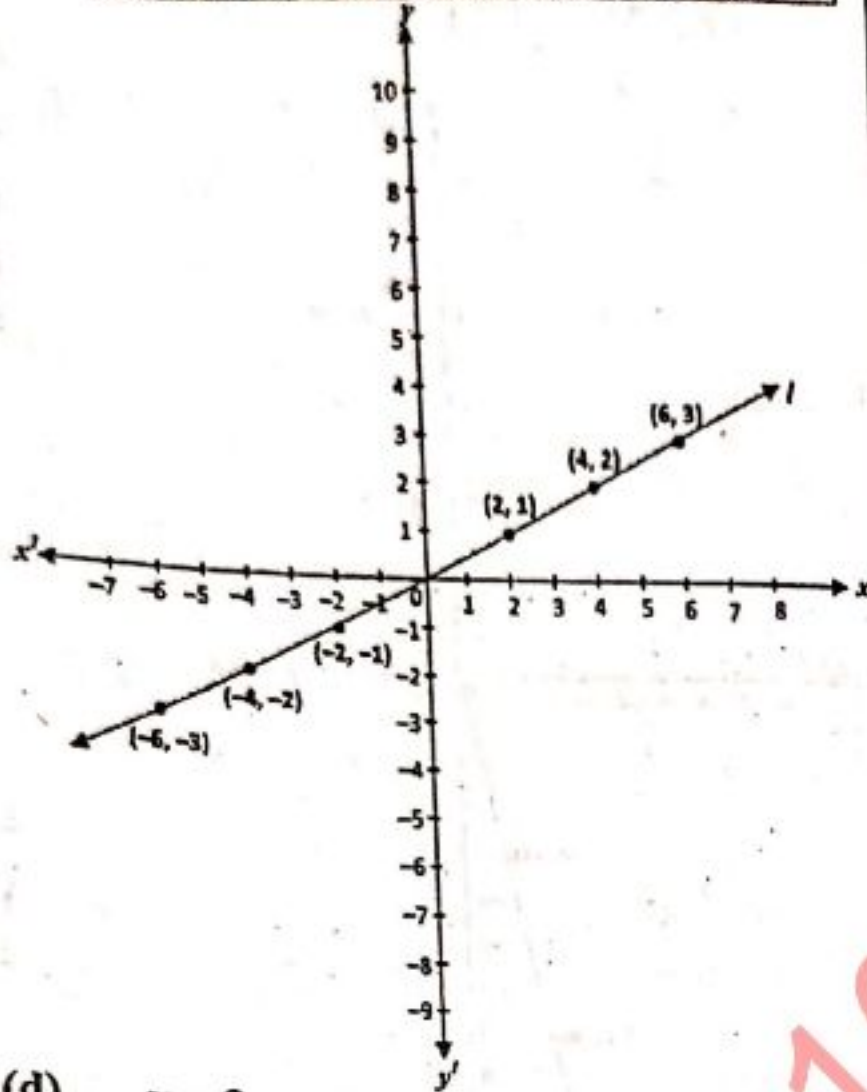
x	0	1	-1	-2	2
$y = 4x + 3$	3	7	-1	-5	11



(c) $y = \frac{1}{2}x$

Sol:

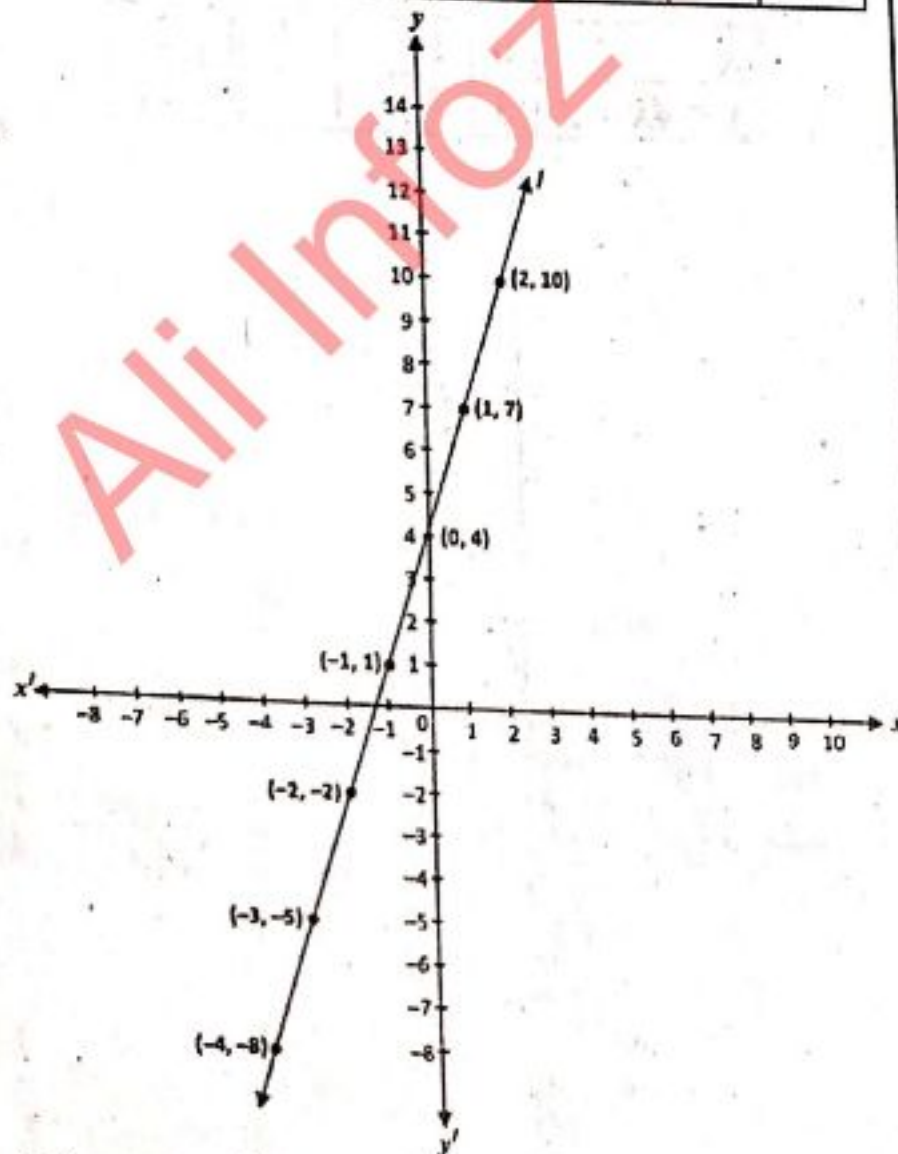
x	0	2	4	-2	-4	6	-6
$y = \frac{1}{2}x$	0	1	2	-1	-2	3	-3



(d) $y = 3x + 4$

Sol:

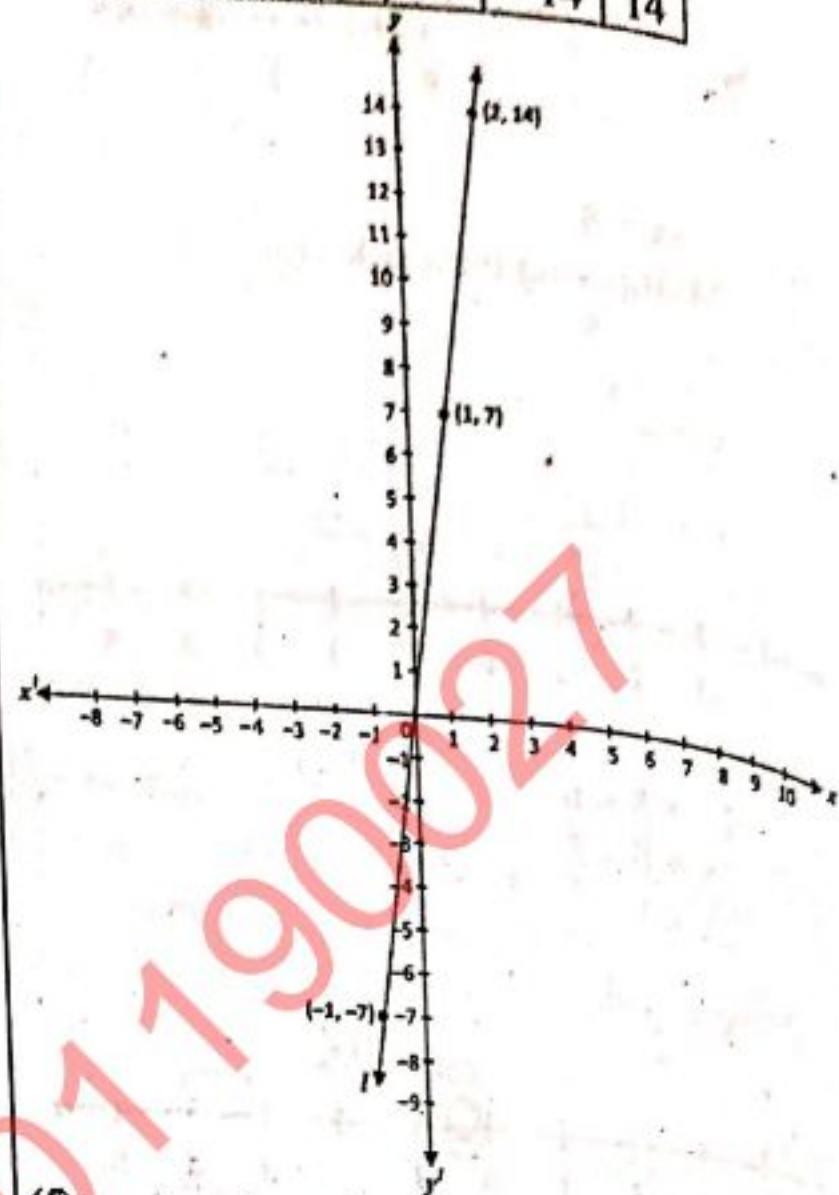
X	0	1	2	-1	-2	-3	-4
$y = 3x + 4$	4	7	10	1	-2	-5	-8



(e) $y = 7x$

Sol:

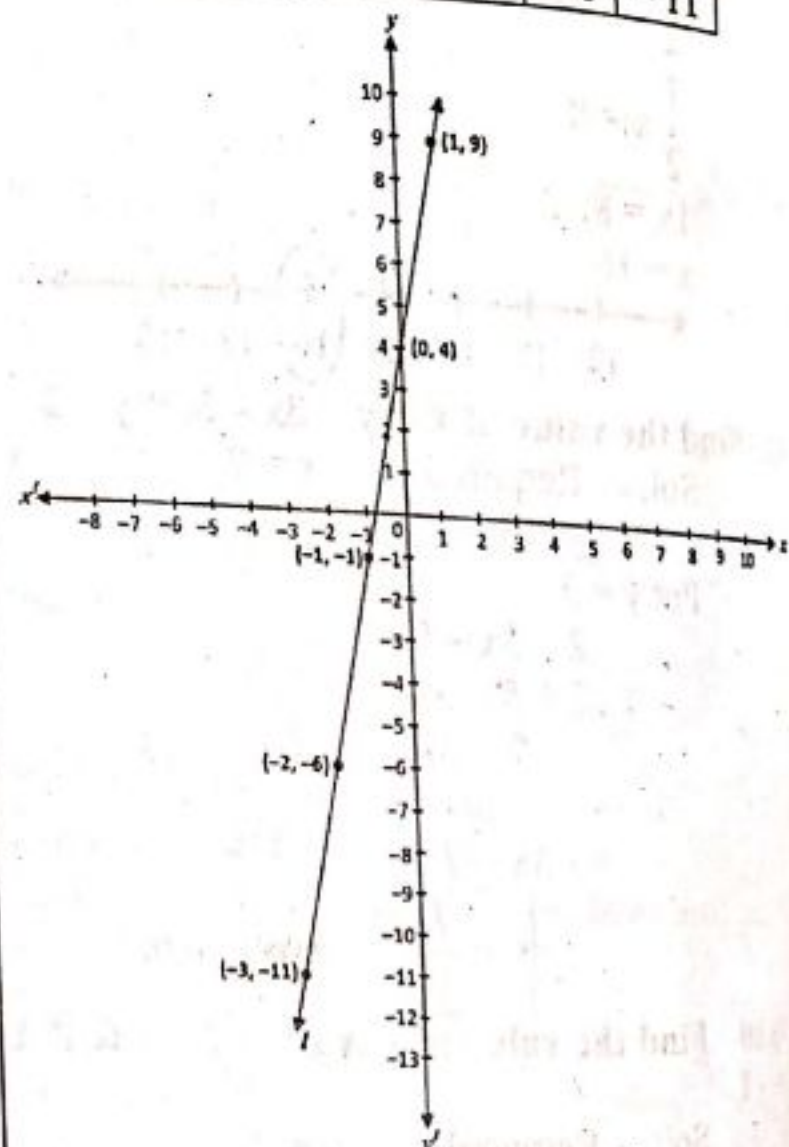
x	0	1	-1	-2	2
$y = 7x$	0	7	-7	-14	14



(f) $y = 5x + 4$

Sol:

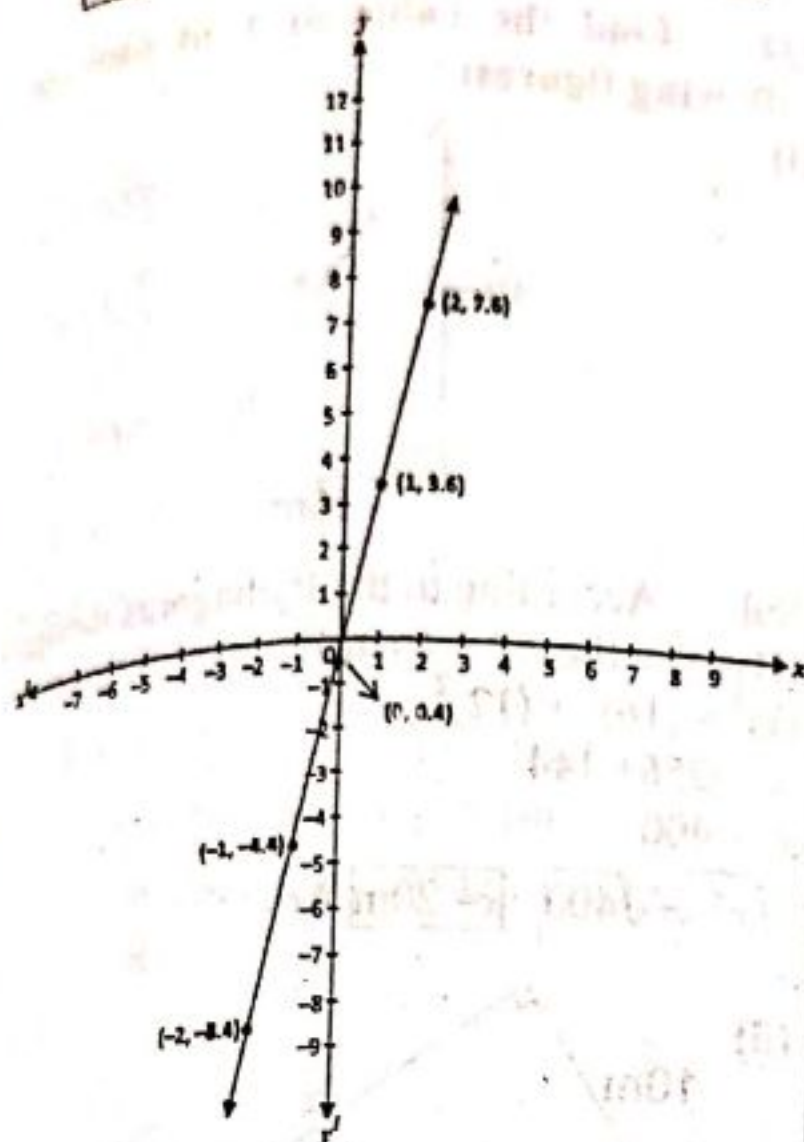
x	0	1	-1	-2	-3
$y = 5x + 4$	4	9	-1	-6	-11



(g) $y = 4x - \frac{2}{5}$

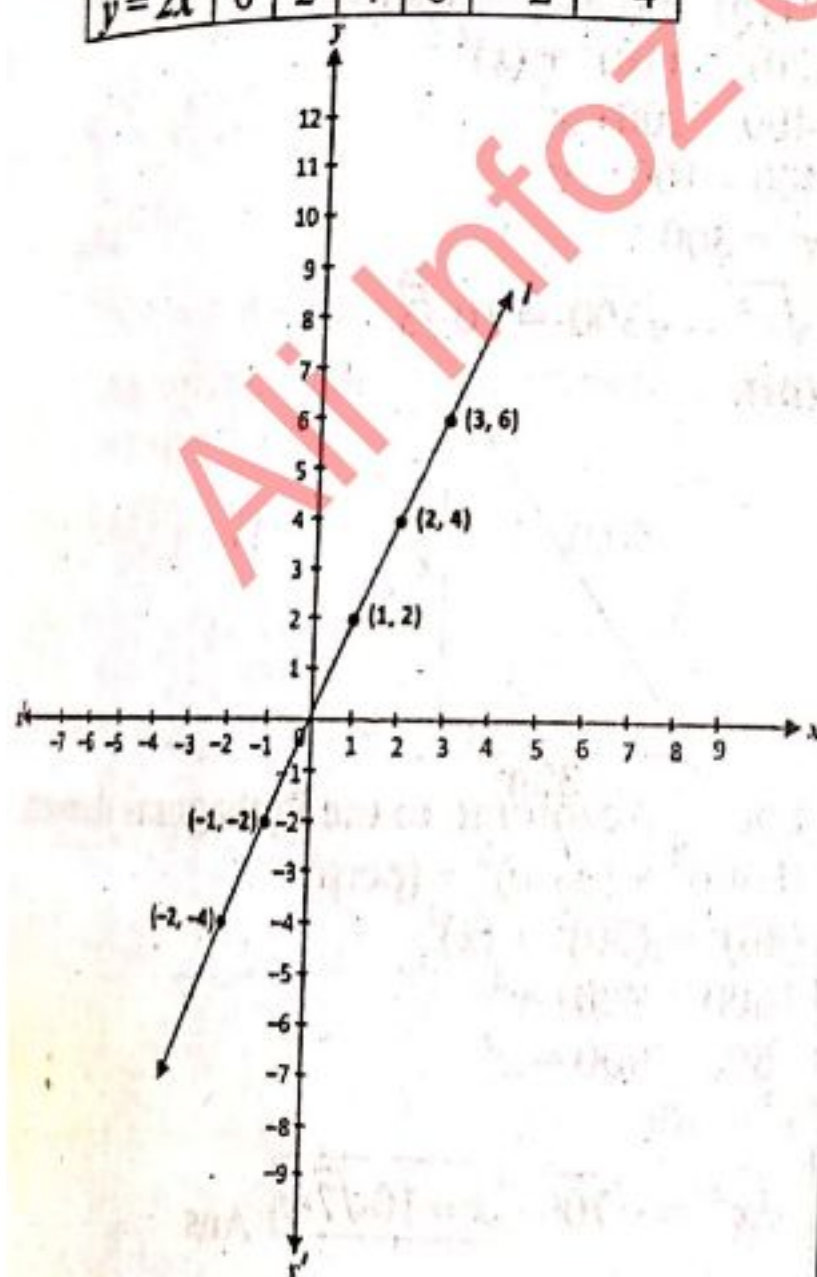
Sol:

x	0	1	2	-1	-2
y = 4x - 2	-2	2	6	-6	-10

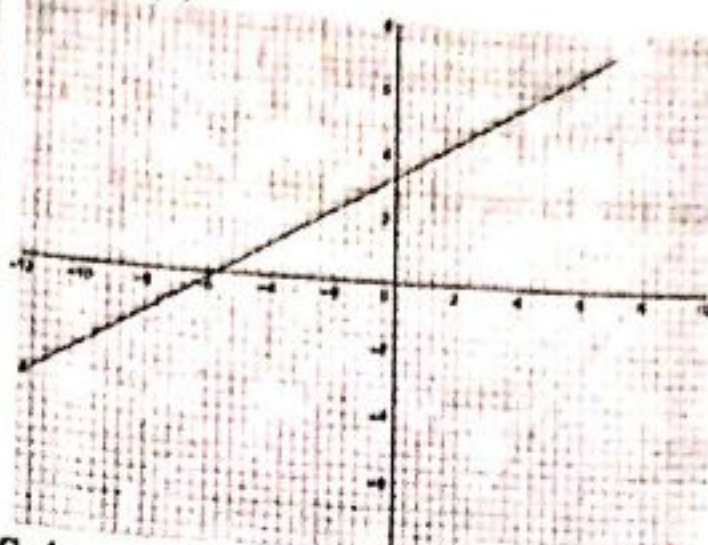


(b) $y = 2x$
Sol:

x	0	1	2	3	-1	-2
y = 2x	0	2	4	6	-2	-4



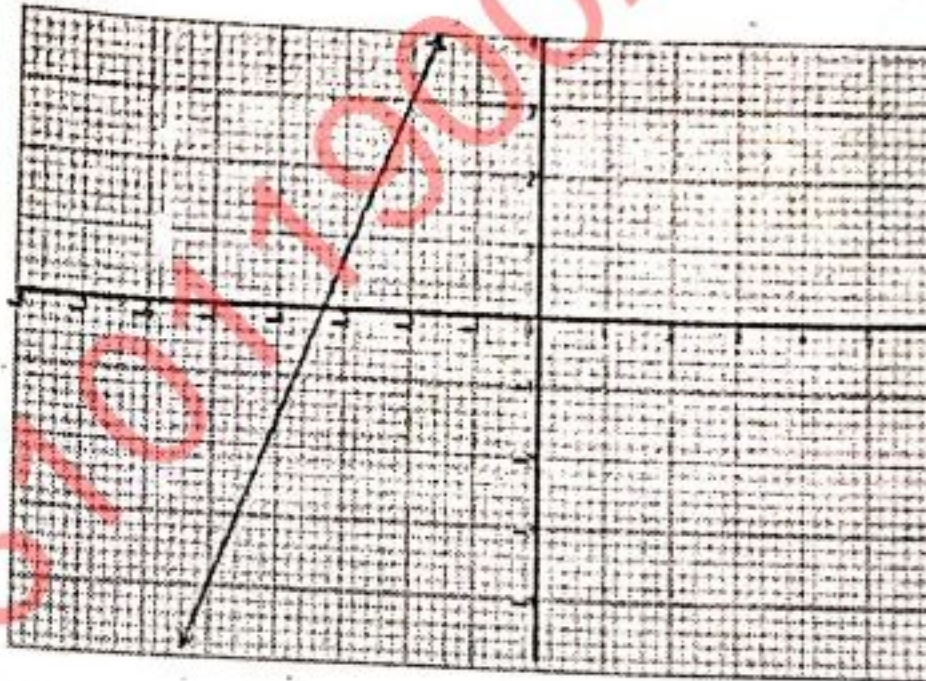
Q.12 Find and interpret the gradient of these lines. Also find the y-intercept.
(a)



Sol: $c = 3$
 $m = \frac{1}{2}$

Ans

(b)

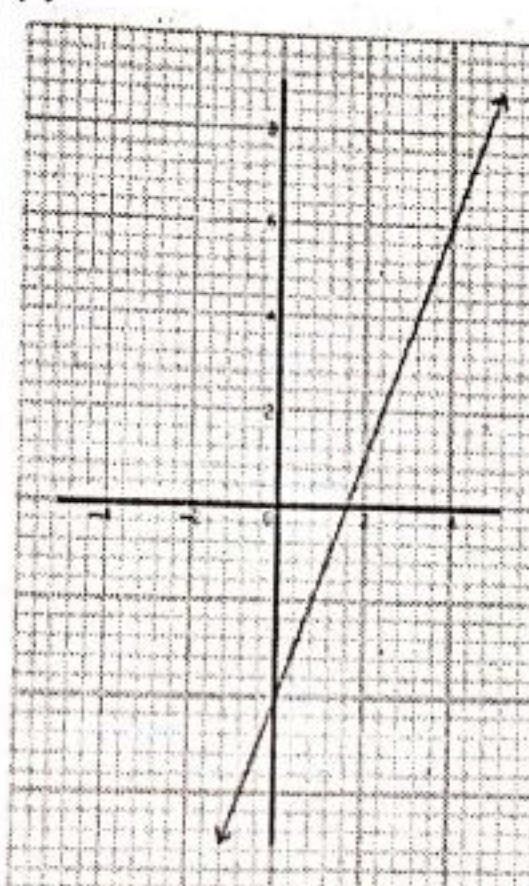


Sol: $c = 6$

$m = 2.5$

Ans

(c)



Sol: $c = 4$

$m = \frac{1}{2}$

Ans

Unit No. 9

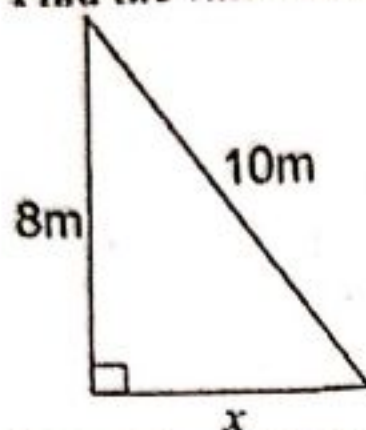
SURFACE AREA AND VOLUME

Exercise 9.1

(Pg 213)

Q1. Find the value of x in each figure.

(i)



Sol: - According to the Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(10)^2 = (x)^2 + (8)^2$$

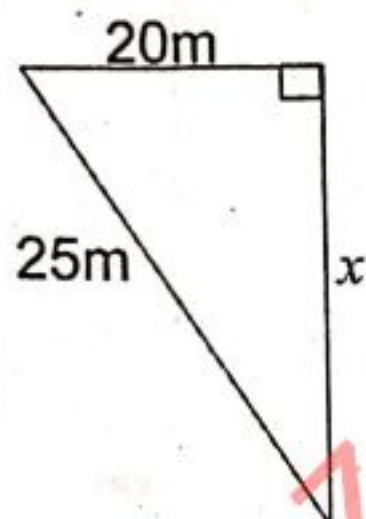
$$100 = x^2 + 64$$

$$100 - 64 = x^2$$

$$x^2 = 36$$

$$\sqrt{x^2} = \sqrt{36} \quad \boxed{x=6\text{m}} \text{ Ans}$$

(ii)



Sol: According to the Pythagoras's theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(25)^2 = (20)^2 + x^2$$

$$625 = 400 + x^2$$

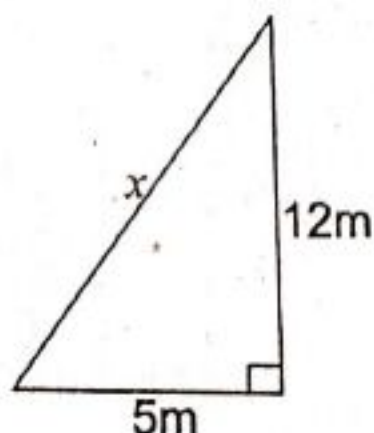
$$625 - 400 = x^2$$

$$x^2 = 225$$

$$\sqrt{x^2} = \sqrt{225}$$

$$\boxed{x=15\text{m}} \text{ Ans}$$

(iii)



Sol According to the Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(x)^2 = (5)^2 + (12)^2$$

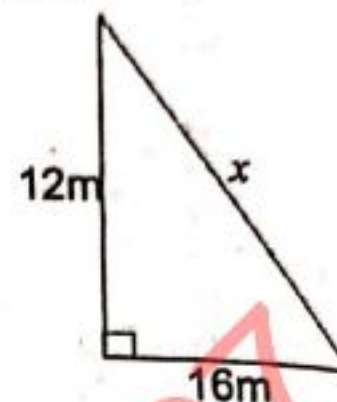
$$x^2 = 25 + 144$$

$$x^2 = 169$$

$$\sqrt{x^2} = \sqrt{169} \quad \boxed{x=13\text{m}} \text{ Ans}$$

Q2. Find the value of x in each of the following figures:

(i)



Sol According to the Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

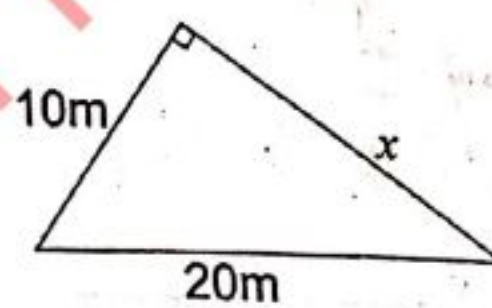
$$(x)^2 = (16)^2 + (12)^2$$

$$x^2 = 256 + 144$$

$$x^2 = 400$$

$$\sqrt{x^2} = \sqrt{400} \quad \boxed{x=20\text{m}} \text{ Ans}$$

(ii)



Sol According to the Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(20)^2 = (10)^2 + (x)^2$$

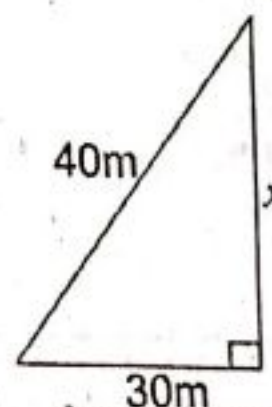
$$400 = 100 + x^2$$

$$400 - 100 = x^2$$

$$x^2 = 300$$

$$\sqrt{x^2} = \sqrt{300} = 10\sqrt{3}$$

(iii)



Sol According to the Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(40)^2 = (30)^2 + (x)^2$$

$$1600 = 900 + x^2$$

$$1600 - 900 = x^2$$

$$x^2 = 700$$

$$\sqrt{x^2} = \sqrt{700} \quad \boxed{x=10\sqrt{7}\text{m}} \text{ Ans}$$

Q3. In $\triangle XYZ$, $\angle y = 90^\circ$. Find the length of the missing side in each of the following:

$\overline{XZ} = 10 \text{ cm}$, $\overline{YZ} = 10 \text{ cm}$

(i) According to the Pythagoras theorem

Sol $(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$

$(\overline{XZ})^2 = (\overline{XY})^2 + (\overline{YZ})^2$

$(10)^2 = (\overline{YZ})^2 + (10)^2$

$225 = (\overline{XY})^2 + 100$

$(\overline{XY})^2 = 225 - 100$

$(\overline{XY})^2 = 125$

$\sqrt{(\overline{XY})^2} = \sqrt{125}$

$\overline{XY} = 5\sqrt{5}$

(ii) $\overline{XY} = 16 \text{ cm}$, $\overline{YZ} = 8 \text{ cm}$

Sol According to the Pythagoras theorem

$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$

$(\overline{XZ})^2 = (\overline{XY})^2 + (\overline{YZ})^2$

$(\overline{XZ})^2 = (16)^2 + (8)^2$

$(\overline{XZ})^2 = 256 + 64$

$(\overline{XZ})^2 = 320$

$\sqrt{(\overline{XZ})^2} = \sqrt{320}$

$\overline{XZ} = 8\sqrt{5} \text{ cm}$

(iii) $\overline{XY} = 2.5 \text{ cm}$, $\overline{XZ} = 5 \text{ cm}$

Sol According to the Pythagoras theorem

$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$

$(\overline{XZ})^2 = (\overline{XY})^2 + (\overline{YZ})^2$

$(5)^2 = (2.5)^2 + (\overline{YZ})^2$

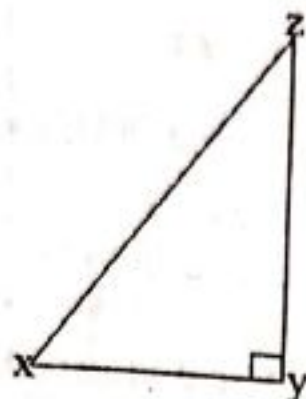
$25 = 6.25 + (\overline{YZ})^2$

$25 - 6.25 = (\overline{YZ})^2$

$(\overline{YZ})^2 = 18.75$

$\sqrt{(\overline{YZ})^2} = \sqrt{18.75}$

$\overline{YZ} = 4.33 \text{ cm}$



Q4. In $\triangle ABC$, $\angle B = 90^\circ$ and b is the length of the hypotenuse then find the length of the missing sides.

(i) $a = 12 \text{ cm}$, $c = 9 \text{ cm}$

Sol According to the Pythagoras theorem

$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$

$b^2 = c^2 + a^2$

$b^2 = (9)^2 + (12)^2$

$b^2 = 81 + 144$

$b^2 = 225$

Taking square root on b/s

$\sqrt{b^2} = \sqrt{225}$

$b = 15 \text{ cm}$ Ans

(ii) $b = 24 \text{ cm}$, $a = 7 \text{ cm}$

Sol According to the Pythagoras theorem

$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$

$(24)^2 = c^2 + (7)^2$

$576 = c^2 + 49$

$576 - 49 = c^2$

$c^2 = 527$

Taking square root on b/s

$\sqrt{c^2} = \sqrt{527}$

$c = 22.96 \text{ cm}$ Ans

(iii) $a = 2 \text{ cm}$, $c = 1.5 \text{ cm}$

Sol According to the Pythagoras theorem

$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$

$b^2 = c^2 + a^2$

$b^2 = (1.5)^2 + (2)^2$

$b^2 = 2.25 + 4$

$b^2 = 6.25$

Taking square root on both sides

$\sqrt{b^2} = \sqrt{6.25}$

$b = 2.5 \text{ cm}$

(iv) $b = \frac{15}{25} \text{ cm}$, $c = \frac{12}{25} \text{ cm}$

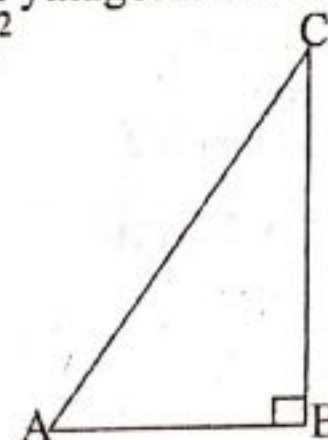
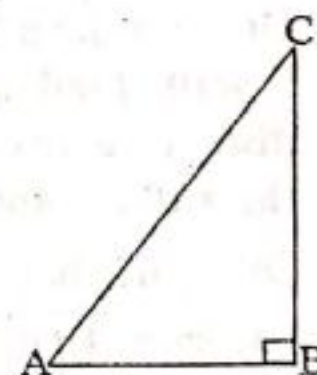
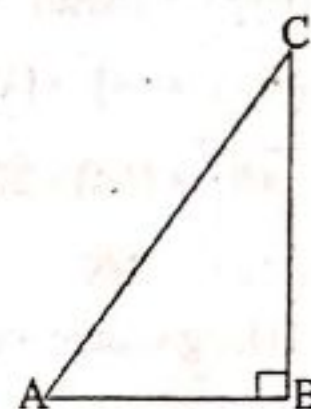
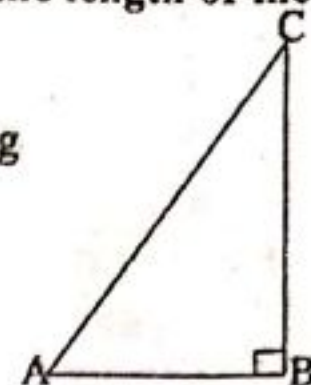
Sol According to the Pythagoras theorem

$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$

$b^2 = c^2 + a^2$

$\left(\frac{15}{25}\right)^2 = \left(\frac{12}{25}\right)^2 + a^2$

$\frac{225}{625} = \frac{144}{625} + a^2$



$$\frac{225}{625} - \frac{144}{625} = a^2$$

$$\frac{225-144}{625} = a^2$$

$$a^2 = \frac{81}{625}$$

$$\sqrt{a^2} = \sqrt{\frac{81}{625}}$$

$$a = \frac{9}{25} \text{ Ans}$$

Q5. In a right angled triangle, the length of its altitude is 15m and its base is 8m. Find the length of its hypotenuse.

Sol hyp = $\overline{AB}$ = ? Altitude = $\overline{BC}$ = 15m

base = $\overline{AC}$ = 8m

by Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(\overline{AB})^2 = (8)^2 + (15)^2$$

$$(\overline{AB})^2 = (64) + 225$$

$$(\overline{AB})^2 = 289$$

Taking square root on b/s

$$\sqrt{(\overline{AB})^2} = \sqrt{289}$$

$$\overline{AB} = 17\text{m} \text{ Ans}$$

Book answer is wrong.

Q6. A 3.4m long ladder touches the top of a wall. Find the height of the wall if the distance between the foot of the ladder and the wall is 2.4m.

Sol: height = $\overline{BC}$ = ?

Ladder = $\overline{AB}$ = 3.4m

$\overline{AC}$ = 2.4 m

By Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(3.4)^2 = (2.4)^2 + (\overline{BC})^2$$

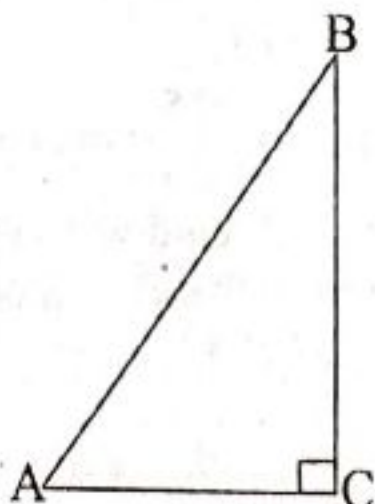
$$11.56 = 5.76 + (\overline{BC})^2$$

$$11.56 - 5.76 = (\overline{BC})^2$$

$$(\overline{BC})^2 = 5.8$$

$$\sqrt{(\overline{BC})^2} = \sqrt{5.8}$$

$$(\overline{BC})^2 = 2.4\text{m} \text{ Ans}$$



Q7. Observe the given figure and find the distance between the school and home.

by Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(35)^2 = (\text{base})^2 + (21)^2$$

$$(1225) = (\text{base})^2 + 441$$

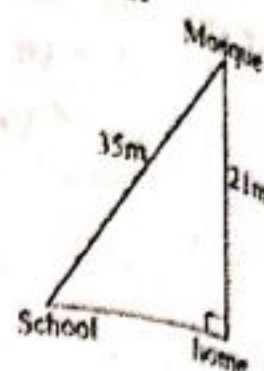
$$1225 - 441 = (\text{base})^2$$

$$(\text{base})^2 = 784$$

$$\sqrt{(\text{base})^2} = \sqrt{784}$$

$$\text{base} = 28\text{m}$$

The distance between the school and home is 28m. Ans



Q8. The distance between the top of a tree and a point on the ground is 7.5m. Find the height of the tree if the distance between the point of the ground and the tree is 4.5m.

Sol height of the tree = ?

By Pythagoras theorem

$$(\text{Hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(7.5)^2 = (4.5)^2 + (h)^2$$

$$56.25 = 20.25 + (h)^2$$

$$56.25 - 20.25 = h^2$$

$$h^2 = 36$$

Taking $\sqrt{\quad}$ on b/s

$$\sqrt{h^2} = \sqrt{36}$$

$$h = 6\text{m}$$

Height of the tree = 6m. Ans

Q9. The length of the hypotenuse of a right angled isosceles triangle is 32 cm. Find the length of its side.

Sol: Let "x" be the length of an isosceles triangle.

By Pythagoras theorem

$$(\text{hyp})^2 = (\text{Base})^2 + (\text{Perp})^2$$

$$(32)^2 = x^2 + x^2$$

$$\frac{1024}{2} = x^2$$

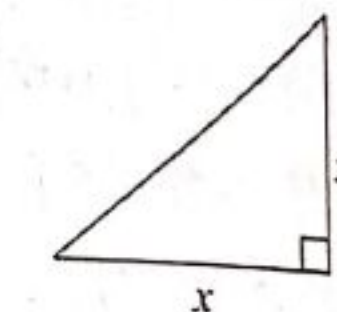
$$x^2 = 512$$

$$\sqrt{x^2} = \sqrt{512}$$

$$x = 22.6\text{cm}$$

So, the length of its side is 22.6cm. Ans

Q10. A ladder which is 9m long touches the top of the wall when its foot is 3m away from the wall. Find the height of the wall.



By Pythagoras theorem
(Hyp)² = (base)² + (perp)²

$$(9)^2 = x^2 + (3)^2$$

$$81 = x^2 + 9$$

$$81 - 9 = x^2$$

$$x^2 = 72$$

Taking $\sqrt{\quad}$ on both sides

$$\sqrt{x^2} = \sqrt{72}$$

$$x = 6\sqrt{2}$$

Height of the wall is $6\sqrt{2}m$ Ans

Q11. The distance between the top of a hill and a point on the ground is 400m. the distance between the point on the ground and the hill is 300m. Find the height of the hill.

Sol. let "x" be the height of the hill.

By Pythagoras theorem.

$$(Hyp)^2 = (base)^2 + (perp)^2$$

$$(400)^2 = (300)^2 + (x)^2$$

$$(400)^2 = (300)^2 + (x)^2$$

$$160000 = 90000 + x^2$$

$$x^2 = 70000$$

$$\sqrt{x^2} = \sqrt{70000}$$

$$x = 100\sqrt{7}m$$

$$or\ x = 264.57\ m$$

Q12. See the figure show here and find the distance between the office and the airport.

Sol: let "x" be the required distance between the office and the airport.

By Pythagoras theorem.

$$(Hyp)^2 = (base)^2 + (perp)^2$$

$$x^2 = (10)^2 + (15)^2$$

$$x^2 = 100 + 225$$

$$x^2 = 325$$

$$\sqrt{x^2} = \sqrt{325}$$

$$x = 18km\ Ans.$$

Book answer is wrong

Q13. The altitude of a right-angled triangle is 12cm and its hypotenuse is 18cm long. Find the length of the base of the triangle.

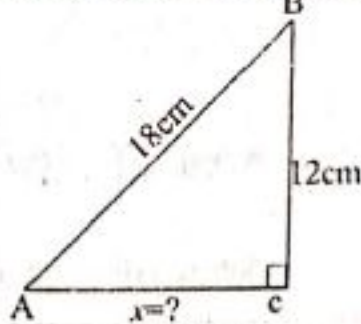
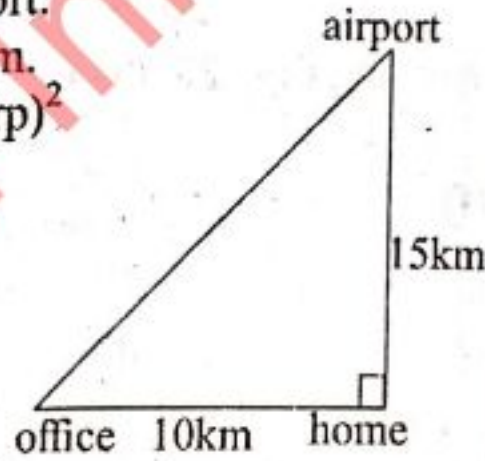
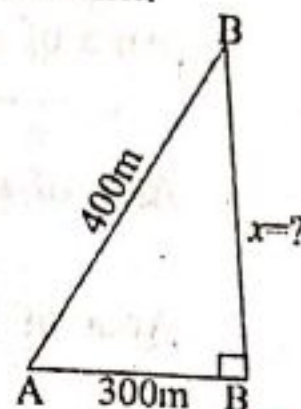
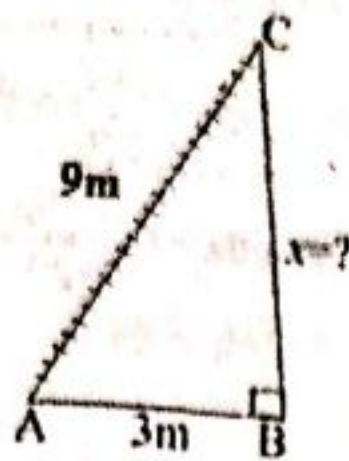
Sol let the length of the base of the triangle is "x"

By Pythagoras theorem

$$(Hyp)^2 = (base)^2 + (perp)^2$$

$$(18)^2 = (x)^2 + (12)^2$$

$$324 = x^2 + 144$$



$$324 - 144 = x^2$$

$$\sqrt{x^2} = \sqrt{180}$$

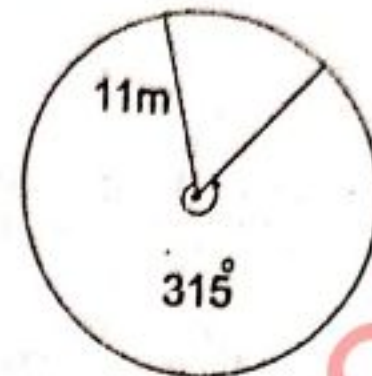
$$x = 6\sqrt{5}$$

Exercise 9.2

(Tb Pg 218)

Q1. Find the area and arc length of the following circles.

(a)



Sol: here $r = 11m$, $\theta = 315^\circ$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{315^\circ}{360^\circ} \times \frac{22}{7} \times (11)^2$$

$$= \frac{838530}{2520} = 332.75$$

Area of sector = 332.45m² Ans

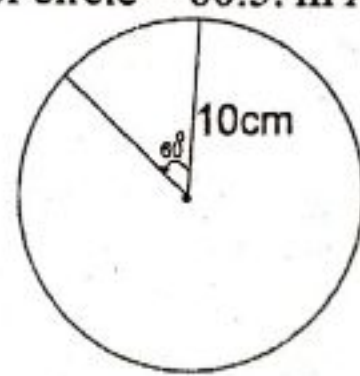
$$\text{Arc length of circle} = \frac{\theta}{360^\circ} \times \frac{22}{7}$$

$$\text{Arc length of circle} = \frac{315^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 11$$

$$= \frac{152,460}{2520} = 60.5$$

Arc length of circle = 60.5. m Ans

(b)



Sol: Here $\theta = 60^\circ$, $r = 10\ cm$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times (10)^2$$

$$\text{Area of sector} = \frac{152,000}{2520}$$

$$\text{Area of sector} = 52.38$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{60^\circ}{360} \times 2 \times \frac{22}{7} \times 10$$

$$\text{Arc length} = \frac{26,400}{2520} = 10.47$$

$$\text{Arc length} = 10.47 \text{ cm}$$

(c)

Sol: Here $\theta = 150^\circ$, $r = 3 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{150^\circ}{360^\circ} \times \frac{22}{7} \times (3)^2$$

$$\text{Area of sector} = \frac{29,700}{2520}$$

$$\text{Area of sector} = 11.78$$

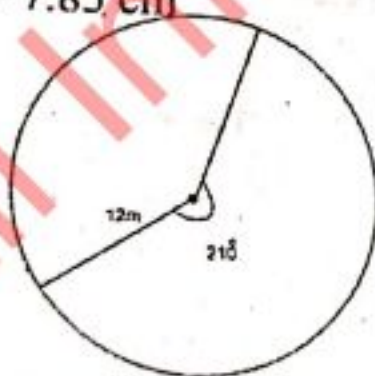
$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{150^\circ}{360} \times 2 \times \frac{22}{7} \times 3$$

$$\text{Arc length} = \frac{19,800}{2520} = 7.85$$

$$\text{Arc length} = 7.85 \text{ cm}$$

(d)

Sol: Here $\theta = 210^\circ$, $r = 12 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{210^\circ}{360^\circ} \times \frac{22}{7} \times (12)^2$$

$$\text{Area of sector} = \frac{665,280}{2520}$$

$$\text{Area of sector} = 264$$

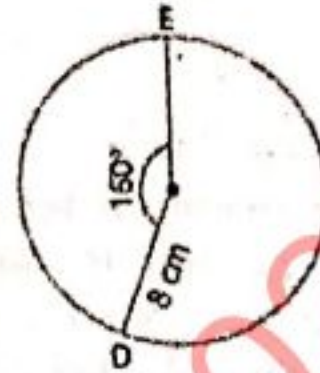
$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{210^\circ}{360} \times 2 \times \frac{22}{7} \times 12$$

$$\text{Arc length} = \frac{110,880}{2520} = 44$$

$$\text{Arc length} = 44 \text{ m}$$

(e)

Sol: Here $\theta = 160^\circ$, $r = 8 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{160^\circ}{360^\circ} \times \frac{22}{7} \times (8)^2$$

$$\text{Area of sector} = \frac{225,280}{2520}$$

$$\text{Area of sector} = 89.40$$

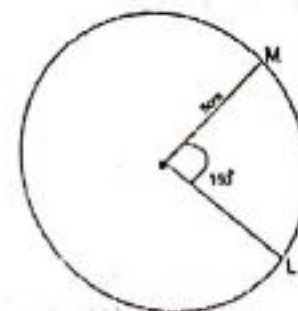
$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{160^\circ}{360} \times 2 \times \frac{22}{7} \times 8$$

$$\text{Arc length} = \frac{56320}{2520} = 22.35$$

$$\text{Arc length} = 22.35 \text{ cm}$$

(f)

Sol: Here $\theta = 150^\circ$, $r = 5 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{150^\circ}{360^\circ} \times \frac{22}{7} \times (5)^2$$

$$\text{Area of sector} = \frac{82500}{2520}$$

$$\text{Area of sector} = 32.74 \text{ cm}^2$$

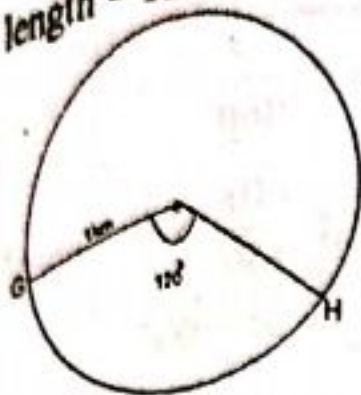
$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{150^\circ}{360} \times 2 \times \frac{22}{7} \times 5$$

$$\text{Arc length} = \frac{33,000}{2520} = 7.85$$

$$\text{Arc length} = 13.10 \text{ cm}$$

(g)



Sol: Here $\theta = 120^\circ$, $r = 11 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{120^\circ}{360^\circ} \times \frac{22}{7} \times (11)^2$$

$$\text{Area of sector} = \frac{319440}{2520}$$

$$\text{Area of sector} = 126.76 \text{ cm}^2$$

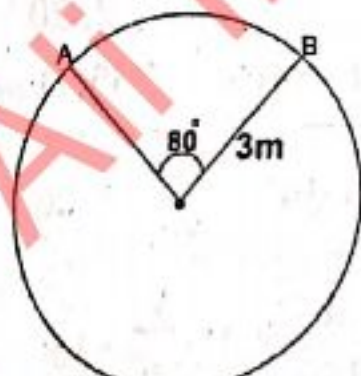
$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{120^\circ}{360} \times 2 \times \frac{22}{7} \times 11$$

$$\text{Arc length} = \frac{58,088}{2520} = 23.04$$

$$\text{Arc length} = 23.04 \text{ cm}$$

(h)



Sol: Here $\theta = 80^\circ$, $r = 3 \text{ m}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{80^\circ}{360^\circ} \times \frac{22}{7} \times (3)^2$$

$$\text{Area of sector} = \frac{15840}{2520}$$

$$\text{Area of sector} = 6.29 \text{ m}$$

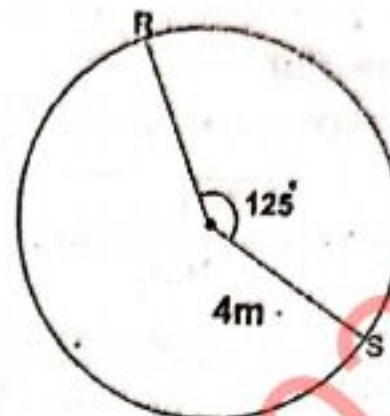
$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{80^\circ}{360} \times 2 \times \frac{22}{7} \times 3$$

$$\text{Arc length} = \frac{10560}{2520} = 4.19$$

$$\text{Arc length} = 4.19 \text{ m}$$

(i)



Sol: Here $\theta = 125^\circ$, $r = 4 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{125^\circ}{360^\circ} \times \frac{22}{7} \times (4)^2$$

$$\text{Area of sector} = \frac{44,000}{2520}$$

$$\text{Area of sector} = 17.46$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{125^\circ}{360} \times 2 \times \frac{22}{7} \times 4$$

$$\text{Arc length} = \frac{22,000}{2520} = 8.73$$

$$\text{Arc length} = 8.73 \text{ m}$$

Q2. Find the length and area of the following measurements of a circle.

(i) $r = 3 \text{ cm}$, $\theta = 80^\circ$

Sol: Here $\theta = 80^\circ$, $r = 3 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{80^\circ}{360^\circ} \times \frac{22}{7} \times (3)^2$$

$$\text{Area of sector} = \frac{15,840}{2520}$$

$$\text{Area of sector} = 6.29 \text{ cm}^2$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{80^\circ}{360} \times 2 \times \frac{22}{7} \times 3$$

$$\text{Arc length} = \frac{10,560}{2520} = 7.85$$

$$\text{Arc length} = 4.19 \text{ cm}$$

(ii) $r = 12\text{m}, \theta = 120^\circ$

Sol: Here $\theta = 120^\circ$, $r = 12 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{120^\circ}{360^\circ} \times \frac{22}{7} \times (12)^2$$

$$\text{Area of sector} = \frac{380,160}{2520}$$

$$\text{Area of sector} = 150.86 \text{ m}^2$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{120^\circ}{360} \times 2 \times \frac{22}{7} \times 12$$

$$\text{Arc length} = \frac{19,800}{2520} = 25.14$$

$$\text{Arc length} = 25.84 \text{ m}^2$$

(iii) $r = 10\text{cm}, \theta = 55^\circ$

Sol: Here $\theta = 55^\circ$, $r = 10 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{55^\circ}{360^\circ} \times \frac{22}{7} \times (10)^2$$

$$\text{Area of sector} = \frac{121,000}{2520}$$

$$\text{Area of sector} = 48.02$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{55^\circ}{360} \times 2 \times \frac{22}{7} \times 10$$

$$\text{Arc length} = \frac{24,200}{2520} = 9.60$$

$$\text{Arc length} = 9.60 \text{ cm}$$

(iv) $r = 3\text{cm}, \theta = 80^\circ$

Sol: Same as Q2 (i)

(v) $r = 12\text{m}, \theta = 120^\circ$

Sol: Same as Q2 (ii)

(vi) $r = 10 \text{ cm}, \theta = 55^\circ$

Sol: Same as Q2 (iii)

(vii) $r = 20\text{cm}, \theta = 110^\circ$

Sol: Here $\theta = 110^\circ$, $r = 20 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{110^\circ}{360^\circ} \times \frac{22}{7} \times (20)^2$$

$$\text{Area of sector} = \frac{968,000}{2520}$$

$$\text{Area of sector} = 384.12 \text{ cm}^2$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{110^\circ}{360} \times 2 \times \frac{22}{7} \times 20$$

$$\text{Arc length} = \frac{96800}{2520} = 38.41$$

$$\text{Arc length} = 38.41 \text{ cm}$$

(viii) $r = 15\text{m}, \theta = 120^\circ$

Sol: Here $\theta = 120^\circ$, $r = 15 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{120^\circ}{360^\circ} \times \frac{22}{7} \times (15)^2$$

$$\text{Area of sector} = \frac{594,000}{2520}$$

$$\text{Area of sector} = 235.71 \text{ m}^2$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{120^\circ}{360} \times 2 \times \frac{22}{7} \times 15$$

$$\text{Arc length} = \frac{79500}{2520} = 31.42$$

$$\text{Arc length} = 31.42 \text{ m}$$

(ix) $r = 56\text{cm}$, $\theta = 100^\circ$
 Here $\theta = 100^\circ$, $r = 56\text{cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{100^\circ}{360^\circ} \times \frac{22}{7} \times (56)^2$$

$$\text{Area of sector} = \frac{6,899,200}{2520}$$

$$\text{Area of sector} = 2737.78\text{ cm}$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{100^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 56$$

$$\text{Arc length} = \frac{246,400}{2520} = 97.78$$

$$\text{Arc length} = 97.78\text{ cm}$$

(x) $r = 21\text{cm}$, $\theta = 150^\circ$
 Here $\theta = 150^\circ$, $r = 21\text{cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{150^\circ}{360^\circ} \times \frac{22}{7} \times (21)^2$$

$$\text{Area of sector} = \frac{1,455,300}{2520}$$

$$\text{Area of sector} = 577.5\text{ cm}^2$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{150^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 21$$

$$\text{Arc length} = \frac{138600}{2520} = 55$$

$$\text{Arc length} = 55\text{ cm}$$

(xi) $r = 6\text{m}$, $\theta = 75^\circ$
 Here $\theta = 75^\circ$, $r = 6\text{m}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{75^\circ}{360^\circ} \times \frac{22}{7} \times (6)^2$$

$$\text{Area of sector} = \frac{59400}{2520}$$

$$\text{Area of sector} = 23.57\text{ m}^2$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{75^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 6$$

$$\text{Arc length} = \frac{19800}{2520} = 7.86$$

$$\text{Arc length} = 7.86\text{ m}$$

(ix) $r = 43\text{cm}$, $\theta = 90^\circ$
 Here $\theta = 90^\circ$, $r = 43\text{cm}$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{90^\circ}{360^\circ} \times \frac{22}{7} \times (43)^2$$

$$\text{Area of sector} = \frac{3,661,020}{2520}$$

$$\text{Area of sector} = 1452.7\text{ cm}^2$$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{90^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 43$$

$$\text{Arc length} = \frac{170280}{2520} = 62.57$$

$$\text{Arc length} = 62.57\text{ cm}$$

Q3. Find the area of a sector of a circular field having diameter 120 and the central 180° .

Sol Given that
 $\theta = 180^\circ$, $d = 120\text{m}$

$$r = \frac{d}{2} = \frac{120}{2} = 60\text{m}$$

We know that

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{180^\circ}{360^\circ} \times \frac{22}{7} \times (60)^2$$

$$= 0.5 \times \frac{22}{7} \times 3600$$

$$\text{Area of sector} = 5657\text{ m}^2 \text{ Ans}$$

Q4. Find the area of a piece of pizza having radius 8cm and the central angle 45° . If the pizza has 8 such identical pieces, what is the total area of the pizza?

Sol: $r = 8\text{cm}$, $\theta = 45^\circ$

$$\begin{aligned}\text{Area of pizza} &= \frac{\theta}{360^\circ} \times \pi r^2 \\ &= \frac{45^\circ}{360^\circ} \times \frac{22}{7} \times (8)^2 \\ &= \frac{63,360}{2520}\end{aligned}$$

$$\begin{aligned}\text{Area of pizza} &= 25.14 \text{ cm}^2 \\ &= 8 \times 25.15 \text{ cm}^2 \\ &= 201.12 \text{ cm}^2\end{aligned}$$

Total area of the pizza is 201.12 cm^2 .

Q5. A pendulum-like swing at an amusement park moving in a circular arc at the end of a 40 meter arm. Find the distance travelled by a rider at the end of the swing's arm if the angle made between the two extreme points is 150° .

Sol: $\theta = 150^\circ$, $r = 40 \text{ m}$

$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{150^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 40 = \frac{264,000}{2520}$$

$$\text{Arc length} = 104.76 \text{ m}$$

The distance travelled by a rider is 104.76 m .

Ans.

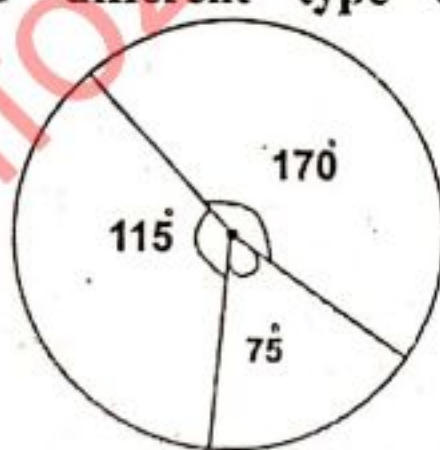
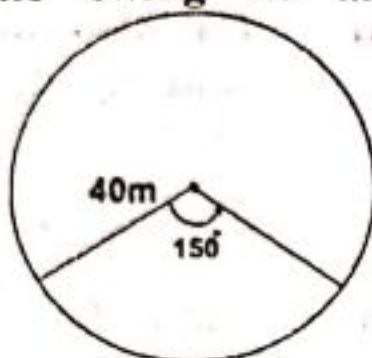
Q6. A circular ground has been divided into three parts for different type of activities. Find the area of each part and the length of the curved boundary of each circle of the diameter of this ground is 220 meter.

Sol: $d = 220 \text{ m}$

$$r = \frac{d}{2} = \frac{220}{2} = 110 \text{ m}$$

$$\begin{aligned}\text{Area of 1st section} &= \frac{\theta}{360^\circ} \times 2\pi r \\ &= \frac{75^\circ}{360^\circ} \times \frac{22}{7} \times (110)^2 = \frac{19965000}{2520}\end{aligned}$$

$$\text{Area of 1st sector} = 7922.62 \text{ m}^2$$



$$\begin{aligned}\text{Area of 2nd sector} &= \frac{115^\circ}{360^\circ} \times \frac{22}{7} \times (110)^2 \\ &= \frac{30613000}{2520} = 12148.02 \text{ m}^2\end{aligned}$$

$$\text{Area of 2nd sector} = 12148.02 \text{ m}^2$$

$$\begin{aligned}\text{Area of 3rd sector} &= \frac{\theta}{360^\circ} \times \pi r^2 \\ &= \frac{170^\circ}{360^\circ} \times \frac{22}{7} \times (110)^2 \\ &= \frac{45,254,000}{2520} = 17,957.93\end{aligned}$$

$$\text{Area of 3rd sector} = 17857.18 \text{ m}^2.$$

Exercise 9.3

(TB pg 223)

Q1. Find the surface area and volume of the sphere for the following radii ($\pi = \frac{22}{7}$)

(i) 4.2 cm

Sol $r = 4.2 \text{ cm}$ (given)

$$\text{Surface Area} = 4\pi r^2$$

$$\text{Surface Area} = 4 \times \frac{22}{7} \times (4.2)^2$$

$$\begin{aligned}\text{Surface Area} &= \frac{4 \times 22 \times 17.64}{7} \\ &= \frac{1,552.32}{7}\end{aligned}$$

$$\text{Surface Area} = 221.76 \text{ cm}^2 \text{ Ans}$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \times \frac{22}{7} \times (4.2)^3$$

$$\text{Volume} = \frac{4 \times 22 \times 74.088}{7 \times 3}$$

$$\text{Volume} = \frac{6,519.744}{21}$$

$$\text{Volume} = 310.46 \text{ cm}^3 \text{ Ans}$$

(ii) 63cm

Sol $\text{Surface Area} = 4\pi r^2$

$$\text{Surface Area} = 4 \times \frac{22}{7} \times (63)^2$$

$$\text{Surface Area} = \frac{4 \times 22 \times 3969}{7}$$

$$= \frac{349,272}{7}$$

$$\text{Surface Area} = 49,896 \text{ cm}^2$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \times \frac{22}{7} \times (63)^3$$

$$\text{Volume} = \frac{4 \times 22 \times 250,047}{3 \times 7}$$

$$\text{Volume} = \frac{22004136}{21}$$

$$\text{Volume} = 1047816 \text{ cm}^3$$

Book answer is wrong.

(iii) 8.4m

$$\text{Sol } \text{Surface Area} = 4\pi r^2$$

$$\text{Surface Area} = 4 \times \frac{22}{7} \times (8.4)^2$$

$$\text{Surface Area} = \frac{4 \times 22 \times 70.56}{7}$$

$$= \frac{6209.28}{7}$$

$$\text{Surface Area} = 887.04 \text{ m}^2$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \times \frac{22}{7} \times (8.4)^3$$

$$\text{Volume} = \frac{4 \times 22 \times 592.704}{3 \times 7}$$

$$\text{Volume} = \frac{52157.952}{21}$$

$$\text{Volume} = 2483.712 \text{ m}^3$$

Q2. The diameter of sphere is 5m. calculate the surface area and volume of the sphere ($\pi = 3.14$).

Sol $d = 5\text{m}$ (given)

$$r = \frac{d}{2} = \frac{5}{2} = 2.5\text{m}$$

$$\text{Surface Area} = 4\pi r^2$$

$$\text{Surface Area} = 4 \times \frac{22}{7} \times (2.5)^2$$

$$\text{Surface Area} = \frac{4 \times 22 \times 6.25}{7}$$

$$= \frac{550}{7}$$

$$\text{Surface Area} = 78.57 \text{ m}^2$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \times \frac{22}{7} \times (2.5)^3$$

$$\text{Volume} = \frac{4 \times 22 \times 15.625}{3 \times 7}$$

$$\text{Volume} = \frac{1375}{21}$$

$$\text{Volume} = 65.48 \text{ m}^3 \text{ Ans}$$

Q3. A spherical water tank has radius 2.1m.

(i) Calculate the cost of painting water tank at rate of Rs 140 per m^2 .

(ii) Find the capacity of the water tank.

$$\left(\pi = \frac{22}{7} \right)$$

Solution of part (i)

$$\text{Surface Area} = 4\pi r^2$$

$$\text{Surface Area} = 4 \times \frac{22}{7} \times (2.1)^2$$

$$\text{Surface Area} = \frac{4 \times 22 \times 4.41}{7}$$

$$\text{Surface Area} = \frac{388.08}{7}$$

$$\text{Surface Area} = 55.44 \text{ m}^2$$

$$\text{Rs } 140 \times 55.44 = \text{Rs } 7,761.6$$

The cost of painting water tank at the rate of Rs 140 per m^2 is Rs 7,761.6 Ans

Solution of Part (ii):-

$$\text{Capacity of water tank} = \frac{4}{3} \pi r^3$$

$$\text{Capacity} = \frac{4}{3} \times \frac{22}{7} \times (2.1)^3$$

$$\text{Capacity} = \frac{4 \times 22 \times 9.261}{3 \times 7}$$

$$\text{Capacity} = \frac{814.968}{21}$$

$$\text{Capacity} = 38.81 \text{ m}^3 \text{ Ans}$$

Q4. A hemispherical water pool whose diameter is 20m.

(i) Calculate the cost of cementing the water pool at the rate of Rs 125 m^2 .

(ii) Find the capacity of the water pool in litres.

Solution of part (i)

$d = 20\text{m}$ (given)

$$r = \frac{d}{2} = \frac{20}{2} = 10\text{m}$$

$$\text{Curved surface area of hemisphere} = 2\pi r^2$$

$$\text{CSA} = 2 \times \frac{22}{7} \times (10)^2$$

$$\text{CSA} = \frac{2 \times 22 \times 100}{7}$$

$$\text{CSA} = \frac{4400}{7}$$

$$\text{CSA} = 628.57\text{m}^2$$

$$628.57 \times 125 = \text{Rs } 78,571.42$$

The cost of cementing the water pool is Rs 78,571.42 Ans

Solution of Part (ii):-

$$\text{Capacity of hemispherical water tank} = \frac{2}{3}\pi r^3$$

$$\text{Capacity} = \frac{2}{3} \times \frac{22}{7} \times (10)^3$$

$$\text{Capacity} = \frac{2 \times 22 \times 1000}{3 \times 7}$$

$$\text{Capacity} = \frac{44,000}{21}$$

$$\text{Capacity} = 2,095.23\text{m}^3$$

$$\text{Capacity} = 2,095.23 \times 1000 \text{ l}$$

$$\text{Capacity} = 2095238 \text{ l Ans}$$

Q5. A sphere of radius 1.5m is made up to and iron sheet. Calculate the cost of iron sphere if the rate of iron sheet is Rs 312 per m^2 .

Sol: $r = 1.5\text{m}$ (given)

$$\text{Surface Area} = 4\pi r^2$$

$$\text{Surface Area} = 4 \times \frac{22}{7} \times (1.5)^2$$

$$\text{Surface Area} = \frac{4 \times 22 \times 2.25}{7}$$

$$\text{Surface Area} = \frac{198}{7}$$

$$\text{Surface Area} = 28.29\text{m}^2$$

$$28.29 \times 312 = \text{Rs } 8,826$$

The cost of iron sphere sheet is Rs 8,826 Ans.

Exercise 9.4

(TB pg 228)

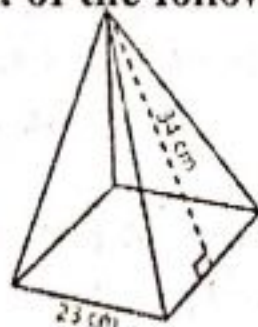
Q1. Find the surface area of the following pyramids.

Solution of part (a): -

Here $b = 23\text{ cm}$, $h = 34\text{ cm}$

$$\text{Total surface Area} = 2bh + b^2$$

$$\text{TSA} = 2 \times 23 \times 34 + (23)^2$$



$$\text{TSA} = 1564 + 529$$

$$\text{TSA} = 2093\text{cm}^2 \text{ Ans}$$

Solution of part (b): -

Here $b = 27\text{ cm}$, $h = 35\text{ cm}$

$$\text{Total surface Area} = 2bh + b^2$$

$$\text{TSA} = 2 \times 27 \times 35 + (27)^2$$

$$\text{TSA} = 1890 + 729$$

$$\text{TSA} = 2619\text{cm}^2 \text{ Ans}$$

Solution of part (c)

$$\text{Total surface Area} = 2bh + b^2$$

$$\text{TSA} = 2 \times 32 \times 45 + (32)^2$$

$$\text{TSA} = 2880 + 1024$$

$$\text{TSA} = 3904\text{cm}^2 \text{ Ans}$$

Solution of part (d)

Here $b = 24\text{ m}$, $h = 38\text{ m}$

$$\text{Total surface Area} = 2bh + b^2$$

$$\text{TSA} = 2 \times 24 \times 38 + (24)^2$$

$$\text{TSA} = 1824 + 576$$

$$\text{TSA} = 2400\text{m}^2 \text{ Ans}$$

Solution of part (e):

Here $b = 18\text{ m}$, $h = 37\text{ m}$

$$\text{Total surface Area} = 2bh + b^2$$

$$\text{TSA} = 2 \times 18 \times 37 + (18)^2$$

$$\text{TSA} = 1332 + 324$$

$$\text{TSA} = 1656\text{m}^2 \text{ Ans}$$

Solution of part (f):

Here $b = 22\text{ m}$, $h = 50\text{ m}$

$$\text{Total surface Area} = 2bh + b^2$$

$$\text{TSA} = 2 \times 22 \times 50 + (22)^2$$

$$\text{TSA} = 2200 + 484$$

$$\text{TSA} = 2684\text{cm}^2 \text{ Ans}$$

Q2. Find the surface area of the following surface pyramids having the given base lengths and slant heights.

- (i) base length = 7cm
Slant height = 5cm

Sol

$$\text{Surface Area} = 2bh + b^2$$

$$= 2 \times 7 \times 5 + (7)^2$$

$$= 70 + 49$$

$$\text{Surface Area} = 119\text{cm}^2 \text{ Ans}$$

- (ii) base length = 8.5cm
Slant height = 6cm

Sol $\text{Surface Area} = 2bh + b^2$

$$\text{Surface Area} = 2 \times 8.5 \times 6 + (8.5)^2$$

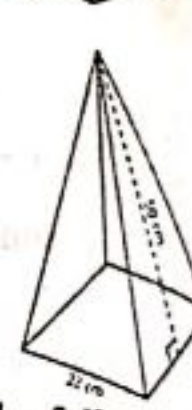
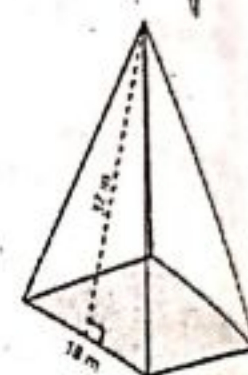
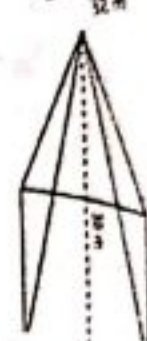
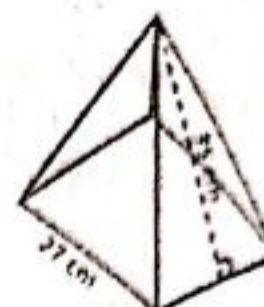
$$\text{Surface Area} = 102 + 72.25$$

$$\text{Surface Area} = 174.25\text{cm}^2 \text{ Ans}$$

- (iii) base length = 4cm
Slant height = 7cm

Sol $\text{Surface Area} = 2bh + b^2$

$$\text{Surface Area} = 2 \times 4 \times 7 + (4)^2$$



Surface Area = $56 + 16$

Surface Area = 70cm^2 Ans

base length = 9cm

Slant height = 10cm

Surface Area = $2bh + b^2$

Surface Area = $2 \times 9 \times 10 + (9)^2$

Surface Area = $180 + 81$

Surface Area = 261cm^2 Ans

base length = 4cm

Slant height = 7cm

Surface Area = $2bh + b^2$

Surface Area = $2 \times 4 \times 7 + (4)^2$

Surface Area = $56 + 16$

Surface Area = 70cm^2 Ans

base length = 15cm

Slant height = 20cm

Surface Area = $2bh + b^2$

Surface Area = $2 \times 15 \times 20 + (15)^2$

Surface Area = $600 + 225$

Surface Area = 825cm^2 Ans

Find the volume of these square

pyramids.

Solution of Part (a)

We cannot find

volume of this

pyramid because

height is not given.

Solution of part (b):

Volume of square pyramid = $\frac{1}{3} \times b^2 \times h$

Volume = $\frac{1}{3} \times (32)^2 \times 50$

Volume = $\frac{51200}{3}$

Volume = $17,066.67\text{m}^3$

Solution of part (c):

Volume of square pyramid = $\frac{1}{3} \times b^2 \times h$

Volume = $\frac{1}{3} \times (15)^2 \times 19$

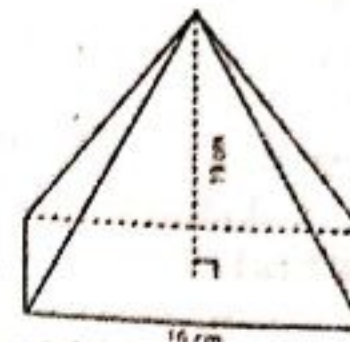
Volume = $\frac{4275}{3}$

Volume = 1425cm^3 Ans

Solution of part (d):

Volume of square pyramid = $\frac{1}{3} \times b^2 \times h$

Volume cannot possible because width is not given.



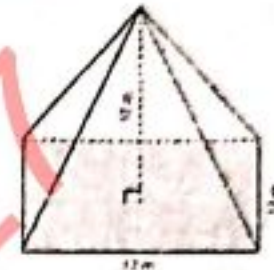
Solution of part (e):

Volume of square pyramid = $\frac{1}{3} \times b^2 \times h$

Volume = $\frac{1}{3} \times (12)^2 \times 17$

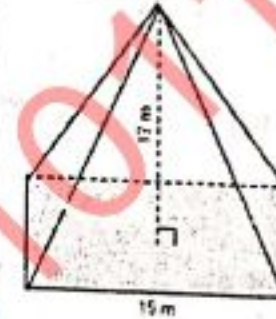
Volume = $\frac{2448}{3}$

Volume = 816m^3 Ans



Solution of part (f):

Volume of square pyramid = $\frac{1}{3} \times b^2 \times h$



Volume cannot be find because it's width is not given.

Q4. An oil bottle is in the shape of a square pyramid. What is the capacity if its base length is 22cm and the perpendicular height (altitude) is 30 cm.

Sol: capacity of pyramid = ?

base = 22cm, height (altitude) = 30cm

Capacity of Pyramid = $\frac{1}{3} \times b^2 \times h$

Capacity of Pyramid = $\frac{1}{3} \times (22)^2 \times 30$

$\frac{14520}{3}$

Capacity of pyramid = 4840m^3 Ans

Q5. A hall in square pyramid shape. Its base length is 30 metre, the slant height is 42 metre and the altitude is 40 meters.

(a) What is the cost of painting it outer triangular walls if the rate of painting is Rs 975 per square metre?

(b) What is the capacity of this building?

Solution of Part (a): -

Sol: Surface Area = $2bh + b^2$

SA = $2 \times 30 \times 42 + 30^2$

SA = $2520 + 900$

SA = 3420 m^2

To find the cost of painting its outer triangular walls = Rs 975×3420 = Rs 3,334,500

Solution of part (b): -

Capacity = $\frac{1}{3} \times (\text{base})^2 \times \text{height}$

Capacity = $\frac{1}{3} \times (30)^2 \times (40)$

= $\frac{1}{3} \times 900 \times (40)$

= 300×40

Capacity = 12000 m^3 Ans

Q6. For comparing, a square pyramid shaped tent is prepared. How much fabric is used for making the four triangular surfaces if the base of this square pyramid is 4 metres and the slanting height is 6 metres. Also find its capacity of the altitude is 5 metres.

Sol: Capacity = ?

Fabric used for making four triangular surfaces = ?

Given that = ?

$b = 4 \text{ m}, l = 6 \text{ m}, h = 5$

Capacity = $\frac{1}{3} \times b^2 \times h$

Capacity = $\frac{1}{3} \times (4)^2 \times 5$

Capacity = $\frac{1 \times 16 \times 5}{3}$

Capacity = $\frac{80}{3}$

Capacity = 26.67 m^3

Q7. Find the surface area and volume of a pyramid shaped marble decoration piece if its base length is 20 cm slant height is 23 cm and the altitude 23 cm. also find the cost of polishing its outer surface if the rate of polishing is Rs 380 per square centimeter.

Sol: Surface area of pyramid = ?

Volume of a pyramid = ?

Given that

$b = 20 \text{ cm}, l = 23 \text{ cm}, h = 23 \text{ cm}$

SA = $2bh + b^2$

SA = $2 \times 20 \times 23 + (20)^2$

SA = $920 + 400$

SA = 1320 cm^2

$V = \frac{1}{3} \times b^2 \times h$

$V = \frac{1}{3} \times (20)^2 \times 23$

$V = \frac{1 \times 400 \times 23}{3}$

$V = \frac{9200}{3} = 3066.67 \text{ cm}^3$

To find the cost of polishing its outer surface,

= Rs 380×1320

= Rs 501,600

So, the cost of polishing its outer surface is Rs 501,600

Quick check (Pg 231)

Complete the table for the following measurements for right circular cones: ($\pi=3.14$)

r	h	l	Surface Area	Volume
3cm	4cm	5cm	75.36cm ²	37.68cm ³
Not possible	15cm	9cm	Not Possible	Not possible
12m	16m	20m	1205.76m ²	2411.52m ³
7m	12.12m	14m	461.58m ²	621.59m ³

Part (i): $r=3 \text{ cm}, h=4 \text{ cm}$

$l=?$, SA = ?, $v=?$

$l^2 = r^2 + h^2$

$l^2 = 3^2 + 4^2$

$l^2 = 9 + 16$

$l^2 = 25$

$\sqrt{l^2} = \sqrt{25}$

$l = 5 \text{ cm}$

SA = $\pi r (l+r)$

SA = $(3.14) (3) (5+3)$

SA = $(3.14) (3) (8)$

SA = 75.36 cm^2 Ans

$V = \frac{1}{3} \pi r^2 h$

$v = \frac{1}{3} \times 3.14 \times (3)^2 \times 4$

$v = \frac{113.04}{3}$

$v = 37.68 \text{ cm}^3$ Ans

Part (ii): $h = 15 \text{ cm}, l = 9 \text{ cm}$

$r=?$, SA = ?, $V=?$

$$l^2 = r^2 + h^2$$

$$9^2 = r^2 + 15^2$$

$$81 = r^2 + 225$$

$$r^2 = 81 - 225$$

(not possible)

Surface area and volume is also not possible.

Ans

Part (c):- $r = 12\text{m}, l = 20\text{m}$

$$h = ?, SA = ?, V = ?$$

$$(20)^2 = (12)^2 + h^2$$

$$400 = 144 + h^2$$

$$400 - 144 = h^2$$

$$h^2 = 256$$

$$\sqrt{h^2} = \sqrt{256}$$

$$h = 16\text{m} \text{ Ans}$$

$$SA = \pi r (l + r)$$

$$SA = (3.14) (12) (20 + 12)$$

$$SA = (3.14) (12) (32)$$

$$SA = 1205.76\text{m}^2 \text{ Ans}$$

$$V = \frac{1}{3} \pi r^2 h$$

$$V = \frac{1}{3} \times 3.14 \times (12)^2 \times 16$$

$$V = 2411.52\text{m}^3 \text{ Ans}$$

Part (iv): - $r = 7\text{m}, l = 14\text{m}$

$$h = ?, SA = ?, V = ?$$

$$l^2 = r^2 + h^2$$

$$(14)^2 = (7)^2 + h^2$$

$$196 = 49 + h^2$$

$$h^2 = 147$$

$$\sqrt{h^2} = \sqrt{147}$$

$$h = 12.12\text{m} \text{ Ans}$$

$$SA = \pi r (l + r)$$

$$SA = (3.14) (7) (14 + 7)$$

$$SA = (3.14) (7) (21)$$

$$SA = 461.58\text{m}^2 \text{ Ans}$$

$$V = \frac{1}{3} \pi r^2 h$$

$$V = \frac{1}{3} \times 3.14 \times (7)^2 \times (12.12)$$

$$V = 621.59\text{m}^3 \text{ Ans}$$

(247)

Mathematics-8

Exercise 9.5 (Tb Pg 233)

Q1. Find the curved surface area and total surface area of cones for the following measurements: ($\pi = 3.14$)

(i) $r = 5\text{cm}, l = 8\text{cm}$

$$CSA = \pi r l$$

$$CSA = (3.14) (5) (8)$$

$$CSA = 125.6\text{cm}^2 \text{ Ans}$$

$$TSA = \pi r (l + r)$$

$$TSA = (3.14) (5) (8 + 5)$$

$$TSA = (3.14) (5) (13) \text{ Ans}$$

$$TSA = 204.1\text{cm}^2 \text{ Ans}$$

(ii) $r = 8.2\text{cm}, l = 20\text{cm}$

$$CSA = \pi r l$$

$$CSA = (3.14) (8.2) (20)$$

$$CSA = 514.96\text{cm}^2 \text{ Ans}$$

$$TSA = \pi r (l + r)$$

$$TSA = (3.14) (8.2) (20 + 8.2)$$

$$TSA = (3.14) (8.2) (28.2) \text{ Ans}$$

$$TSA = 726.09\text{cm}^2 \text{ Ans}$$

(iii) $r = 3\text{m}, h = 4\text{m}$

Sol

$$l^2 = r^2 + h^2$$

$$l^2 = (3)^2 + (4)^2$$

$$l^2 = 9 + 16$$

$$l^2 = 25$$

$$\sqrt{l^2} = \sqrt{25}$$

$$l = 5\text{m}$$

$$CSA = \pi r l$$

$$CSA = (3.14) (3) (5)$$

$$CSA = 47.1\text{m}^2 \text{ Ans}$$

$$TSA = \pi r (l + r)$$

$$TSA = (3.14) (3) (5 + 3)$$

$$TSA = (3.14) (3) (8) \text{ Ans}$$

$$TSA = 75.36\text{m}^2 \text{ Ans}$$

(iv) $r = 6\text{cm}, h = 8\text{cm}$

Sol

$$l^2 = r^2 + h^2$$

$$l^2 = (6)^2 + (8)^2$$

$$l^2 = 36 + 64$$

$$l^2 = 100$$

$$\sqrt{l^2} = \sqrt{100}$$

$$l = 10\text{cm}$$

$$CSA = \pi r l$$

$$CSA = (3.14) (6) (10)$$

$$CSA = 188.4\text{cm}^2 \text{ Ans}$$

$$TSA = \pi r (r + l)$$

$$TSA = (3.14) (6) (6 + 10)$$

$$TSA = (3.14) (6) (16) \text{ Ans}$$

$$TSA = 301.44\text{cm}^2 \text{ Ans}$$

Q2. Calculate the total surface area and volume of cones of the following measurements: ($\pi=3.14$)

(i) $r = 2.5$ cm, $h = 12$ cm

Sol

$$l^2 = r^2 + h^2$$

$$l^2 = (2.5)^2 + (12)^2$$

$$l^2 = 6.25 + 144$$

$$l^2 = 150.25$$

$$\sqrt{l^2} = \sqrt{150.25}$$

$$l = 12.26$$
 cm

$$\text{TSA} = \pi r(l+r)$$

$$\text{TSA} = (3.14)(2.5)(12.26+2.5)$$

$$\text{TSA} = (3.14)(2.5)(14.76)$$

$$\text{TSA} = 115.87 \text{ cm}^2 \text{ Ans}$$

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume} = \frac{1}{3} \times 3.14 \times (2.5)^2 \times 12$$

$$\text{Volume} = 78.5 \text{ cm}^3 \text{ Ans}$$

(ii)

Sol

$r = 3.2$ cm, $h = 8.5$ cm

$$l^2 = r^2 + h^2$$

$$l^2 = (3.2)^2 + (8.5)^2$$

$$l^2 = 10.24 + 72.25$$

$$l^2 = 82.49$$

$$\sqrt{l^2} = \sqrt{82.49}$$

$$l = 9.08$$
 cm

$$\text{TSA} = \pi r(l+r)$$

$$\text{TSA} = (3.14)(3.2)(9.08+3.2)$$

$$\text{TSA} = (3.14)(3.2)(12.28)$$

$$\text{TSA} = 123.38 \text{ m}^2 \text{ Ans}$$

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume} = \frac{1}{3} \times 3.14 \times (3.2)^2 \times (8.5)$$

$$\text{Volume} = 91.10 \text{ cm}^3 \text{ Ans}$$

(iii)

Sol

$r = 1.25$ m, $h = 3$ m

$$l^2 = r^2 + h^2$$

$$l^2 = (1.25)^2 + (3)^2$$

$$l^2 = 1.5625 + 9$$

$$l^2 = 10.5625$$

$$\sqrt{l^2} = \sqrt{10.5625}$$

$$l = 3.25$$

$$\text{TSA} = \pi r(l+r)$$

$$\text{TSA} = (3.14)(1.25)(3.25+1.25)$$

$$\text{TSA} = (3.14)(1.25)(4.5)$$

$$\text{TSA} = 17.66 \text{ m}^2 \text{ Ans}$$

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume} = \frac{1}{3} \times 3.14 \times (1.25)^2 \times 3$$

$$\text{Volume} = 3.14 \times 1.5625$$

$$\text{Volume} = 4.91 \text{ m}^3 \text{ Ans}$$

(iv)

Sol

$r = 5$ cm, $l = 13$ cm

$$l^2 = r^2 + h^2$$

$$(13)^2 = (5)^2 + h^2$$

$$169 = 25 + h^2$$

$$169 - 25 = h^2$$

$$h^2 = 144$$

$$\sqrt{h^2} = \sqrt{144}$$

$$h = 12$$
 cm

$$\text{TSA} = \pi r(l+r)$$

$$\text{TSA} = (3.14)(5)(13+5)$$

$$\text{TSA} = (3.14)(5)(18)$$

$$\text{TSA} = 282.6 \text{ cm}^2 \text{ Ans}$$

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume} = \frac{1}{3} \times 3.14 \times (5)^2 \times 12$$

$$\text{Volume} = 3.14 \times 25 \times 4$$

$$\text{Volume} = 314 \text{ cm}^3 \text{ Ans}$$

Q3. The radius of the conical roof of a the mirror of a mosque is 1.25m and its slant height is 5m. find the cost of the metal sheet to cover the roof at a rate of Rs 250 per m^2 .

Sol

$$\text{CSA} = \pi r l$$

$$\text{CSA} = (3.14)(1.25)(5)$$

$$\text{CSA} = 19.625 \text{ m}^2$$

$$19.625 \times \text{Rs } 250 = \text{Rs } 4906.25$$

The cost of the metal sheet to cover the roof is Rs 4906.25. Ans

Q4. The slant height of a conical funnel is 11cm. how much metal plate is required to cover a conical funnel, if the diameter of its

base is 8.2 cm. $\left(\pi = \frac{22}{7}\right)$

Sol: $d = 8.2$ cm

$$r = \frac{d}{2} = \frac{8.2}{2} = 4.1 \text{ cm}$$

$$l = 11 \text{ cm}$$

$$l^2 = r^2 + h^2$$

$$(11)^2 = (4.1)^2 + h^2$$

$$121 = 16.81 + h^2$$

$$h^2 = 121 - 16.81$$

$$h^2 = 104.19$$

$$\sqrt{h^2} = \sqrt{104.19}$$

$$h = 10.21 \text{ cm}$$

$$\begin{aligned}\text{Total surface area of cone} &= (\pi r)(l + r) \\ &= 3.14 \times 4.1(11 + 4.1) \\ &= 12.874(15.1) \\ &= 194.40 \text{ cm}^2\end{aligned}$$

194.40 cm² of metal plate is required to cover a conical funnel.

Note: Book answer is wrong.

Q5. The radius of a cone is 6cm and its slant height is 10cm.

How much paper is required to cover the cone?

(ii) Find the cost of the cone at a rate of Rs. 0.09 per m²?

Sol: Given that:

$$r = 6 \text{ cm}, l = 10 \text{ cm}$$

$$l^2 = r^2 + h^2$$

$$l^2 = (6)^2 + (h)^2$$

$$100 = 36 + h^2$$

$$h^2 = 100 - 36$$

$$h^2 = 64 \Rightarrow \sqrt{h^2} = \sqrt{64}$$

$$h = 8$$

Solution of part (i)

$$\text{Total surface area of cone} = \pi r(l + r)$$

$$= 3.14(6)(10 + 6)$$

$$= 18.84(16)$$

$$= 301.44 \text{ cm}^2$$

Solution of part (ii)

$$\text{Rs } 0.09 \times 301.44 = \text{Rs } 27.13$$

The cost of the cone at the rate of Rs 0.09 per m² is Rs 27.13

Q6. A conical vessel has a radius 5cm and its slant height is 12cm.

- Find its curved surface area.
- Calculate its total surface area.
- Find the capacity of the conical vessel.

$$\text{Sol: } r = 5 \text{ cm}, l = 12 \text{ cm}$$

$$l^2 = r^2 + h^2$$

$$(12)^2 = (5)^2 + h^2$$

$$144 = 25 + h^2$$

$$h^2 = 144 - 25$$

$$h^2 = 119$$

$$\sqrt{h^2} = \sqrt{119}$$

$$h = 10.91 \text{ cm}$$

Solution of Part (i)

$$CSA = \pi r l$$

$$CSA = (3.14)(5)(12)$$

$$CSA = 188.4 \text{ cm}^2$$

Solution of Part (ii)

$$TSA = \pi r(l + r)$$

$$= 3.14 \times 5(12 + 5)$$

$$= 15.7 \times 17$$

$$TSA = 266.9 \text{ cm}^2$$

Solution of Part (iii)

$$\text{Capacity} = \frac{1}{3} \pi r^2 h$$

$$\text{Capacity} = \frac{1}{3} \times (3.14) \times (5)^2 \times 10.91$$

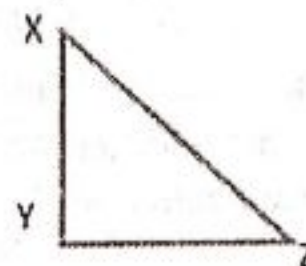
$$\text{Capacity} = \frac{3.14 \times 25 \times 10.91}{3}$$

$$\text{Capacity} = \frac{856.435}{3}$$

$$\text{Capacity} = 285.48$$

Review Exercise

- a. The Pythagoras theorem for the given triangle is:



- $(XY)^2 = (YZ)^2 + (XZ)^2$
- $(XY)^2 = (YZ)^2 - (XZ)^2$
- $(YZ)^2 = (XY)^2 + (XZ)^2$
- $(XZ)^2 = (YZ)^2 + (XY)^2$ ✓

- b. If the length of hypogenous is 15 cm and length of the base is 12 cm then the length of latitude is:

(i) 9cm✓ (ii) 12cm

(iii) 15cm (iv) 10cm

c. A _____ is the part of the circle that is enclosed by two radii and an arc.

(i) circumference (ii) diameter

(iii) arc (iv) sector✓

d. The value of π is:

(i) 360 (ii) 3.14 ✓

(iii) 2.14 (iv) 3.15

e. The formula to find the arc of the circle is:

i. $\frac{360^\circ}{2\pi r} \times \theta$ ii. $\frac{\theta}{360^\circ} \times 2\pi r$ ✓iii. $\frac{2\pi d}{360^\circ} \times \theta$ iv. $\frac{\theta}{360^\circ} \times 2r$

f. The Greek letter that is used in math as variable to represent a measured angle.

i. θ ✓ ii. Φ

g. a solid sphere has a radius of 5.5m. the surface area of the sphere is:

(i) 408.07m² (ii) 408.07m(iii) 408.07m² (iv) 408.17m

No correct option.

h. The volume of the cone is:

(i) $\pi r^2 h$ (ii) $\frac{1}{2} \pi r h$ (iii) $\frac{1}{2} \pi r^2 h$ (iv) $\frac{1}{3} \pi r^2 h$ ✓i. If $r = 4\text{cm}$ and $h = 3\text{cm}$ then the total surface area of the cone is:(i) 408.07m² (ii) 408.07m(iii) 408.07m² (iv) 408.17m

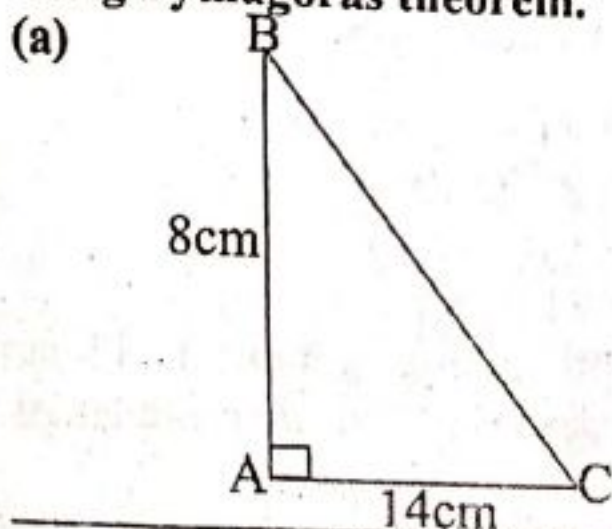
No correct Option

j. When the central angle formed by the two radii is _____ degree, the sector is called a quadrant.

(i) 180° (ii) 270°

(iii) 90°✓ (iv) 360°

Q2. Find the value of unknown length (hypotenuous, perpendicular or base) by using Pythagoras theorem.

Sol base = $\overline{AC} = 14\text{cm}$ Perp = $\overline{AB} = 8\text{cm}$ Hyp = $\overline{BC} = ?$

According to the Pythagoras theorem

$$(\text{hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(\overline{BC})^2 = (14)^2 + (8)^2$$

$$(\overline{BC})^2 = 196 + 64$$

$$(\overline{BC})^2 = 260$$

$$\overline{BC} = 16.12 \text{ cm Ans}$$

(b) Sol In $\triangle ABD$ Base = $(\overline{BD}) = ?$ Prep = $\overline{AB} = 5\text{cm}$, hyp = $\overline{AD} = 10\text{cm}$

By Pythagoras Theorem

$$(\text{hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(10)^2 = (\overline{BD})^2 + (5)^2$$

$$100 = (\overline{BD})^2 + 25$$

$$100 - 25 = \overline{BD}^2$$

$$(\overline{BD})^2 = 75$$

$$\sqrt{(\overline{BD})^2} = \sqrt{75}$$

$$\overline{BD} = 8.66\text{cm}$$

In $\triangle BCD$;hyp = $\overline{BC} = x = ?$ base = $\overline{BD} = 8.66$ perp = $\overline{CD} = 4\text{cm}$

By Pythagoras theorem

$$(\text{hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(x)^2 = (8.66)^2 + (4)^2$$

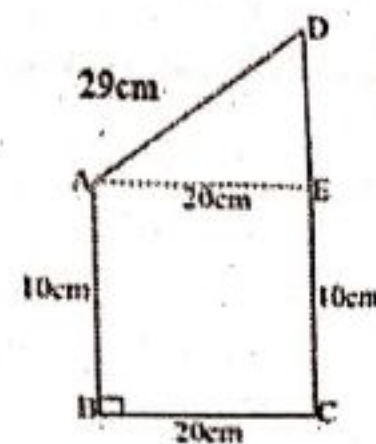
$$x^2 = 75 + 16$$

$$x^2 = 91$$

$$\sqrt{x^2} = \sqrt{91}$$

$$x = 9.54 \text{ Ans}$$

(c)



Sol: $CD = ?$

In $\triangle ADE$,

$$(\text{hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(29)^2 = (20)^2 + (\overline{DE})^2$$

$$841 = 400 + (\overline{DE})^2$$

$$841 - 400 = (\overline{DE})^2$$

$$(\overline{DE})^2 = 441$$

$$\sqrt{(\overline{DE})^2} = \sqrt{441}$$

$$\overline{DE} = 21\text{cm} \text{ Ans}$$

Q3. The hypotenuous of a right - angled triangular ground is 45m. if the length of one side of the triangular ground is 30m. what is the length of other side.

Sol $\overline{AB} = \text{hyp} = 45\text{m}$

$\overline{AB} = \text{base} = 30\text{m}$

$\overline{BC} = \text{perp} = ?$

By Pythagoras theorem

$$(\text{hyp})^2 = (\text{base})^2 + (\text{prep})^2$$

$$(45)^2 = (30)^2 + (\overline{BC})^2$$

$$2025 = 900 + (\overline{BC})^2$$

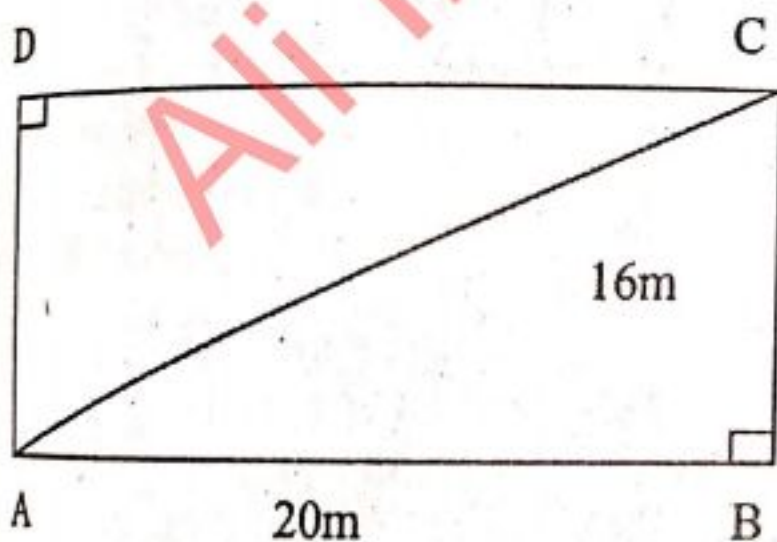
$$2025 - 900 = (\overline{BC})^2$$

$$1125 = (\overline{BC})^2$$

$$\sqrt{\overline{BC}^2} = \sqrt{1125}$$

$$\overline{BC} = 33.54\text{m}$$

Q4. Find the length of the diagonal of a rectangular shaped computer lab. If the length of the computer lab is 20m and width is 16m.



Sol

base = 20m

prep = 16m

hyp = ?

By Pythagoras theorem

$$(\text{hyp})^2 = (\text{base})^2 + (\text{perp})^2$$

$$(\overline{AC})^2 = (20)^2 + (16)^2$$

$$(\overline{AC})^2 = 400 + 256$$

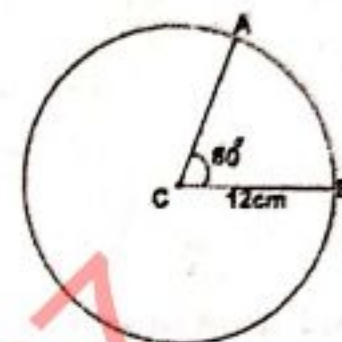
$$(\overline{AC})^2 = 656$$

$$\sqrt{(\overline{AC})^2} = \sqrt{656}$$

$$\overline{AC} = 25.61\text{m} \text{ Ans}$$

Q5. Find the area of the sector ACB if angle is 60° and the length of the radius is 12cm.

Sol $r = 12\text{cm}, \theta = 60^\circ$



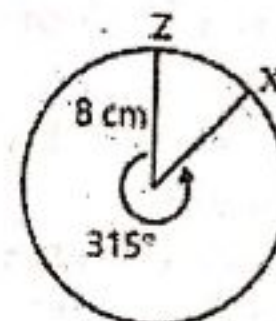
$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{60^\circ}{360^\circ} \times 3.14 \times (12)^2$$

$$= 0.167 \times 3.14 \times 144$$

$$\text{Area of sector} = 75.51\text{cm}^2 \text{ Ans}$$

Q6. Find the area of the sector XYZ if the length of the radius is 8cm and the angle is 315° .



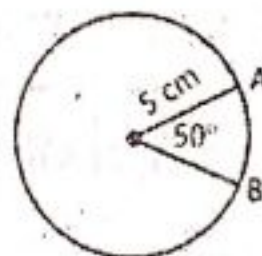
$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector} = \frac{315^\circ}{360^\circ} \times 3.14 \times (8)^2$$

$$= 0.875 \times 3.14 \times 64$$

$$\text{Area of sector} = 175.84\text{cm}^2 \text{ Ans}$$

Q7. Find the arc length AB of angle is 50° and radius is 5cm.



Sol: $r = 5\text{cm}, \theta = 50^\circ$

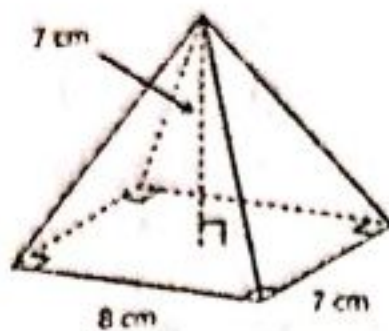
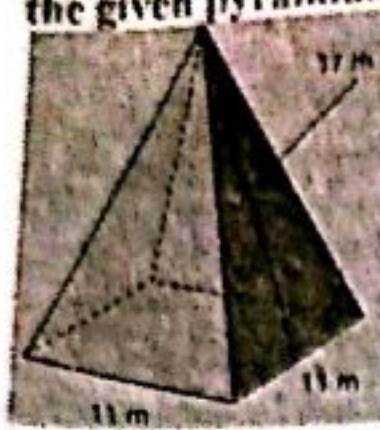
$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Arc length} = \frac{50^\circ}{360^\circ} \times 2 \times 3.14 \times 5$$

$$= (0.14) \times 2 \times 3.14 \times 5$$

$$\text{Arc length} = 4.40 \text{ cm Ans}$$

Q8. Find the surface area and volume of the given pyramids.



Solution of part (a)

$$\text{Surface Area} = 2bh + b^2$$

$$\text{SA} = 2 \times 11 \times 17 + (11)^2$$

$$\text{SA} = 374 + 121$$

$$\text{SA} = 495 \text{ m}^2 \text{ Ans}$$

$$\text{Volume} = \frac{1}{3} b^2 h$$

$$\text{Volume} = \frac{1}{3} \times (11)^2 \times 17$$

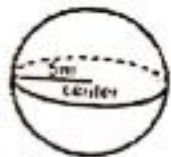
$$\text{Volume} = \frac{121 \times 17}{3}$$

$$\text{Volume} = 685.67 \text{ m}^3 \text{ Ans}$$

Solution of part (b) :-

Solution is not possible because the given pyramid is not a square.

Q9. Find the surface area and volume of the given spheres.



Solution of part (a)

$$\text{Surface Area} = 4\pi r^2$$

$$\text{SA} = 4 \times 3.14 \times (5)^2$$

$$\text{SA} = 12.56 + 25$$

$$\text{SA} = 314 \text{ m}^2 \text{ Ans}$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \times 3.14 \times (5)^3$$

$$\text{Volume} = \frac{1570}{3}$$

$$\text{Volume} = 523.33 \text{ m}^3 \text{ Ans}$$

Solution of part (b)

$$\text{Surface Area} = 4\pi r^2$$

$$\text{SA} = 4 \times 3.14 \times (18)^2$$

$$\text{SA} = 12.56 \times 324$$

$$\text{SA} = 4069.44 \text{ m}^2 \text{ Ans}$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \times 3.14 \times (18)^3$$

$$\text{Volume} = \frac{73249.92}{3}$$

$$\text{Volume} = 24416.64 \text{ m}^3 \text{ Ans}$$

Solution of Part (c) :-

d = 20m (given)

$$r = \frac{d}{2} = \frac{20}{2} = 10 \text{ m}$$

$$\text{Surface Area} = 4\pi r^2$$

$$\text{SA} = 4 \times 3.14 \times (10)^2$$

$$\text{SA} = 12.56 \times 100$$

$$\text{SA} = 1256 \text{ m}^2 \text{ Ans}$$

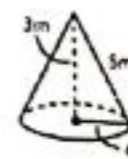
$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \times 3.14 \times (10)^3$$

$$\text{Volume} = \frac{12560}{3}$$

$$\text{Volume} = 4186.67 \text{ m}^3 \text{ Ans}$$

Q10. Find the surface area and volume of cones.



Solution of part (a)

$$r = 4 \text{ cm}, l = 5 \text{ cm}$$

$$l^2 = r^2 + h^2$$

$$(5)^2 = (4)^2 + h^2$$

$$25 = 16 + h^2$$

$$25 - 16 = h^2$$

$$h^2 = 9$$

$$\sqrt{h^2} = \sqrt{9}$$

$$h = 3 \text{ cm}$$

$$\text{TSA} = \pi r(l+r)$$

$$\text{TSA} = 3.14 \times 4(5+4)$$

$$= 12.56 \times 9$$

$$\text{TSA} = 113.04 \text{ cm}^2 \text{ Ans}$$

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume} = \frac{1}{3} \times 3.14 \times (14)^2 \times 16$$

$$\text{Volume} = 3.14 \times 16$$

$$\text{Volume} = 50.24 \text{ cm}^3$$

Solution of part (b): -

$$h = 3m, l = 5m$$

$$l^2 = r^2 + h^2$$

$$(5)^2 = r^2 + (3)^2$$

$$25 = r^2 + 9$$

$$25 - 9 = r^2$$

$$r^2 = 16$$

$$r = 4m$$

$$TSA = \pi(l+r)$$

$$TSA = 3.14 \times 4(5+4)$$

$$= 12.56 \times 9$$

$$TSA = 113.04 m^2 \text{ Ans}$$

$$Volume = \frac{1}{3} \pi r^2 h$$

$$Volume = \frac{1}{3} \times 3.14 \times 4^2 \times 3$$

$$Volume = 3.14 \times 16$$

$$Volume = 50.24 m^3 \text{ Ans}$$

Solution of part (c)

$$h = 48m, l = 50m, d = 28m$$

$$r = \frac{d}{2} = \frac{28}{2} = 14$$

$$TSA = \pi(l+r)$$

$$TSA = 3.14 \times 14(50+14)$$

$$= 43.96 \times 64$$

$$TSA = 2813.14 m^2 \text{ Ans}$$

$$Volume = \frac{1}{3} \pi r^2 h$$

$$Volume = \frac{1}{3} \times 3.14 \times (14)^2 \times 48$$

$$Volume = 3.14 \times 196 \times 16$$

$$Volume = 9847.04 m^3 \text{ Ans}$$

Q11. Find the surface area and volume of hemispheres:

(i) **Radius = 6cm**

Sol $r = 6cm$ (given)

$$Surface Area = 2\pi r^2$$

$$SA = 2 \times 3.14 \times 6^2$$

$$SA = 6.28 \times 36$$

$$SA = 226.08 cm^2 \text{ Ans}$$

$$Volume = \frac{2}{3} \pi r^3$$

$$Volume = \frac{2}{3} \times 3.14 \times 6^3$$

$$Volume = \frac{1356.48}{3}$$

$$Volume = 452.16 cm^3 \text{ Ans}$$

(ii) **diameter = 24m**

$$Sol \quad r = \frac{d}{2} = \frac{24}{2} = 12m$$

$$Surface Area = 2\pi r^2$$

$$SA = 2 \times 3.14 \times (12)^2$$

$$SA = 6.28 \times 144$$

$$SA = 904.32 m^2 \text{ Ans}$$

$$Volume = \frac{2}{3} \pi r^3$$

$$Volume = \frac{2}{3} \times 3.14 \times (12)^3$$

$$Volume = \frac{10851.84}{3}$$

$$Volume = 3617.28 m^3 \text{ Ans}$$

Q12. Spherical water tank whose radius is 3.5m.

(i) Find the cost of painting water tank at the rate of Rs 135 per m^2 .

(ii) Find the capacity of water tank $\left(\pi = \frac{22}{7}\right)$

Solution of part (i)

$$Surface Area = 4\pi r^2$$

$$SA = 4 \times \frac{22}{7} \times (3.5)^2$$

$$SA = \frac{4 \times 22 \times 12.25}{7}$$

$$SA = \frac{1078}{7}$$

$$SA = 154 m^2$$

$$Rs 135 \times 154 = Rs 20,790.$$

The cost of painting water tank is Rs 20,790

Solution of part (ii): -

$$Capacity of water tank = \frac{4}{3} \pi r^3$$

$$Capacity = \frac{4}{3} \times \frac{22}{7} \times (3.5)^3$$

$$Capacity = \frac{4 \times 22 \times 42.875}{3 \times 7}$$

$$Capacity = \frac{3773}{21}$$

$$Capacity = 179.67 m^3 \text{ Ans}$$

Q13. The height of a conical flask is 10cm and its area of the circular base 78.50 cm^2 .

(i) Find the curved surface area of the conical flask.

- (ii) Calculate its total surface area.
 (iii) Find the capacity of the conical flask.

Solution of Part (i)

$$CSA = \pi r l$$

$$CSA = 3.14 \times 5 \times 11.18$$

$$CSA = 175.53 \text{ cm}^2 \text{ Ans}$$

Solution of part (ii)

$$H = 10 \text{ cm, area} = 78.50 \text{ cm}^2$$

$$\text{Area} = \pi r^2$$

$$78.50 = 3.14 r^2$$

$$\frac{78.50}{3.14} = r^2$$

$$r^2 = 25$$

$$\sqrt{r^2} = \sqrt{25}$$

$$r = 5 \text{ cm}$$

$$l^2 = r^2 + h^2$$

$$l^2 = (5)^2 + (10)^2$$

$$l^2 = 25 + 100$$

$$l^2 = 125$$

$$\sqrt{l^2} = \sqrt{125}$$

$$l = 11.18 \text{ cm}$$

$$TSA = \pi r(l+r)$$

$$TSA = 3.14 \times 5 (11.18 + 5)$$

$$TSA = 3.14 \times 5 \times 16.18$$

$$TSA = 254.03 \text{ cm}^2 \text{ Ans}$$

Solution of part (iii)

$$\text{Capacity} = \frac{1}{3} \pi r^2 h$$

$$\text{Capacity} = \frac{1}{3} \times 3.14 \times (5)^2 \times 10$$

$$= \frac{785}{3}$$

$$\text{Capacity} = 261.67 \text{ cm}^3 \text{ Ans}$$

Q14. Jamal wants to make a tent for this he wants to bought a high-quality fabric. Find the surface area of the tent including the floor of the tent below. find the cost of the cloth if per square metre cloth is Rs 450. Also find the volume of the tent.

Sol: Required

$$\text{Surface Area} = ?$$

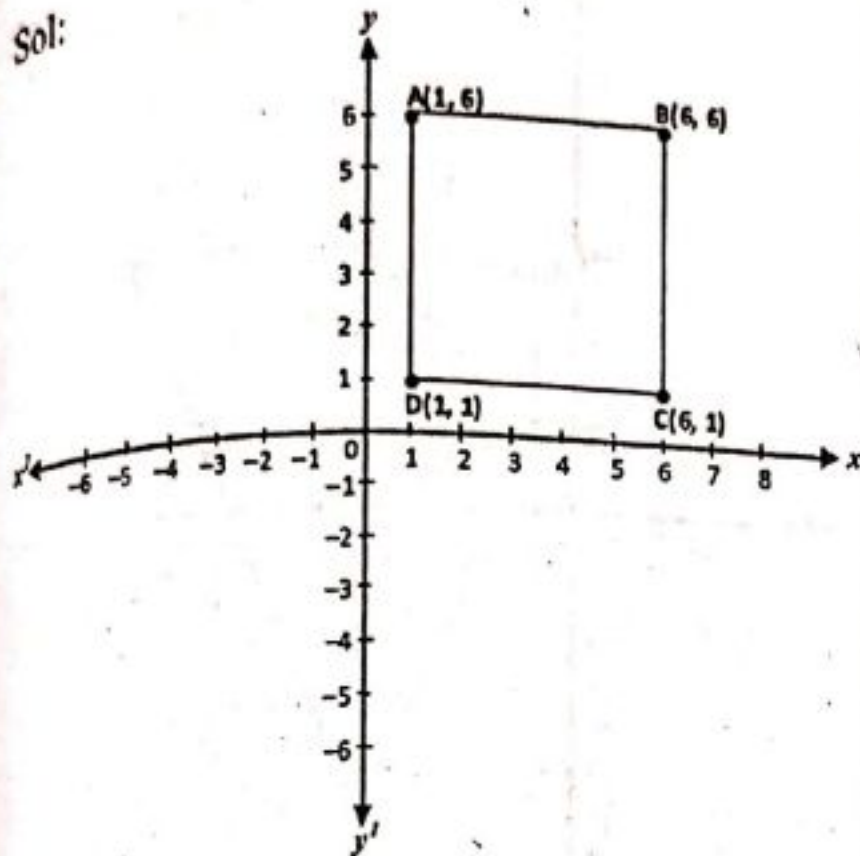
$$\text{Cost of the cloth} = ?$$

$$\text{Volume} = ?$$

The solution of this word problem is not possible because dimensions of the tent are not given. Ans

Exercise 10.1 (Tb Pg 242)
Q.1 Draw a square on coordinate plane. Then rotate it through 90° clockwise about the origin.

Sol:

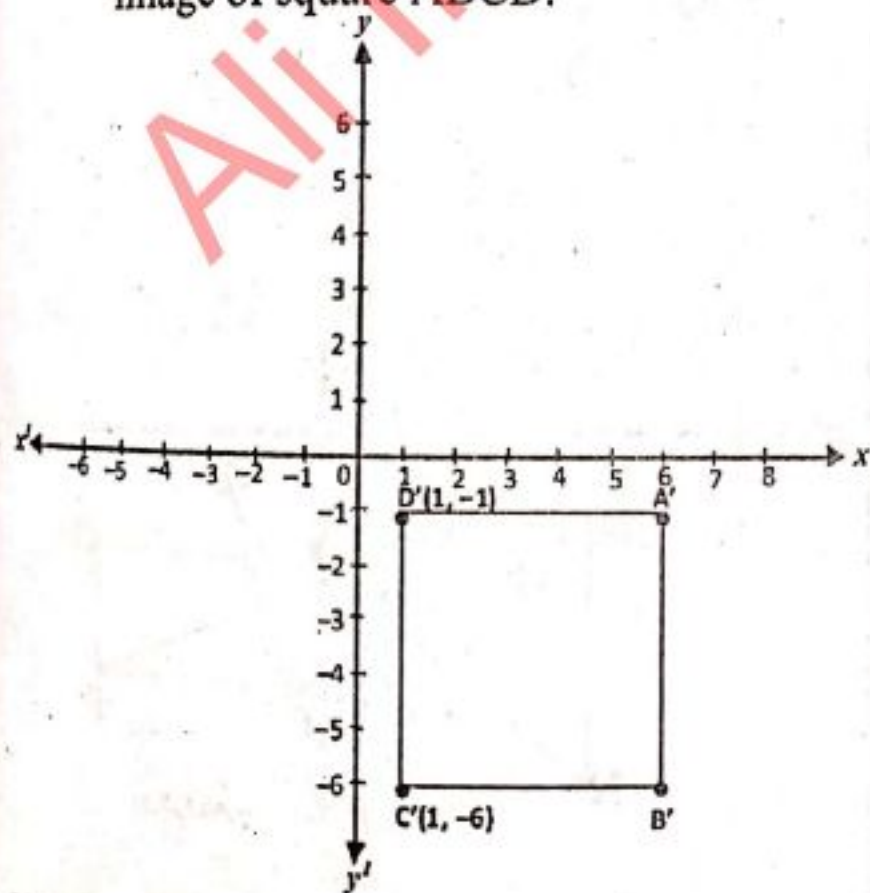


We know that
Rotating 90° clockwise about the origin.

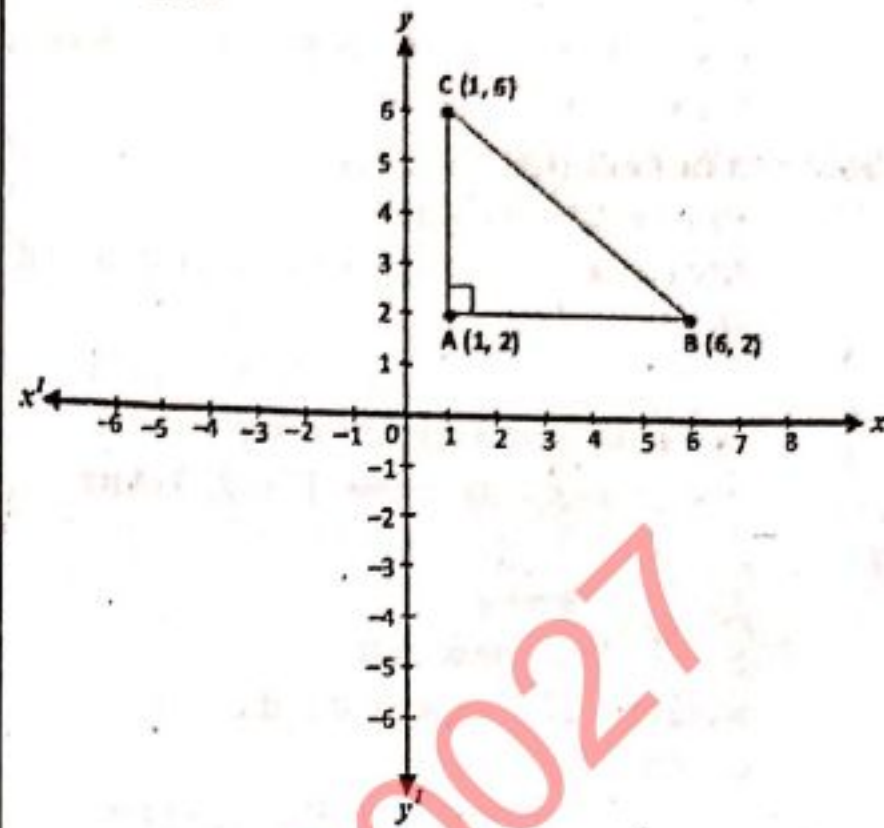
$P(x, y) \longrightarrow P'(y, -x)$ i.e. change the sign of x and then switch x, y.
Let's apply the rule to the vertices to create the new square $A'B'C'D'$.

A(1, 6) becomes $A'(6, -1)$
B(6, 6) becomes $B'(6, -6)$
C(6, 1) becomes $C'(1, -6)$
D(1, 1) becomes $D'(1, -1)$

The square $A'B'C'D'$ is the required rotated image of square ABCD.



Q.2 Draw a triangle on the coordinate plane. Then rotate it through 180° clockwise about the origin.
Sol:



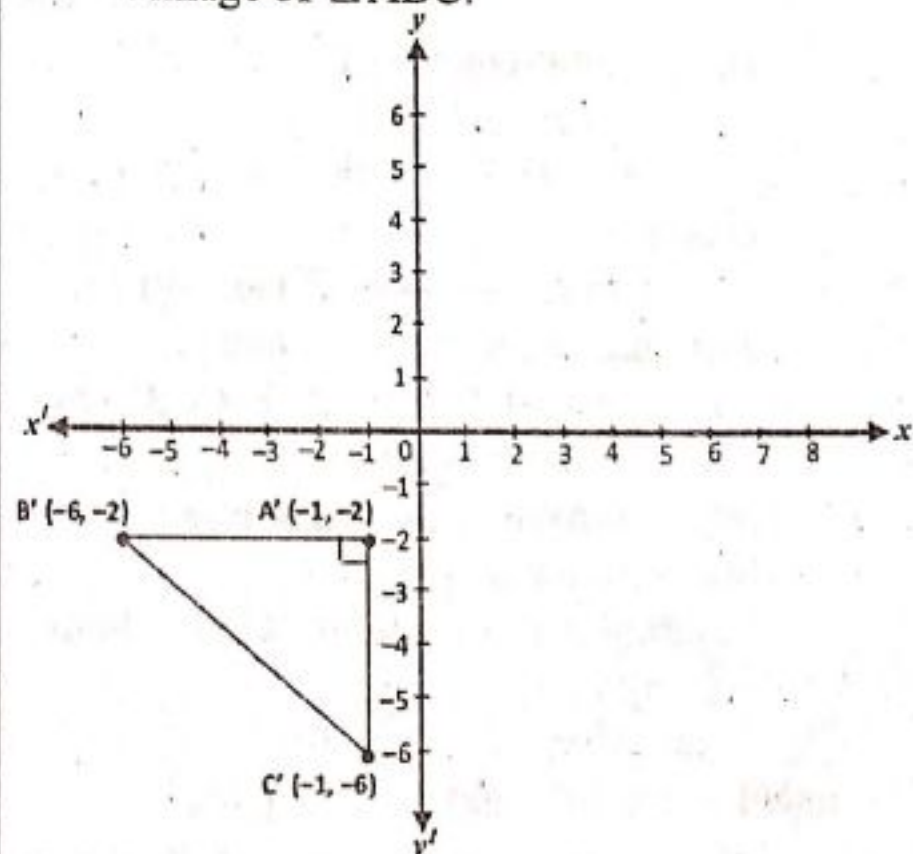
We know that
Rotating 180° clockwise about the origin.

$P(x, y) \longrightarrow P'(-x, -y)$ i.e. just change the sign of x and y.

Let's apply the rule to the vertices to create the new $\Delta A'B'C'$.

A(1, 2) becomes $A'(-1, -2)$
B(6, 2) becomes $B'(-6, -2)$
C(1, 6) becomes $C'(-1, -6)$

The $\Delta A'B'C'$ is the required rotated image of ΔABC .



Q.3 What will be the values of x and y for P' if an image having point P(2, -9) is rotated:

(a) 90° clockwise

Sol: We know that

Rotating 90° clockwise about the origin.
 $P(x, y) \rightarrow P'(y, -x)$ i.e.
 change the sign of x and then switch x, y .
 $\Rightarrow P(2, -9) \rightarrow P'(-9, -2)$ Ans

(b) 180° counterclockwise
 Sol: We know that
 Rotating 180° counterclockwise about the origin.
 $P(x, y) \rightarrow P'(-x, -y)$ i.e.
 just change the sign of x and y .
 $\Rightarrow P(2, -9) \rightarrow P'(-2, 9)$ Ans

(c) 270° clockwise
 Sol: We know that
 Rotating 270° clockwise about the origin.
 $P(x, y) \rightarrow P'(-y, x)$ i.e.
 change the sign of y and switch x, y .
 $\Rightarrow P(2, -9) \rightarrow P'(9, 2)$
 Ans

Q.4 What will be the value of x and y for P' if an image having point $P(-5, -3)$ is rotated:

(a) 90° counterclockwise
 Sol: We know that
 Rotating 90° counterclockwise about the origin.
 $P(x, y) \rightarrow P'(-y, x)$ i.e. change the sign of y and switch x, y .

$\Rightarrow P(-5, -3) \rightarrow P'(3, -5)$ Ans

(b) 180° clockwise
 Sol: We know that
 Rotating 180° clockwise about the origin.

$P(x, y) \rightarrow P'(-x, -y)$ i.e.
 Just change the sign of x and y .

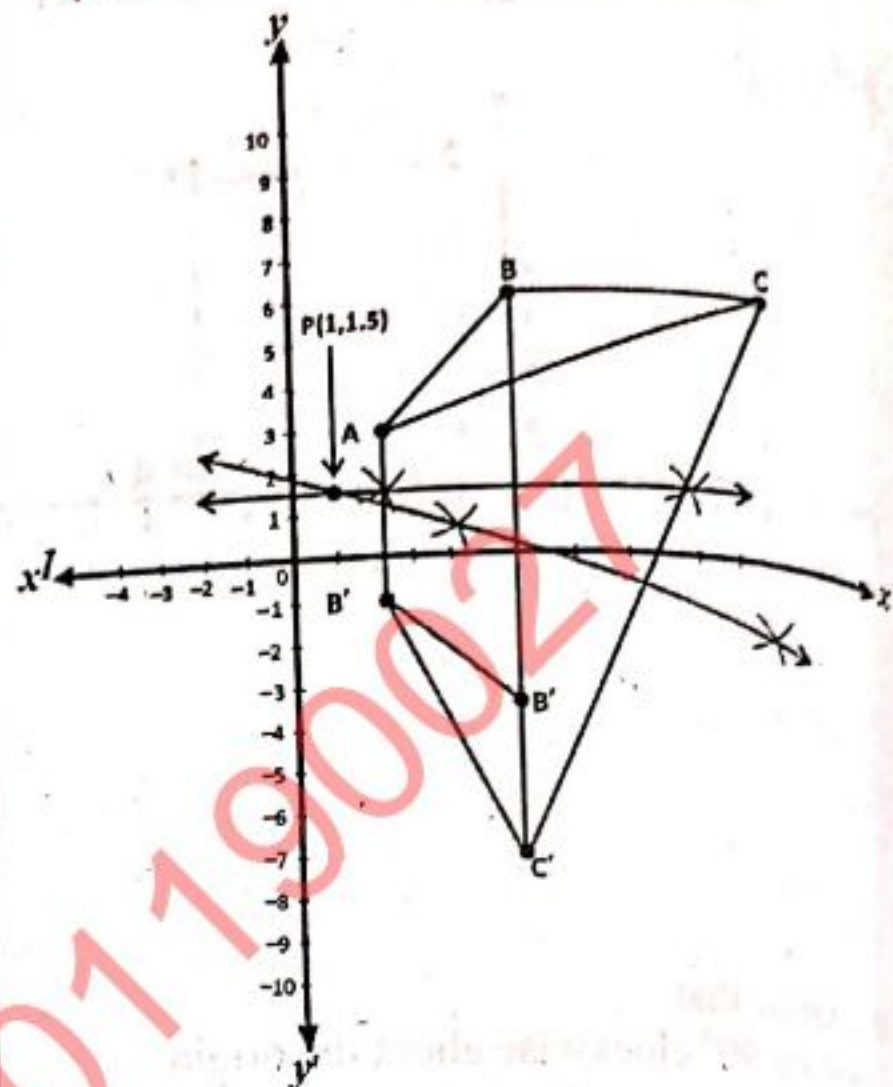
$\Rightarrow P(-5, -3) \rightarrow P'(5, 3)$ Ans

(c) 270° counterclockwise
 Sol: We know that
 Rotating 270° counterclockwise about the origin.

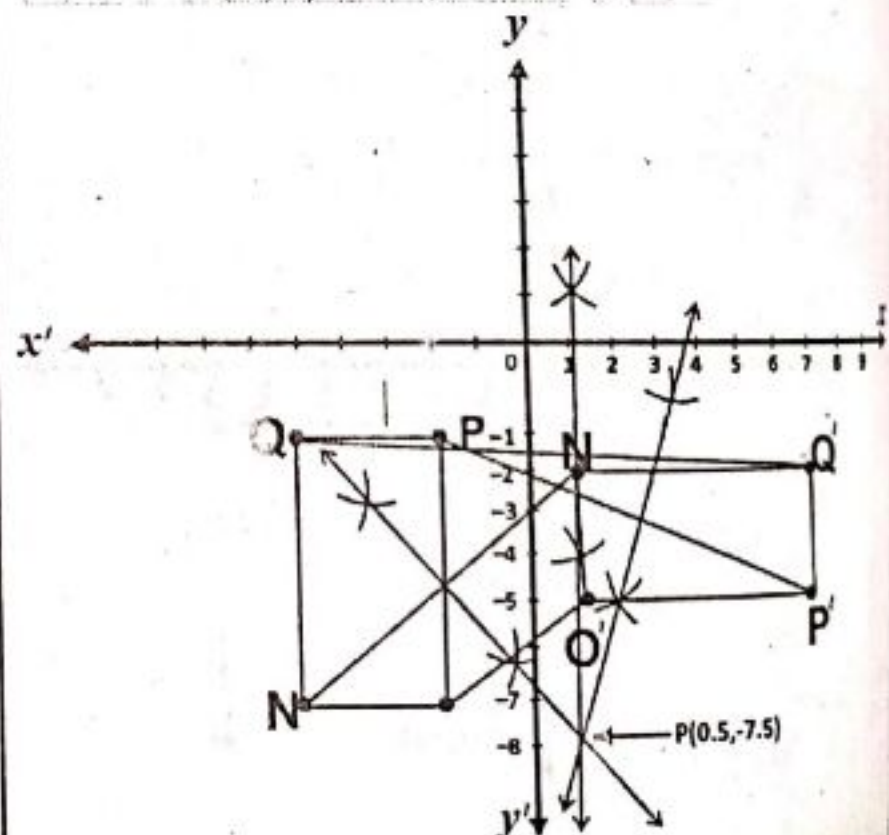
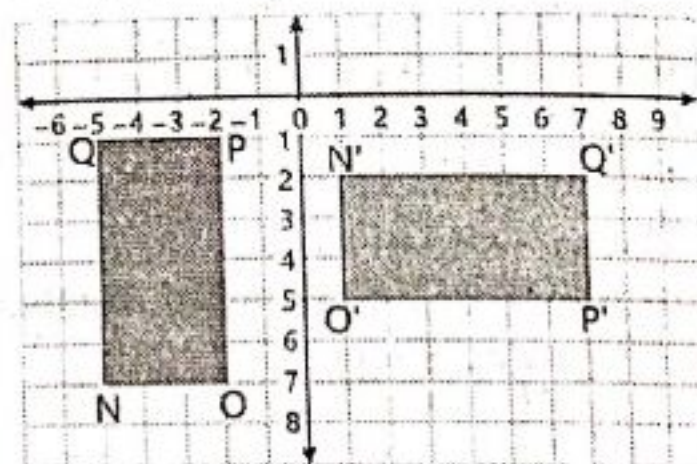
$P(x, y) \rightarrow P'(y, -x)$ i.e.
 change the sign of x and then switch x, y .
 $\Rightarrow P(-5, -3) \rightarrow P'(-3, 5)$ Ans

Q.5 Find the center of rotation for the following figures.

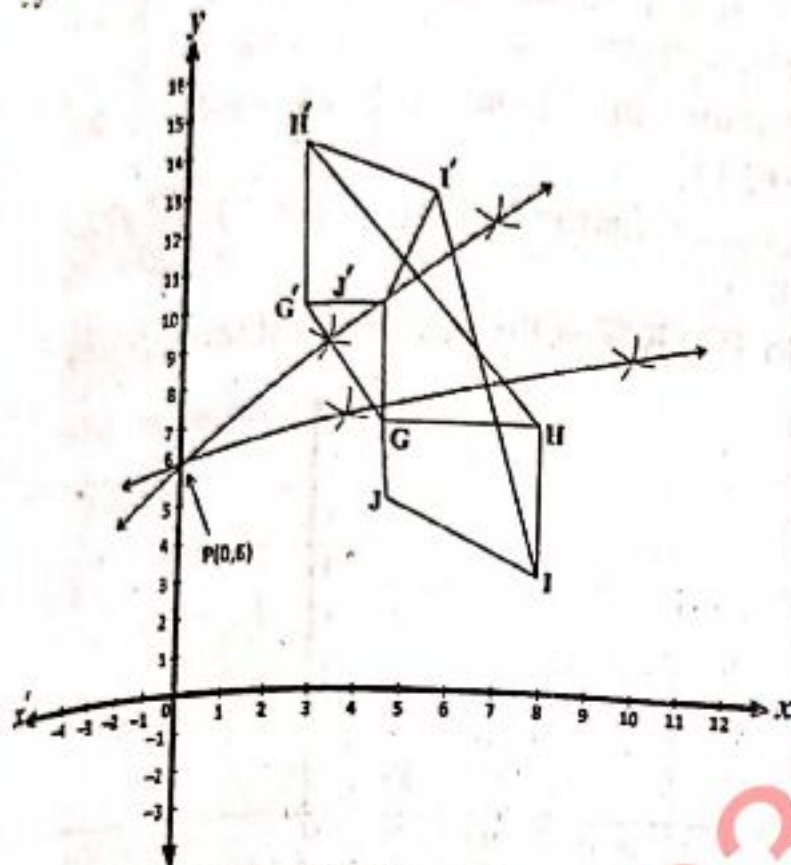
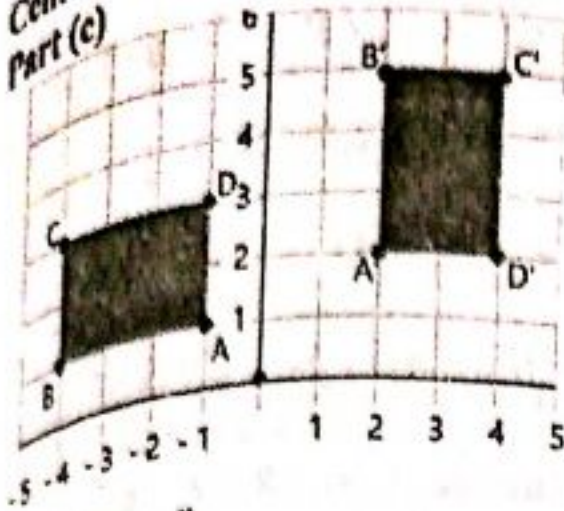
Part (a)



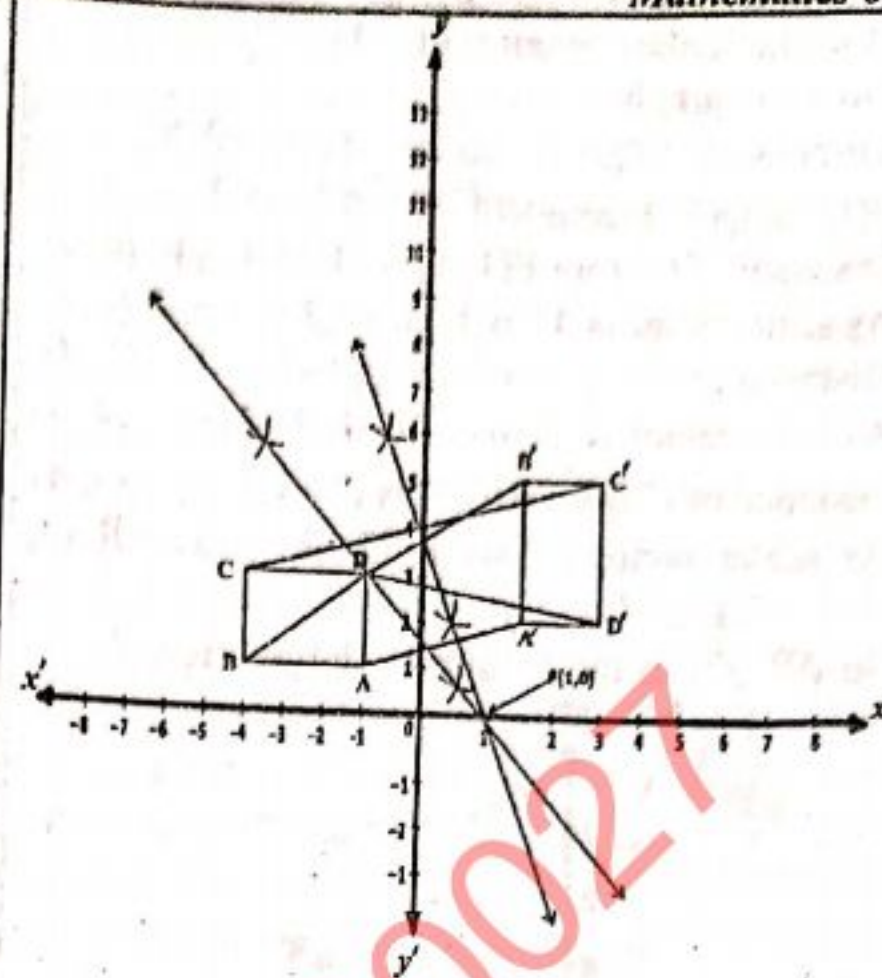
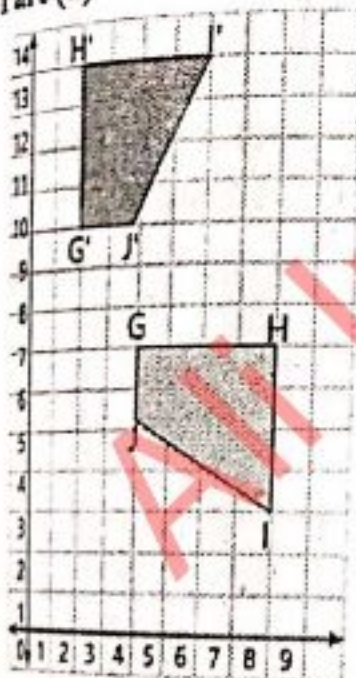
Center of rotation = $(1, 1.5)$
 Part (b)



Center of rotation = P. (0.5, -7.5)
Part (c)



Center of rotation = P (0,6) Ans
Part (d)



Center of rotation = P(1,0) Ans

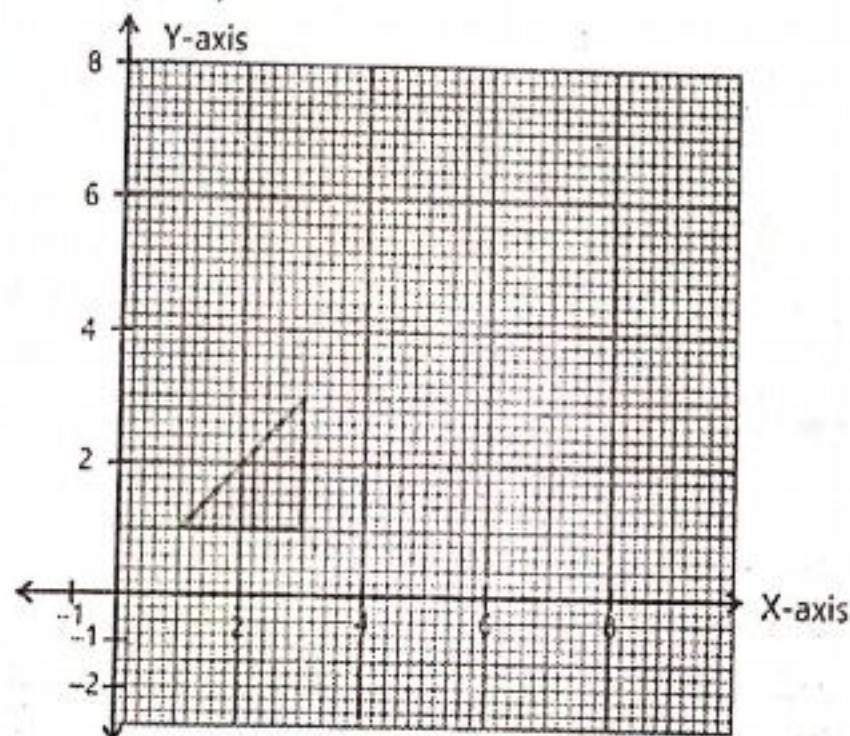
Important Note for Ex : 10.2

We know that a transformation is a way of changing the size or position of a shape or object. Enlargement is a type of transformation where the shape of the objects remains the same but the size increases.

For enlargement of a figure, we need the centre of enlargement and the scale factor for the enlargement. The scale factor describes the size of an enlargement. For example, a scale factor of 3 means that the new shape is three times the size of the original one.

Exercise 10.2 (Tb Pg 245)

Q.1 Enlarge the given figure by a scale factor of 2 about the centre of enlargement (1, -1).



Sol: Factor = 2

Centre of enlargement = $(1, -1)$

From the graph

Vertices of $\triangle PQR$

$P(1, 1)$, $Q(3, 3)$ and $R(3, 3)$

Distance of C from $P(1, 1)$ is $(1-1, 1+1) = (0, 2)$

As scale factor is 2, so $P'(0 \times 2, 2 \times 2) = P'(0, 4)$

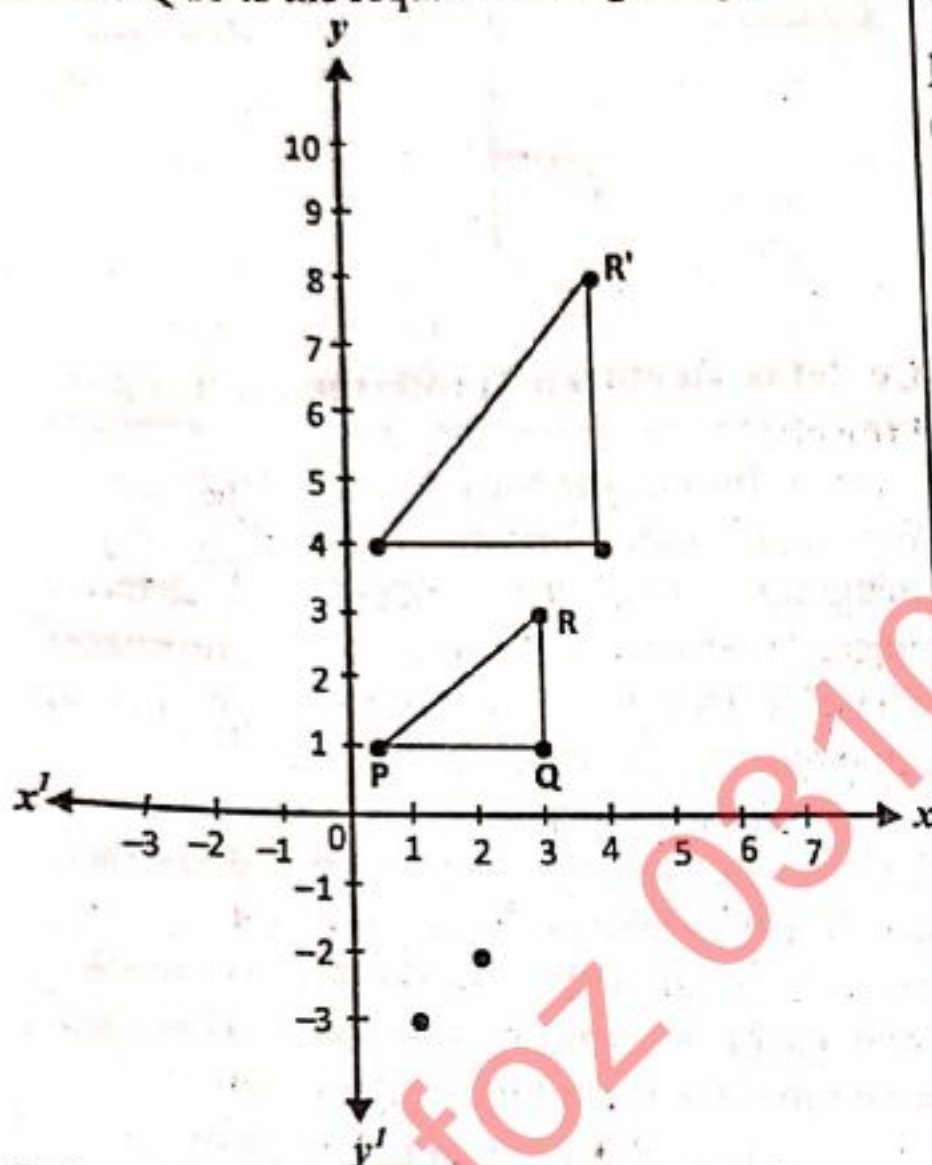
Distance of C from $Q(3, 1)$ is $(3-1, 1+1) = (2, 2)$

As scale factor is 2, so $Q'(2 \times 2, 2 \times 2) = Q'(4, 4)$

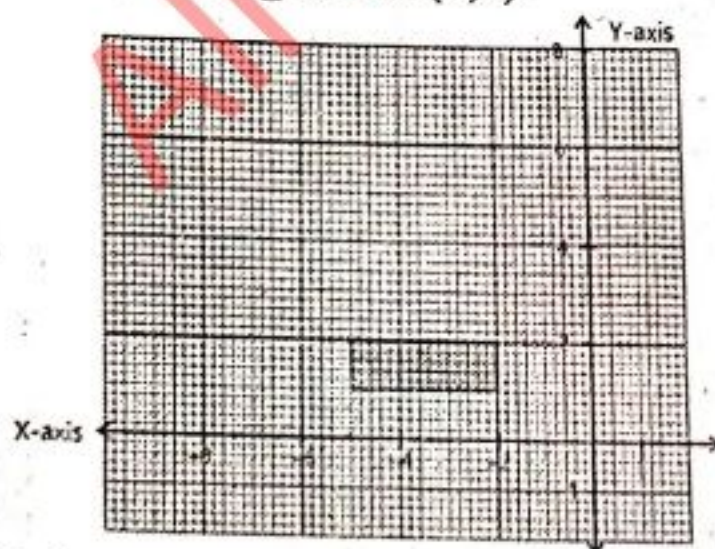
Distance of C from $R(3, 3)$ is $(3-1, 3+1) = (2, 4)$

As scale factor is 2, so $R'(2 \times 2, 4 \times 2) = R'(4, 8)$

So $\triangle P'Q'R'$ is the required enlarged figure



Q.2 Enlarge the given figure by a scale factor of 3 about the centre of enlargement $(1, 1)$.



Sol: From the graph

Vertices of $\triangle PQR$

$P(-5, 1)$, $Q(-2, 1)$, $R(-2, 2)$ and $S(-5, 2)$ are the vertices of a rectangle PQRS.

Scale factor = 3

Centre of enlargement = $(1, 1)$

Distance of C from $P(-5, 1)$ is $(-5-1, 1-1) = (-6, 0)$

As scale factor is 3, so $P'(-6 \times 3, 0 \times 3) = P'(-18, 0)$

Distance of C from $Q(-2, 1)$ is $(-2-1, 1-1) = (-3, 0)$

As scale factor is 3, so $Q'(-3 \times 3, 0 \times 3) = Q'(-9, 0)$

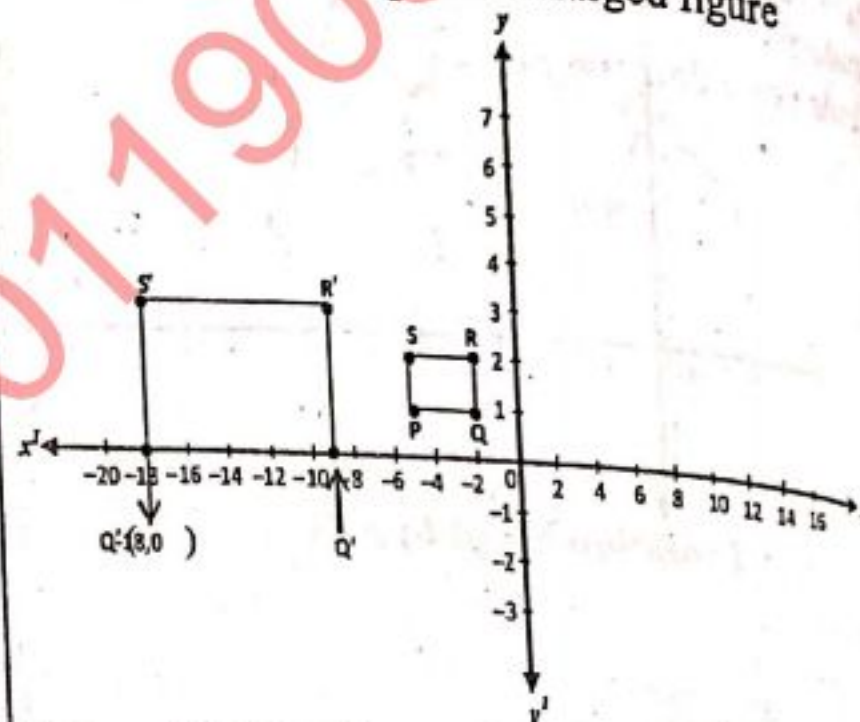
Distance of C from $R(-2, 2)$ is $(-2-1, 2-1) = (-3, 1)$

As scale factor is 3, so $R'(-3 \times 3, 1 \times 3) = R'(-9, 3)$

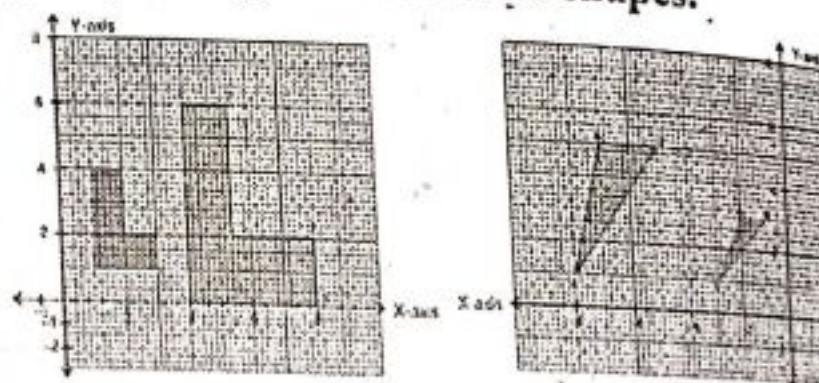
Distance of C from $S(-5, 2)$ is $(-5-1, 2-1) = (-6, 1)$

As scale factor is 3, so $S'(-6 \times 3, 1 \times 3) = S'(-18, 3)$

So $P'Q'R'S'$ is the required enlarged figure



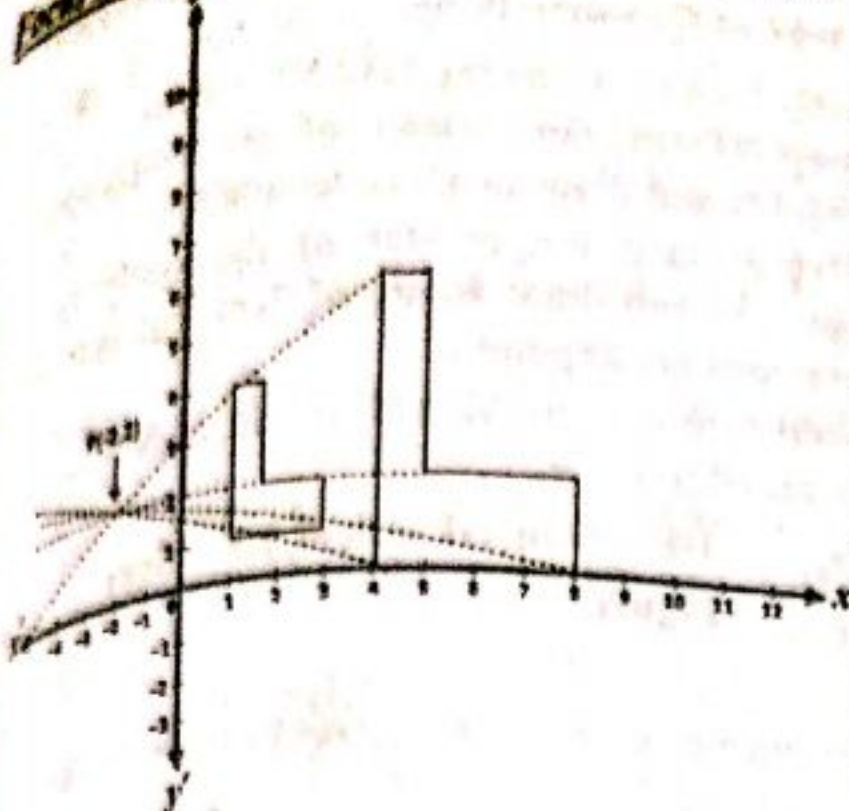
Q.3 Finding the scale factor and center of enlargement of these shapes.



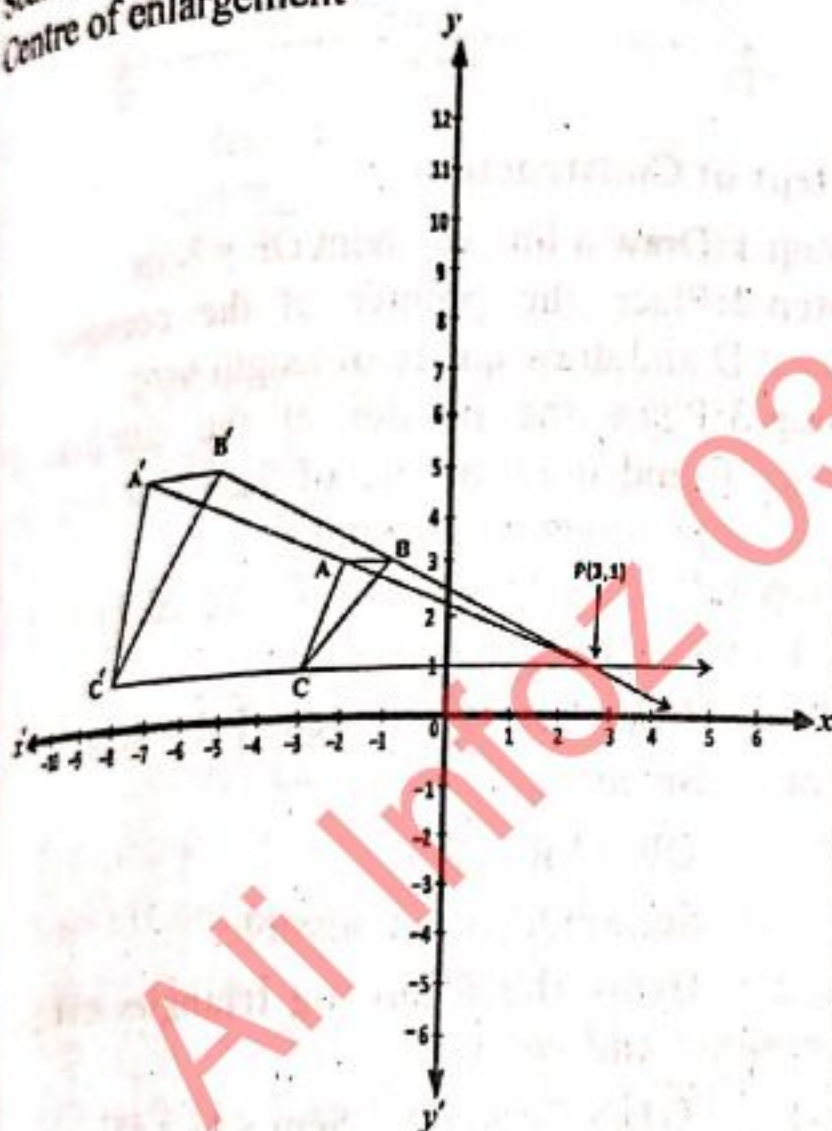
Sol: Part (a)

Scale factor =

Centre of enlargement =



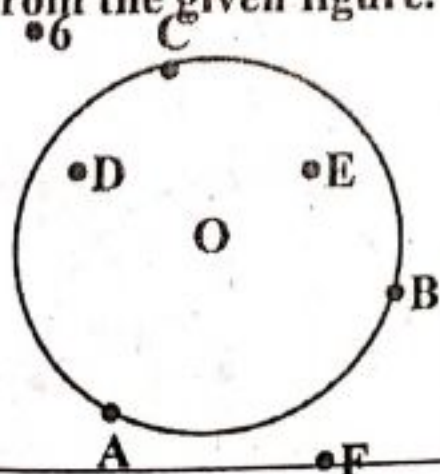
Scale factor = 3
Center of enlargement = (-2, 2) Ans
Part (b)
Scale factor =
Centre of enlargement =



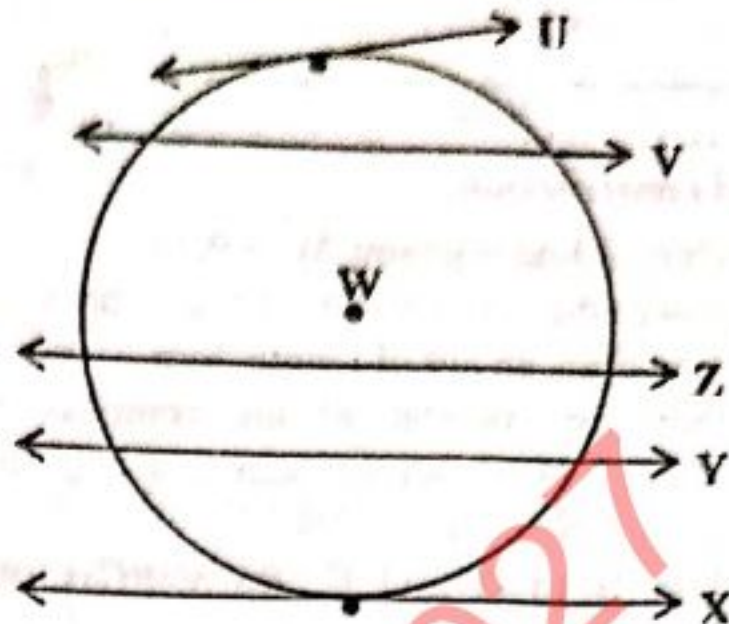
Scale factor = 4
Center of enlargement = (3, 1) Ans

Exercise 10.3 (Tb Pg 248)

- Q.1 Sort out points from the given figure.
(i) Interior point
Sol: D, O, E Ans
(ii) Exterior point
Sol: F, G Ans
(iii) Concyclic point
Sol: A, B, C Ans

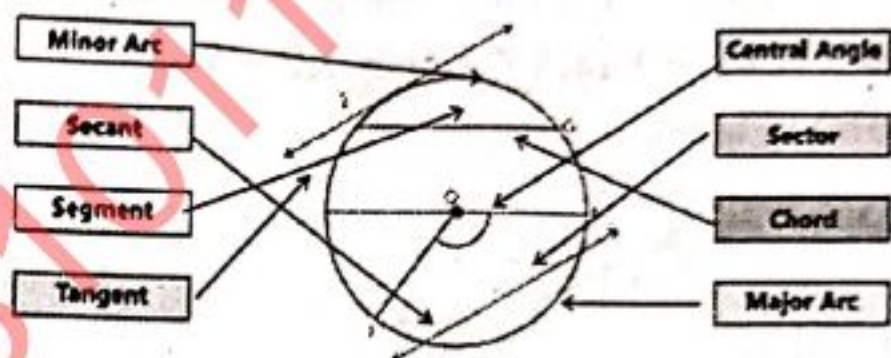


Q.2 Observe the given figure and write the name of secants and tangents.



Sol: U and X are tangent lines.
V, Z and Y are secant lines

Q.3 Match the labels with the correct part of the circle.



Important Note for Ex: 10.4

A geometrical shape that has 3 sides and three angles is called a triangle. The word triangle is made up of two words tri and angle. Tri means three so, it's a figure that has three angles. Triangles are classified in two ways.

- (a) With respect to their sides (equilateral triangle, isosceles triangle and scalene triangle)
(b) With respect to their angles (acute angled triangle, obtuse angled triangle and right angled triangle).

Triangle Inequality Property:

In any triangle, the sum of the length of any two sides is always greater than the length of the third side.

Pythagoras Theorem:

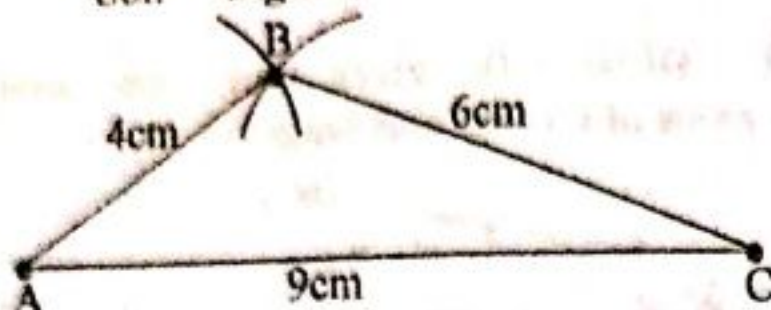
$$(\text{Hyp})^2 = (\text{Base})^2 + (\text{Perp})^2$$

Exercise 10.4 (Tb Pg 253)

Q.1 Draw the following triangles using a compass and ruler. (if possible)

- (a) $\overline{AB} = 4\text{cm}$, $\overline{AC} = 9\text{cm}$, $\overline{BC} = 6\text{cm}$

Sol: Figure:



Steps of construction:

Step 1: Draw a line segment $\overline{AC} = 9\text{cm}$.

Step 2: Place the pointer of the compass at point A and draw an arc of length 4cm.

Step 3: Place the pointer of the compass at point C and draw an arc of 6cm that cuts the previous arc at point B.

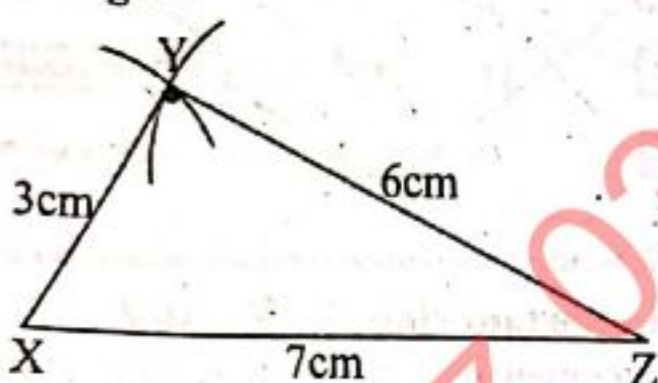
Step 4: Join B to A and C. So, $\triangle ABC$ is the required triangle.(b) $\overline{JK} = 2\text{cm}, \overline{KL} = 8\text{cm}, \overline{JL} = 5\text{cm}$

Sol: Since

$$\overline{JK} + \overline{JL} < \overline{KL}$$

So, $\triangle JKL$ is not possible(c) $\overline{XY} = 3\text{cm}, \overline{YZ} = 6\text{cm}, \overline{XZ} = 7\text{cm}$

Sol: Figure



Steps of Constructions:

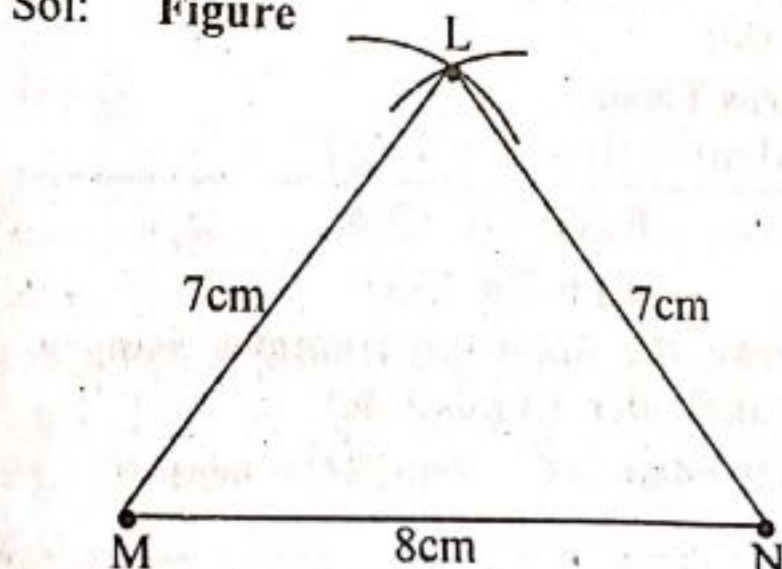
Step 1: Draw a line segment $\overline{XZ} = 7\text{cm}$.

Step 2: Place the pointer of the compass at point X and draw an arc of length 3cm.

Step 3: Place the pointer of the compass at point Z and draw an arc of 6cm that cuts the previous arc at point Y.

Step 4: Join Y to X and Z. So, $\triangle XYZ$ is the required triangle.(d) $\overline{LN} = 7\text{cm}, \overline{LM} = 7\text{cm}, \overline{MN} = 8\text{cm}$

Sol: Figure



Steps of Constructions:

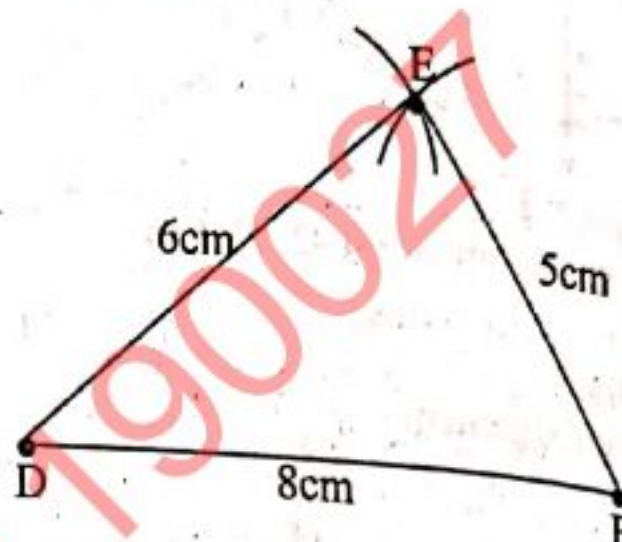
Step 1: Draw a line segment $\overline{XN} = 8\text{cm}$.

Step 2: Place the pointer of the compass at point N and draw an arc of length 7cm.

Step 3: Place the pointer of the compass at point M and draw an arc of 7cm that cuts the previous arc at point L.

Step 4: Join L to M and N. So, $\triangle LMN$ is the required triangle.(e) $\overline{DE} = 6\text{cm}, \overline{DF} = 8\text{cm}, \overline{EF} = 5\text{cm}$

Sol: Figure



Steps of Constructions:

Step 1: Draw a line segment $\overline{DF} = 8\text{cm}$.

Step 2: Place the pointer of the compass at point D and draw an arc of length 6cm.

Step 3: Place the pointer of the compass at point F and draw an arc of 5cm that cuts the previous arc at point E.

Step 4: Join E to D and F. So, $\triangle DEF$ is the required triangle.(f) $\overline{PQ} = 9\text{cm}, \overline{QR} = 4\text{cm}, \overline{PR} = 4\text{cm}$

Sol: Since

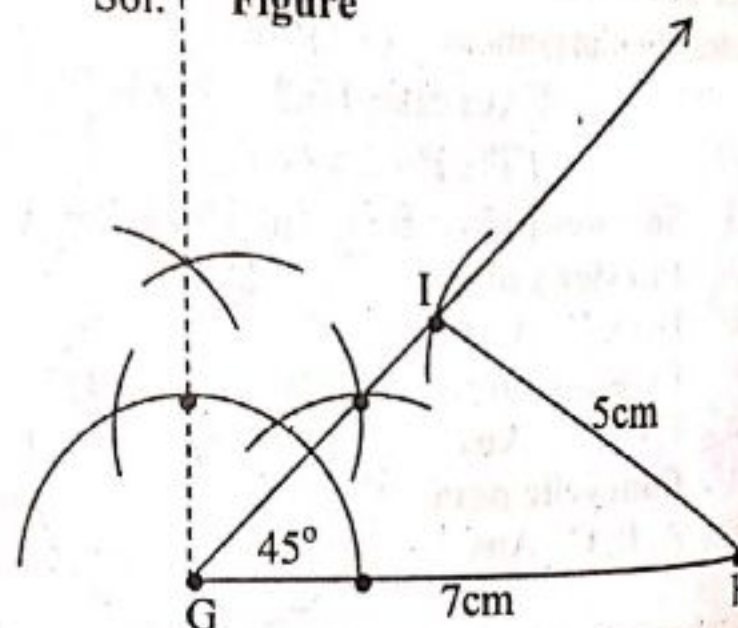
$$\overline{QR} + \overline{PR} < \overline{PQ}$$

So, $\triangle PQR$ is not possible.

Q.2 Draw the following triangles using a compass and ruler.

(a) $\overline{GH} = 7\text{cm}, \overline{HI} = 5\text{cm}, \angle G = 45^\circ$

Sol: Figure

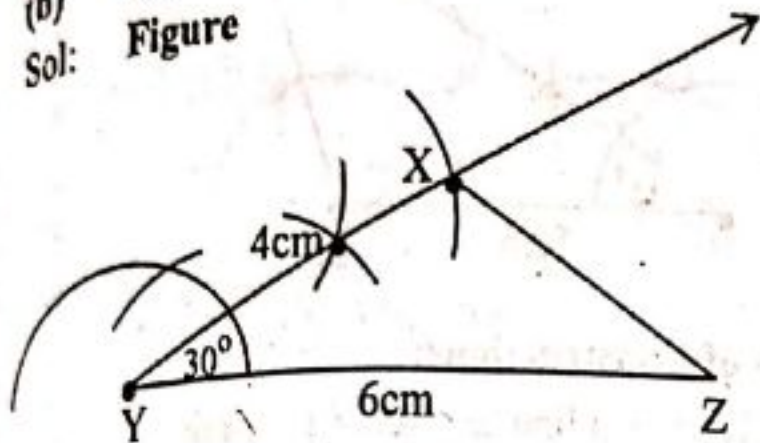


Steps of Constructions:Step 1: Draw a line segment $\overline{GH} = 7\text{cm}$.Step 2: Draw an angle of 45° at point G.

Step 3: Place the pointer of the compass at point H and draw an arc of length 5cm which cuts the arm of the angle at point I.

Step 4: Join I to H. So, $\triangle GHI$ is the required triangle.(b) $\overline{XY} = 4\text{cm}$, $\overline{YZ} = 6\text{cm}$, $\angle Y = 30^\circ$

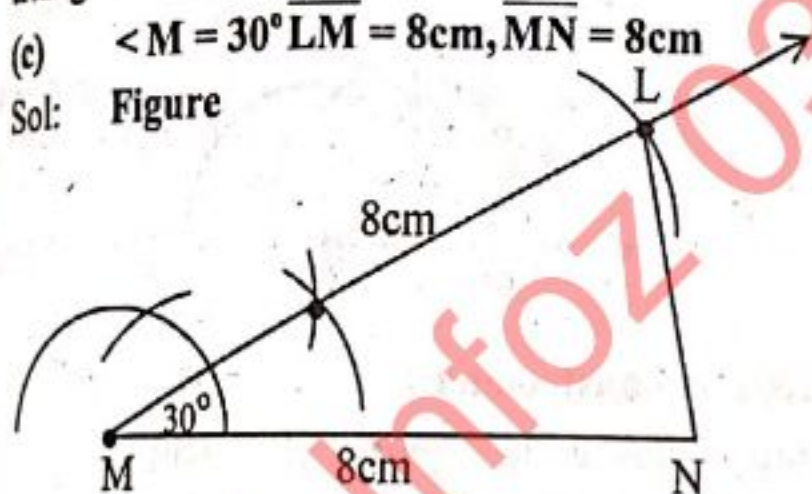
Sol: Figure

**Steps of Constructions:**Step 1: Draw a line segment $\overline{YZ} = 6\text{cm}$.Step 2: Draw an angle of 30° at point Y.

Step 3: Place the pointer of the compass at point Y and draw an arc of 4cm which cuts the arm of the angle at point X.

Step 4: Join X to Z. So, $\triangle XYZ$ is the required triangle.(c) $\angle M = 30^\circ$, $\overline{LM} = 8\text{cm}$, $\overline{MN} = 8\text{cm}$

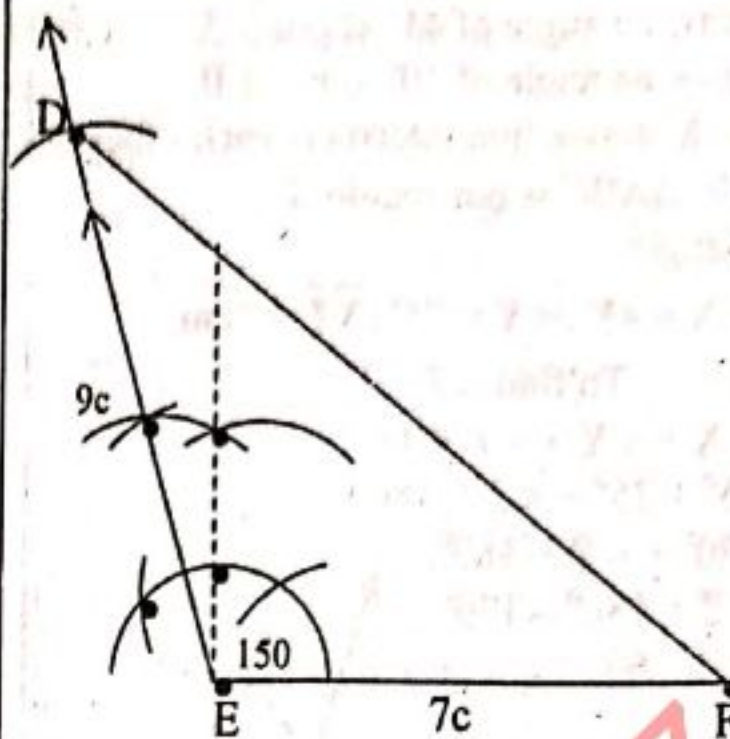
Sol: Figure

**Steps of Constructions:**Step 1: Draw a line segment $\overline{MN} = 8\text{cm}$.Step 2: Draw an angle of 30° at point M.

Step 3: Place the pointer of the compass at point M and draw an arc of 8cm, which cuts the arm of the angle at point L.

Step 4: Join L to N. So, $\triangle LMN$ is the required triangle.(d) $\overline{DE} = 9\text{cm}$, $\angle E = 105^\circ$, $\overline{EF} = 7\text{cm}$

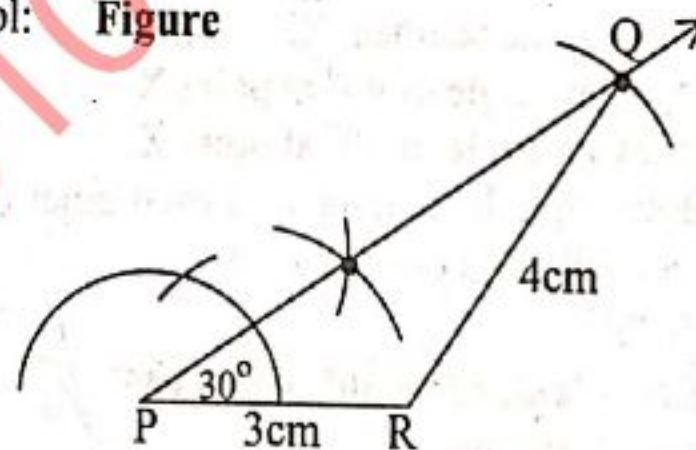
Sol: Figure

**Steps of Constructions:**Step 1: Draw a line segment $\overline{EF} = 7\text{cm}$.Step 2: Draw an angle of 105° at point E.

Step 3: Place the pointer of the compass at point E and draw an arc of 9cm, which cuts the angle line at point D.

Step 4: Join D to F. So, $\triangle DEF$ is our required triangle.(e) $\angle P = 30^\circ$, $\overline{QR} = 4\text{cm}$, $\overline{PR} = 3\text{cm}$

Sol: Figure

**Steps of Constructions:**Step 1: Draw a line segment $\overline{PR} = 3\text{cm}$.Step 2: Draw an angle of 30° at point P.

Step 3: Place the pointer of the compass at point R and draw an arc of 4cm, which cuts the angle line at point Q.

Step 4: Join Q to R. So, $\triangle PQR$ is our required triangle.**Q.3** Draw the following triangles using a compass and ruler.

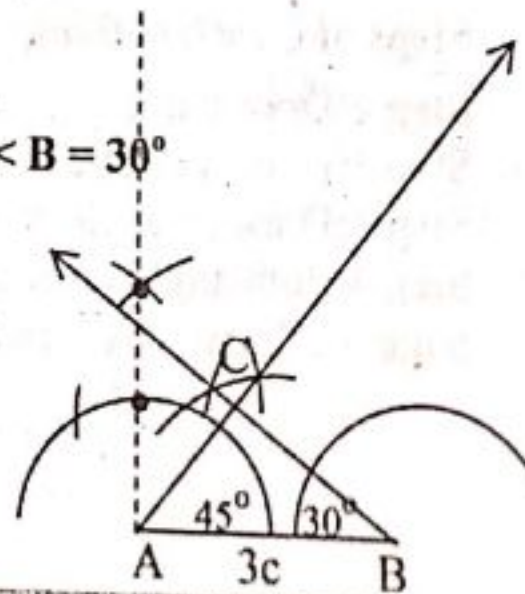
(a)

 $\overline{AB} = 3\text{cm}$, $\angle A = 45^\circ$, $\angle B = 30^\circ$

Sol: Figure

Steps of

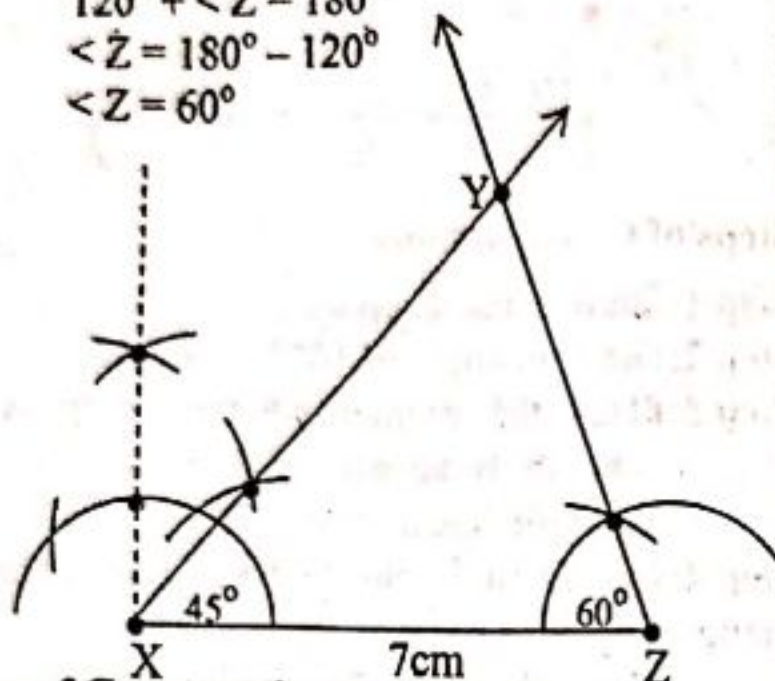
Constructions:

Step 1: Draw a line segment $\overline{AB} = 3\text{cm}$.

Step 2: Draw an angle of 45° at point A.
 Step 3: Draw an angle of 30° at point B.
 Step 4: Both angle lines intersect each other at point C. So, $\triangle ABC$ is our required triangle.

(b) $\angle X = 45^\circ, \angle Y = 75^\circ, \overline{XZ} = 7\text{cm}$

Sol: To find $\angle Z$
 $\angle X + \angle Y + \angle Z = 180^\circ$
 $45^\circ + 75^\circ + \angle Z = 180^\circ$
 $120^\circ + \angle Z = 180^\circ$
 $\angle Z = 180^\circ - 120^\circ$
 $\angle Z = 60^\circ$

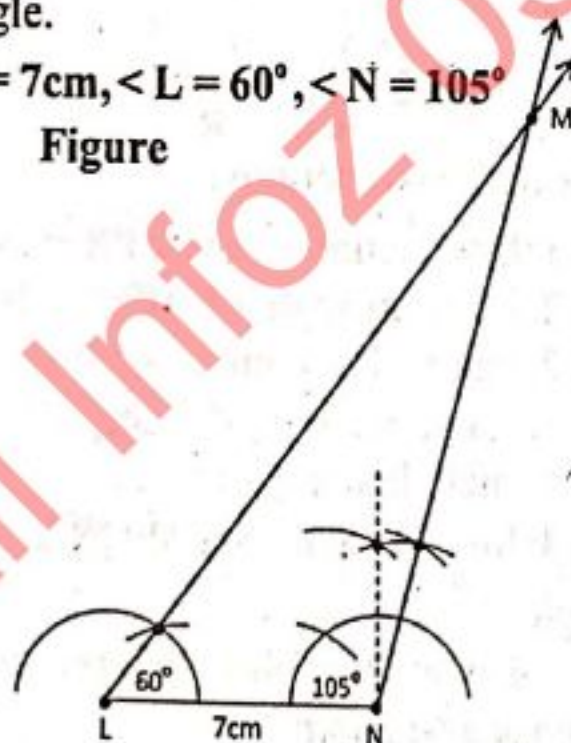


Steps of Constructions:

Step 1: Draw a line segment $\overline{XZ} = 7\text{cm}$.
 Step 2: Draw an angle of 45° at point X.
 Step 3: Draw an angle of 60° at point Z.
 Step 4: Both angle lines intersect each other at point Y. So, $\triangle XYZ$ is our required triangle.

(c) $\overline{LN} = 7\text{cm}, \angle L = 60^\circ, \angle N = 105^\circ$

Sol: Figure

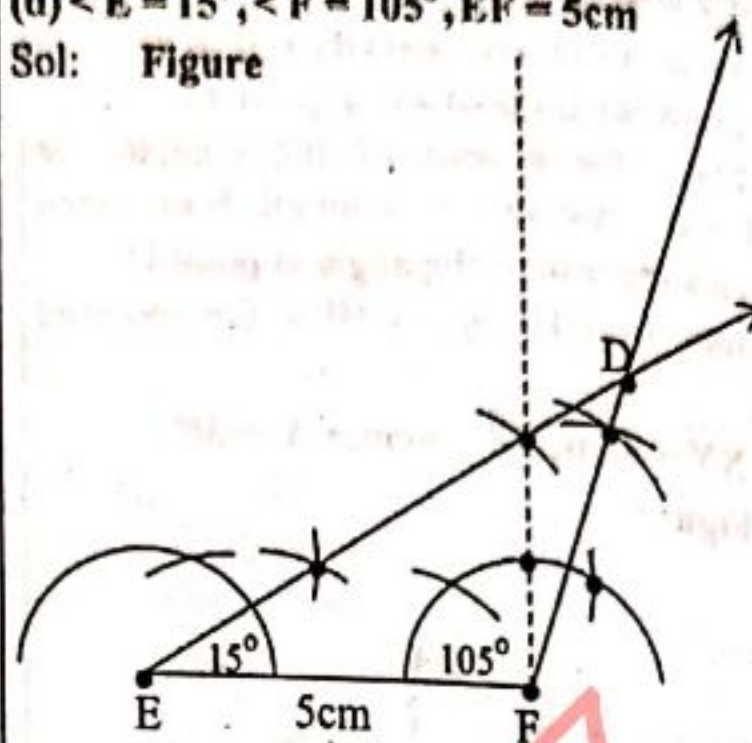


Steps of Constructions:

Step 1: Draw a line segment $\overline{LN} = 7\text{cm}$.
 Step 2: Draw an angle of 60° at point L.
 Step 3: Draw an angle of 105° at point N.
 Step 4: Both angle lines intersect each other at point M. So, $\triangle LMN$ is our required triangle.

(d) $\angle E = 15^\circ, \angle F = 105^\circ, \overline{EF} = 5\text{cm}$

Sol: Figure

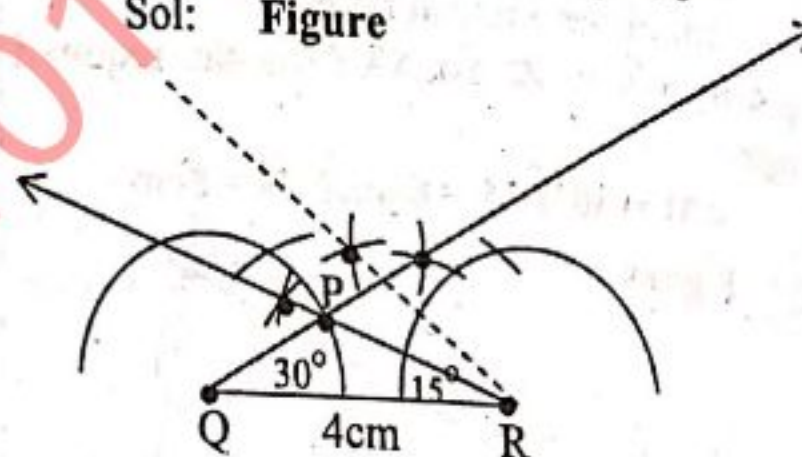


Steps of Constructions:

Step 1: Draw a line segment $\overline{EF} = 5\text{cm}$.
 Step 2: Draw an angle of 15° at point E.
 Step 3: Draw an angle of 105° at point F.
 Step 4: Both angle lines intersect each other at point D. So, $\triangle DEF$ is our required triangle.

(e) $\angle R = 15^\circ, \overline{QR} = 4\text{cm}, \angle Q = 30^\circ$

Sol: Figure



Steps of Constructions:

Step 1: Draw a line segment $\overline{QR} = 4\text{cm}$.
 Step 2: Draw an angle of 30° at point Q.
 Step 3: Draw an angle of 15° at point R.
 Step 4: Both angle lines intersect each other at point P. So, $\triangle PQR$ is our required triangle.

Q.4 Draw the following right angle triangles using a compass and ruler.

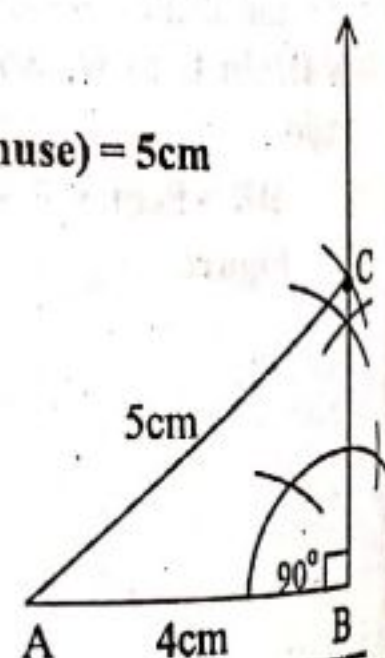
(a)

$\overline{AB} = 4\text{cm}, \overline{AC}$ (Hypotenuse) $= 5\text{cm}$

Sol: Figure

Steps of Constructions:

Step 1: Draw a line segment $\overline{AB} = 4\text{cm}$.
 Step 2: Draw an angle of 90° at point B.



Step 3: Place the pointer of the compass at point A and draw an arc of 5cm that cuts the angle line at point C.

Step 4: Join the point A to C. So, $\triangle ABC$ is the required triangle.

(b) $\overline{XY} = 2\text{cm}$, $\overline{YZ}$ (Hypotenuse) = 4cm

Sol: Figure

Steps of Constructions:

Step 1: Draw a line segment $\overline{XY} = 2\text{cm}$.

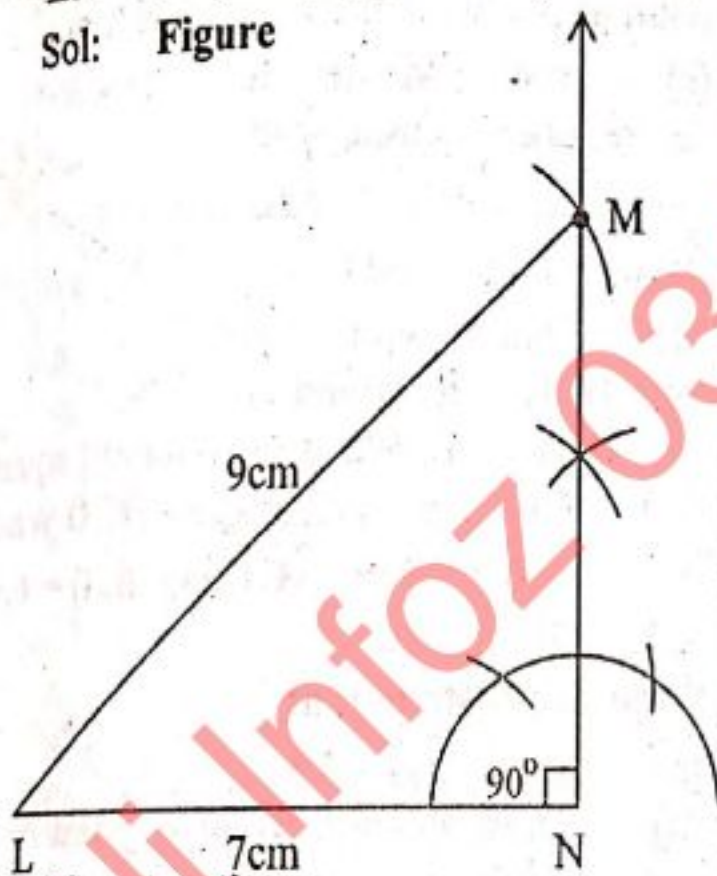
Step 2: Draw an angle of 90° at point X.

Step 3: Place the pointer of the compass at point Y and draw an arc of 4cm that cuts angle line at point Z.

Step 4: Join the point Y to Z. So, $\triangle XYZ$ is the required triangle.

(c) $\overline{LN} = 7\text{cm}$, $\overline{LM}$ (Hypotenuse) = 9cm

Sol: Figure



Steps of Constructions:

Step 1: Draw a line segment $\overline{LN} = 7\text{cm}$.

Step 2: Draw an angle of 90° at point N.

Step 3: Place the pointer of the compass at point L and draw an arc of length 9cm that cuts angle line at point M.

Step 4: Join the point M to L. So, $\triangle LMN$ is our required triangle.

(d) $\overline{DE} = 4\text{cm}$, $\overline{DF}$ (Hypotenuse) = 6cm

Sol: Figure

Steps of Constructions:

Step 1: Draw a line segment $\overline{DE} = 4\text{cm}$.

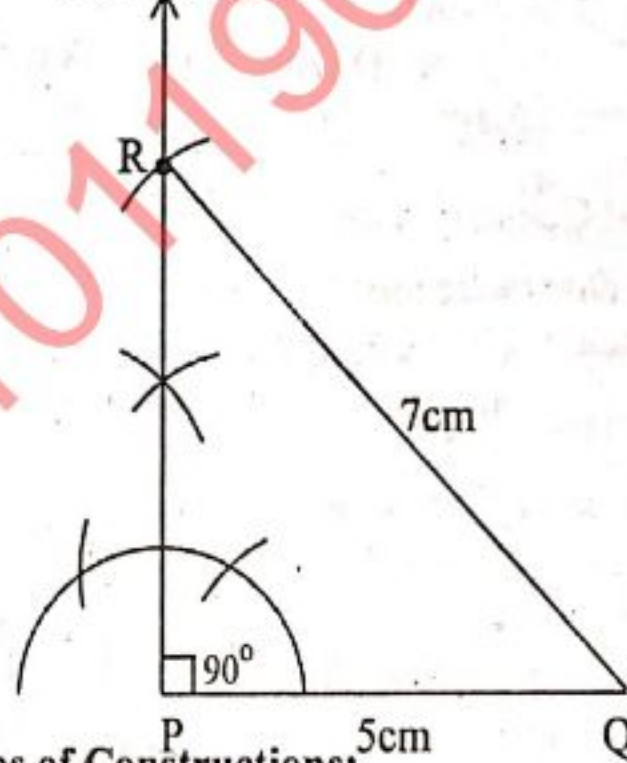
Step 2: Draw an angle of 90° at point E.

Step 3: Place the pointer of the compass at point D and draw an arc of length 6cm that cuts angle line at point F.

Step 4: Join the point F to D. So, $\triangle DEF$ is our required triangle.

(e) $\overline{PQ} = 5\text{cm}$, $\overline{QR}$ (Hypotenuse) = 7cm

Sol: Figure



Steps of Constructions:

Step 1: Draw a line segment $\overline{PQ} = 5\text{cm}$.

Step 2: Draw an angle of 90° at point P.

Step 3: Place the pointer of the compass at point Q and draw an arc of length 7cm that cuts angle line at point R.

Step 4: Join the point Q to R. So, $\triangle PQR$ is our required triangle.

Exercise 10.5

(Tb Pg 257)

Q.1 Construct the square when the lengths of their diagonals are given below:

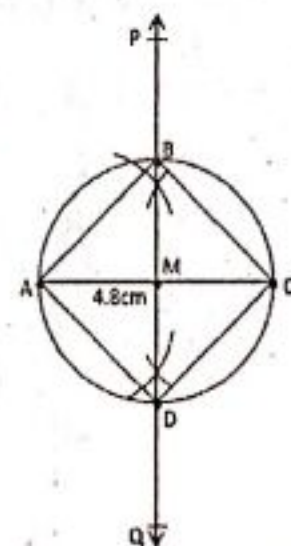
(i) 4.8cm

Sol: Figure:

Steps of construction:

(a) Draw $\overline{AC} = 4.8\text{cm}$.

(b) Draw $\overline{PQ}$ the right



bisector of $\overline{AC}$ at point M.

(c) With M as a centre, draw a circle with radius $\overline{MA}$ which cuts $\overline{PQ}$ at points B and D.

(d) Join A with B, B with C, C with D and D with A. Here, ABCD is the required square.

(ii) 5.2cm

Sol: Figure:

Steps of construction:

(a) Draw

$\overline{AC} = 5.2\text{cm}$.

(b) Draw $\overline{PQ}$ the right bisector of $\overline{AC}$ at point M.

(c) With M as a centre, draw a circle with radius $\overline{MA}$ which cuts $\overline{PQ}$ at points B and D.

(d) Join A with B, B with C, C with D and D with A. Here, ABCD is the required square.

(iii) 5.6cm

Sol: Figure:

Steps of construction:

(a) Draw $\overline{AC} = 5.6\text{cm}$.

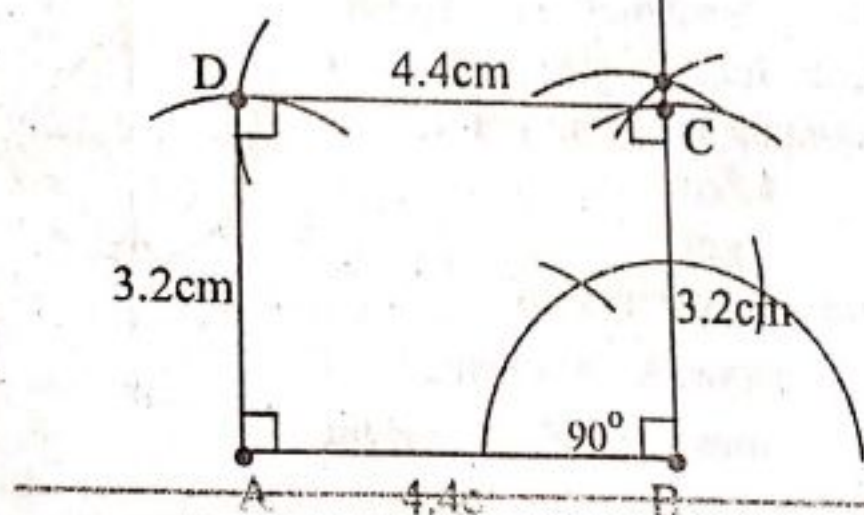
(b) Draw $\overline{PQ}$ the right bisector of $\overline{AC}$ at point M.

(c) With M as a centre, draw a circle with radius $\overline{MA}$ which cuts $\overline{PQ}$ at points B and D.

(d) Join A with B, B with C, C with D and D with A. Here, ABCD is the required square.

Q.2 Construct a rectangle ABCD when $\overline{AB} = 4.4\text{cm}$ and $\overline{BC} = 3.2\text{cm}$

Sol: Figure:



Steps of construction:

(i) Draw $\overline{AB} = 4.4\text{cm}$.

(ii) Draw an angle of 90° at point B.

(iii) With B as a centre draw an arc of 3.2cm which cuts angle line at points C.

(iv) With A as a centre draw an arc of 3.2cm at point A.

(v) Taking C as a centre, draw an arc of 4.4cm, which cuts previous arc at point D.

(vi) Join A with D and C with D. So, ABCD is the required rectangle.

Q.3 Construct a square EFGH whose diagonal $\overline{EH} = 6\text{cm}$.

Sol: Figure:

Steps of construction:

(a) Draw $\overline{EH} = 6\text{cm}$.

(b) Draw $\overline{PQ}$ the right bisector of $\overline{EH}$ at point M.

(c) With M as a centre, draw a circle with radius $\overline{ME}$ which cuts $\overline{PQ}$ at points F and G.

(d) Join E with F, F with H, H with G and G with E. Here, EFHG is the required square.

Q.4 Construct rectangle ABCD when $\overline{AB} = 5.6\text{cm}$, $\overline{AC}$ (diagonal) = 6.4cm

Sol: Figure

Steps of construction:

(a) Draw $\overline{AB} = 5.6\text{cm}$.

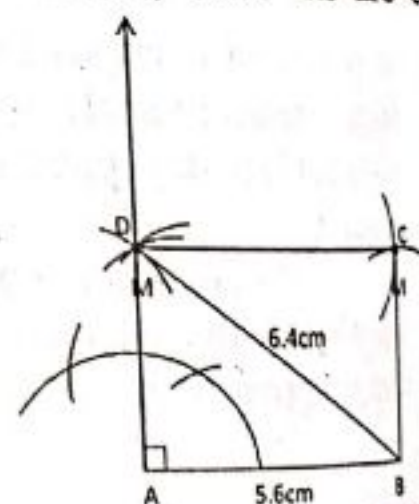
(b) Draw an angle of 90° at point A.

(c) With B as a centre, draw an arc of radius 6.4cm which cuts angle line at point D.

(d) With D as a centre, draw an arc of radius 5.6cm.

(e) Measure the length AD and taking B as a centre, draw an arc of radius equal to AD. Mark the point of intersection of these two arcs as C.

(f) Join C with D and C with B. Here ABCD is the required rectangle.



$\overline{AB} = 5.2\text{cm}$, $\overline{AC}$ (diagonal) $= 7.2\text{cm}$

(ii) Sol: Figure

Steps of construction:

Draw

(a) $\overline{AB} = 5.2\text{cm}$.

(b) Draw an angle of 90° at point A.

(c) With B as a centre, draw an arc of radius

7.2cm which cuts angle line at point D.

(d) With D as a centre, draw an arc of radius 5.2cm .

(e) Measure the length $\overline{AD}$ and taking B as

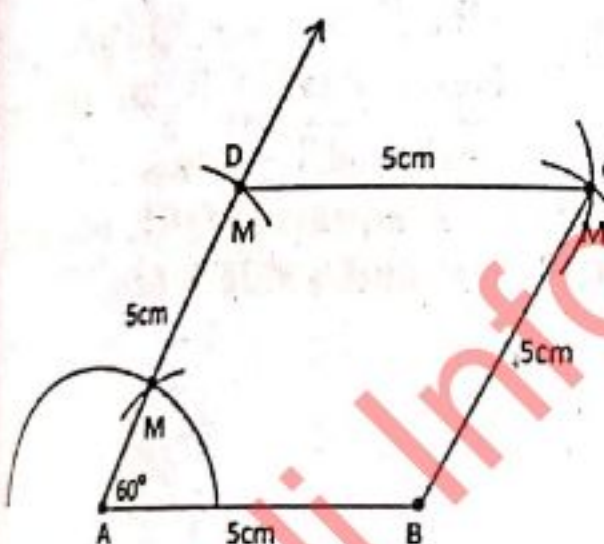
a centre, draw an arc of radius equal to $\overline{AD}$. Mark the point of intersection of these two arcs as C.

(f) Join C with D and C with B. Here ABCD is the required rectangle.

Q.5 Construct rhombus ABCD when the measurement of its sides and included angle are given.

(i) $\overline{AB} = 5\text{cm}$, $\angle A = 60^\circ$

Sol: Figure



Steps of construction:

(a) Draw $\overline{AB} = 5\text{cm}$.

(b) Draw an angle of 60° at point A.

(c) With A as a centre, draw an arc of radius 5cm which cuts angle line at point D.

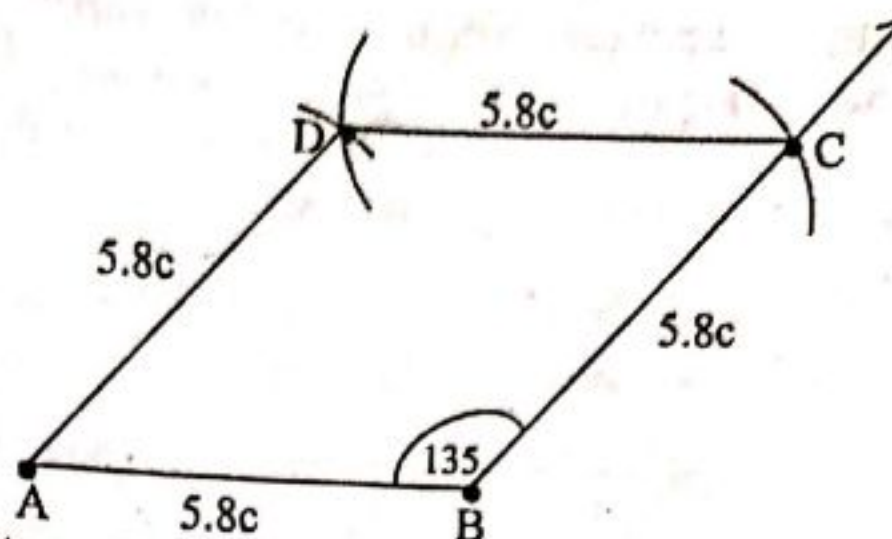
(d) With B as a centre, draw an arc of 5cm .

(e) With D as a centre, draw an arc of 5cm , which intersects previous arc at point C.

(f) Join C with D and C with B. ABCD is the required rhombus.

(ii) $\overline{AB} = 5.8\text{cm}$, $\angle B = 135^\circ$

Sol: Figure



Steps of construction:

(a) Draw $\overline{AB} = 5.8\text{cm}$.

(b) Draw an angle of 135° at point B.

(c) With B as a centre, draw an arc of radius 5.8cm which cuts angle line at point C.

(d) With A as a centre, draw an arc of 5.8cm .

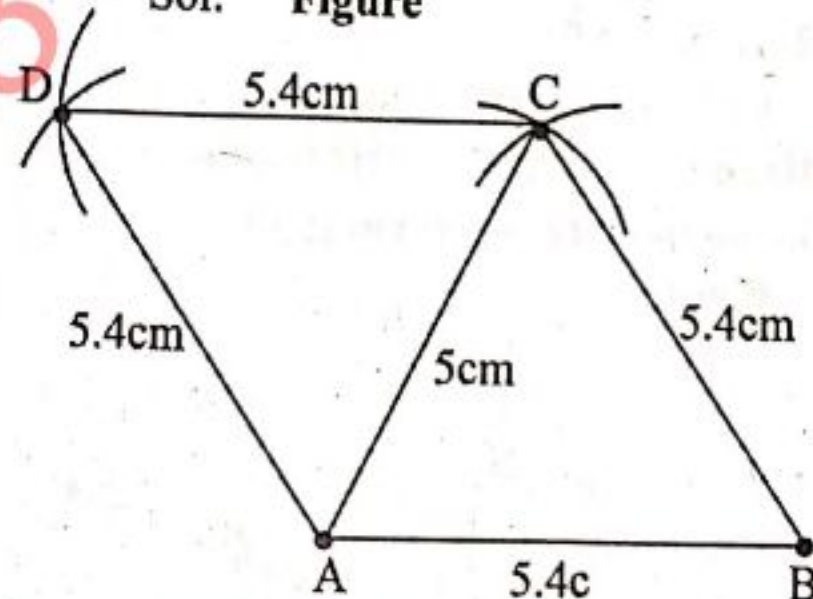
(e) With C as a centre, draw an arc of 5.8cm , which intersects previous arc at point D.

(f) Join D with C and D with A. ABCD is the required rhombus.

Q.6 Construct rhombus ABCD when measure of its side and a diagonal are given.

(i) $\overline{AB} = 5.4\text{cm}$, $\overline{AC}$ (diagonal) $= 5\text{cm}$

Sol: Figure



Steps of construction:

(a) Draw $\overline{AB} = 5.4\text{cm}$.

(b) Taking A as a centre, draw an arc of 5cm .

(c) Taking B as a centre, draw an arc of 5.4cm , which intersects previous arc at point C.

(d) Taking C as a centre, draw an arc of 5.4cm .

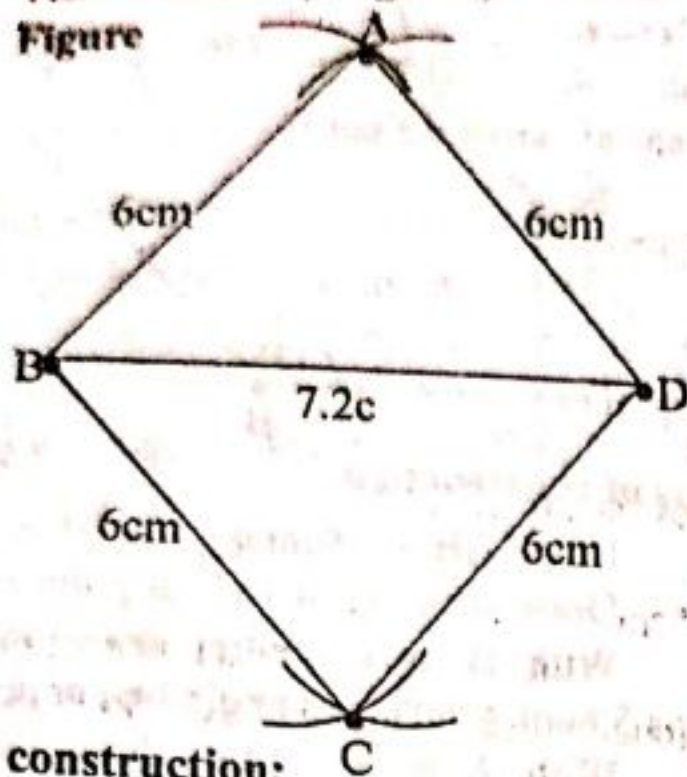
(e) Taking A as a centre, draw an arc of 5.4cm , which cuts previous arc at point D.

(f) Join B with C, C with D and D with A.

So, ABCD is the required rhombus.

(ii) $AB = 6\text{cm}$, $BD(\text{diagonal}) = 7.2\text{cm}$

Sol: Figure

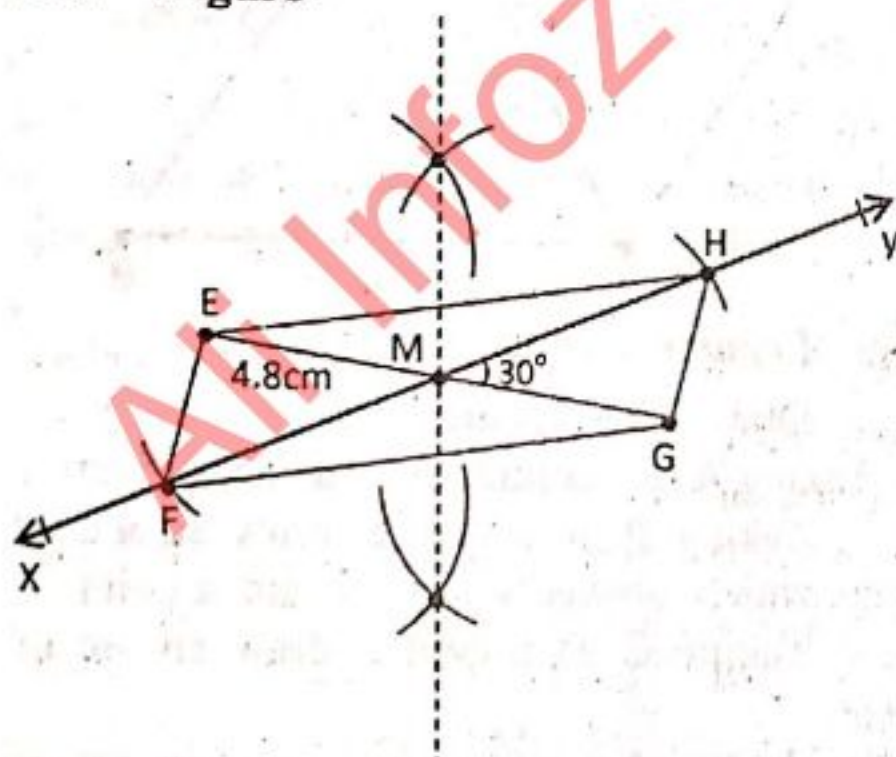


Steps of construction:

- Draw $BD = 7.2\text{cm}$.
- With B as centre, draw arcs of radius 6cm above and below BD .
- With D as a centre, draw an arc of 6cm above and below BD .
- With D as a centre, draw an arc of 6cm and below BD .
- Join B with C, C with D, D with A and A with B. Hence, ABCD is the required rhombus.

Q.7 Construct parallelogram EFGH when $EG(\text{diagonal}) = 4.8\text{cm}$, $FH(\text{diagonal}) = 6\text{cm}$ and the angle between them is 30° .

Sol: Figure



Steps of construction:

- Draw $EG = 4.8\text{cm}$.
- Draw the perpendicular bisector of EG , when M is the mid point of EG .
- Draw an angle of 30° at point M and produce the arm of this angle on both sides of M to form XY .

(iv) With M as a centre, draw an arc of radius 3cm (half of 6cm) which cut XY at points F and H.

(v) Join E with F, F with G, G with H and H with E. Parallelogram EFGH is required figure.

Q.8 Construct a square ABCD when the difference of its diagonal and a side is 4cm.

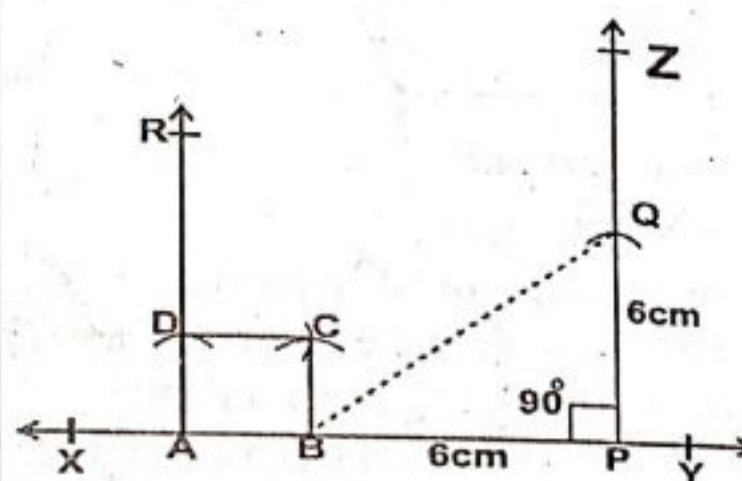
Sol: Figure

Step of construction:

- Draw a line XY .
- Chose a point B on XY and draw $\angle XBZ = 90^\circ$.
- On XY , mark a point L such that $LB = 4\text{cm}$.
- On BZ , mark a point M such that $BM = 4\text{cm}$ where 4cm is the difference between the diagonal and the side of the required square.
- Join LM and mark a point A on XY , such that $LA = LM$.
- Taking AB as one side, complete the square ABCD. Here, ABCD is the required square in which $AB - \text{side} = 4\text{cm}$.

Q.9 Construct a square PQRS when the sum of its diagonal and a side is 6cm.

Sol: Figure

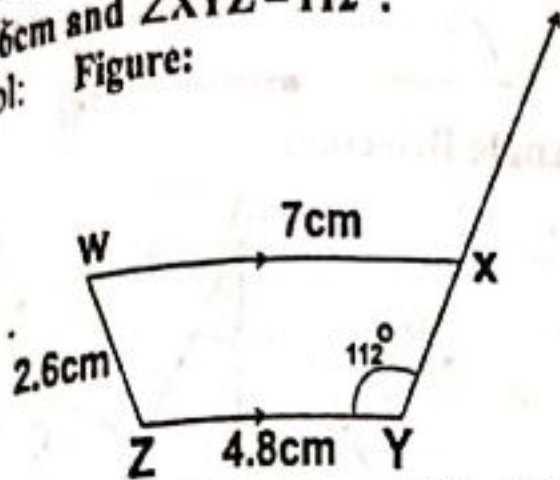


- Draw a line XY .
- Mark a point P on XY .
- Draw $\angle XPZ = 90^\circ$.
- As the sum of the diagonal and a side is 6cm, so cut off $PB = 6\text{cm}$ on PX and cut of $PQ = 6\text{cm}$ on PZ .
- Mark a point A on XY , such that $PA = BQ$.

vi. On side $\overline{AB}$, construct a square ABCD. Here, ABCD is the required square in which $\overline{AC} + \overline{AB} = 6\text{cm}$.

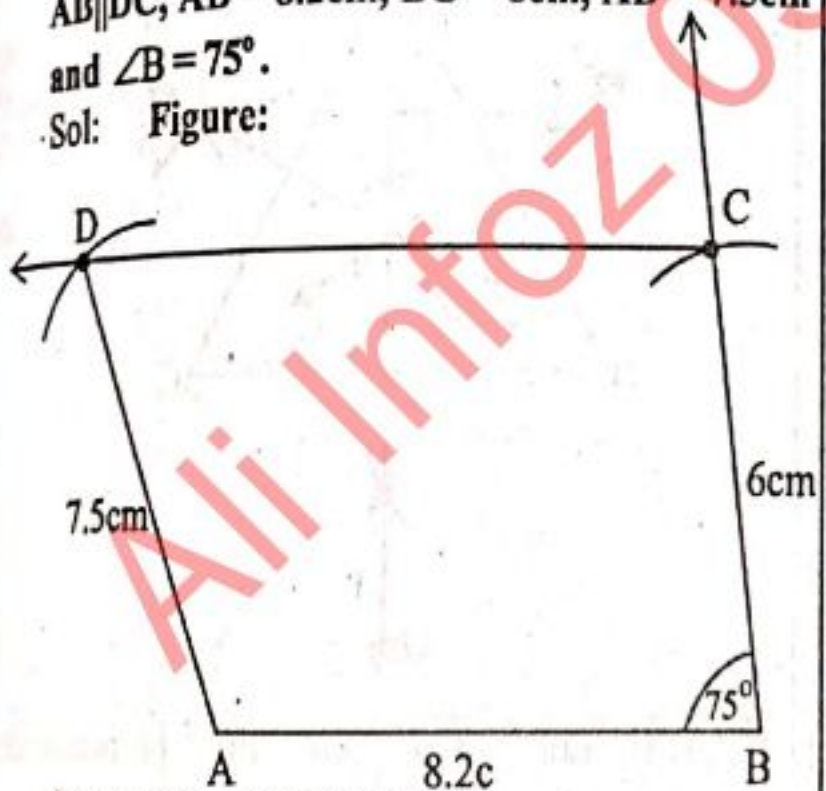
Exercise 10.6 (Tb Pg 259)

Q.1 Draw a trapezium WXYZ such that $\overline{WX} \parallel \overline{YZ}$, $\overline{ZY} = 4.8\text{cm}$, $\overline{WX} = 7\text{cm}$, $\overline{WZ} = 2.6\text{cm}$ and $\angle XYZ = 112^\circ$.
Sol: Figure:



- Draw a line segment $\overline{ZY} = 4.8\text{cm}$
- Take y as a center, draw an angle of 112° with the help of protractor.
- Take Z as a center, draw an arc of 2.6cm
- Draw $\overline{WX} \parallel \overline{ZY}$, which intersects the arc at point w. join point w to z so wxyz is required trapezium.

Q.2 Draw a trapezium ABCD in which $\overline{AB} \parallel \overline{DC}$, $\overline{AB} = 8.2\text{cm}$, $\overline{BC} = 6\text{cm}$, $\overline{AD} = 7.5\text{cm}$ and $\angle B = 75^\circ$.
Sol: Figure:



Steps of Constructions:

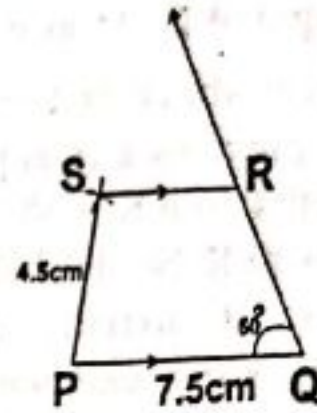
- Step 1: Draw a line segment $\overline{AB} = 8.2\text{cm}$.
- Step 2: Draw an angle of 60° at point B.
- Step 3: Taking B as a center, draw an arc of 6cm which cuts the arm of angle at point C.
- Step 4: Use a set square and ruler to draw a line parallel to $\overline{AB}$ through C.
- Step 5: Taking A as a center, draw an arc of 7.5cm , which cut the line at point D.
- Step 6: Join D with A. So, ABCD is required trapezium.

Q.3 Draw a trapezium PQRS in which $\overline{PQ} \parallel \overline{RS}$, $\overline{PQ} = 7.5\text{cm}$, $\overline{QS} = 5.9\text{cm}$, $\overline{PR} = 4.5\text{cm}$ and $\angle Q = 60^\circ$.

Sol: Figure:

Steps of constructions

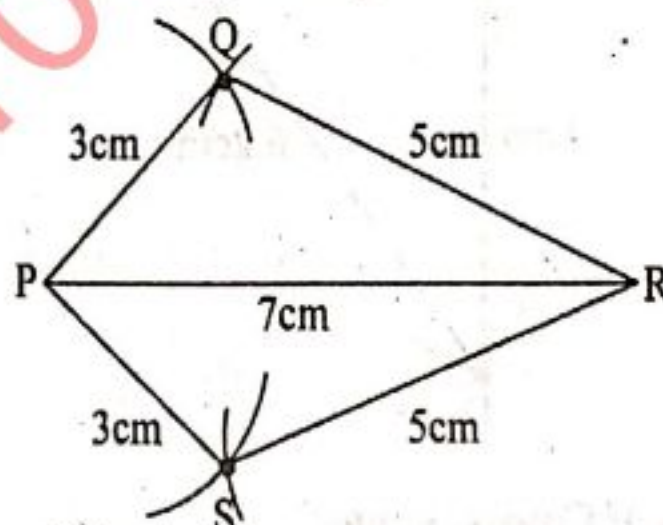
- Draw a line segment $\overline{PQ} = 7.5\text{cm}$
- Draw an angle of 60° at point Q with the help of protractor.
- Take Q as a center, draw an arc of 5.9cm .
- Take P as a center, draw an arc of 4.5cm .
- Both arc intersect each other at point 'S'. through point S, Draw $\overline{PQ} \parallel \overline{RS}$. So PQRS is our req trapezium.



Exercise 10.7 (Tb Pg 259)

Q.1 Construct a kite PQRS in which $\overline{PQ} = 3\text{cm}$, $\overline{QR} = 5\text{cm}$ and $\overline{PR}(\text{diagonal}) = 7\text{cm}$.

Sol: Figure:

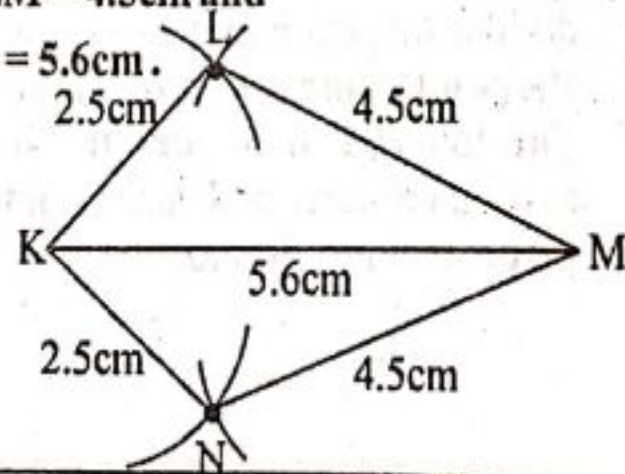


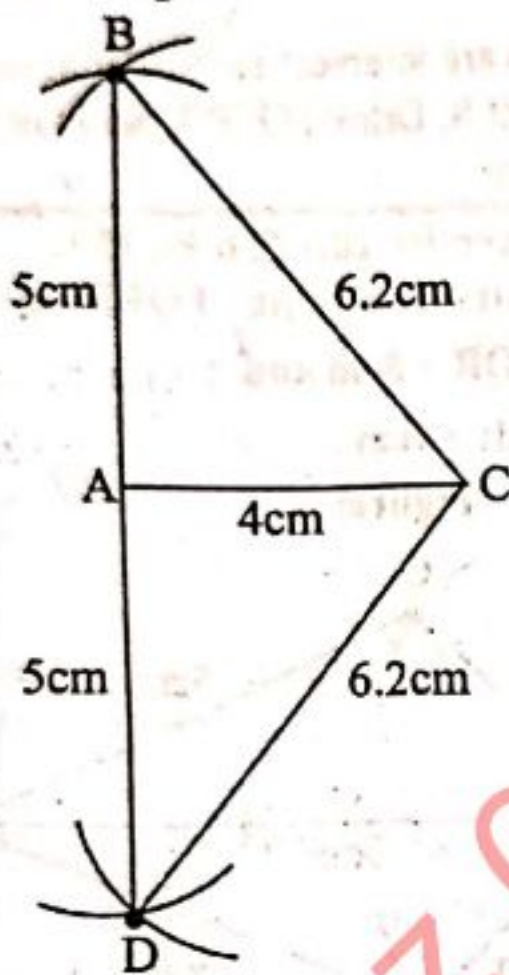
Steps of Constructions:

- Step 1: Draw a line segment $\overline{PR} = 7\text{cm}$.
- Step 2: With "P" as a centre, draw arcs of radius 3cm above and below PR.
- Step 3: With R as centre, draw arcs of radius 5cm above and below $\overline{PR}$ which intersects the previous arcs at points Q and S.
- Step 4: Join P with Q, Q with R, R with S and S with "P". So, PQRS is the required kite.

Q.2 Construct a kite KLMN in which $\overline{KL} = 2.5\text{cm}$, $\overline{LM} = 4.5\text{cm}$ and $\overline{KM}(\text{diagonal}) = 5.6\text{cm}$.

Sol: Figure:

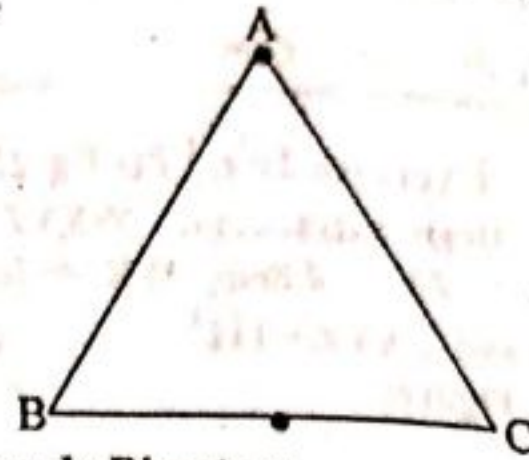
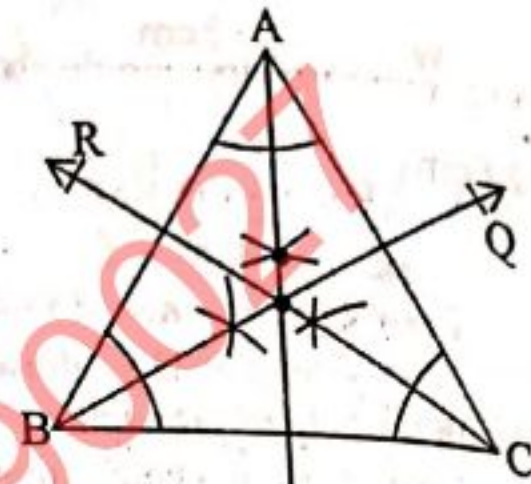
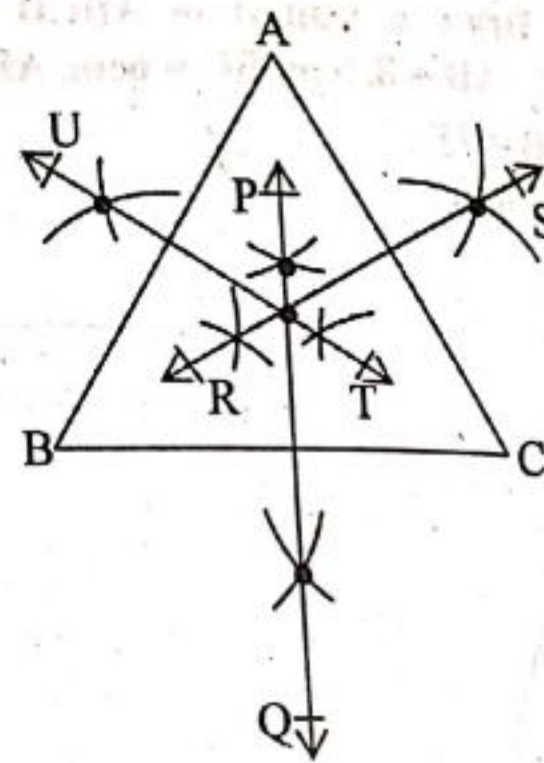


Steps of Constructions:**Step 1:** Draw $\overline{KM} = 5.6\text{cm}$.**Step 2:** With K as centre, draw arcs of radius 2.5cm above and below $\overline{KM}$.**Step 3:** With M as a centre, draw arcs of radius 4.5cm above and below $\overline{KM}$, which intersects the previous arcs at points L and N.**Step 4:** Join K with L, L with M, M with N and N with K. So, KLMN is the required kite.**Q.3** Construct a kite with length of diagonal 4 and length of sides are 5cm and 6.2cm respectively**Sol:** **Figure:****Steps of Constructions:****Step 1:** Draw a line segment $\overline{AC} = 4\text{cm}$.**Step 2:** With A as a centre, draw arcs of radius 5cm above and below $\overline{AC}$.**Step 3:** With C as a centre, draw arcs of radius 6.2cm above and below $\overline{AC}$, which intersects the previous arcs at points B and D.**Step 4:** Join A with B, B with C, C with D and D with A. So, ABCD is the required kite.**Exercise 10.8 (Tb Pg 261)****Angle bisector:** The angle bisector of an angle divides the angle into two equal angles.**Perpendicular bisector (right bisector)**

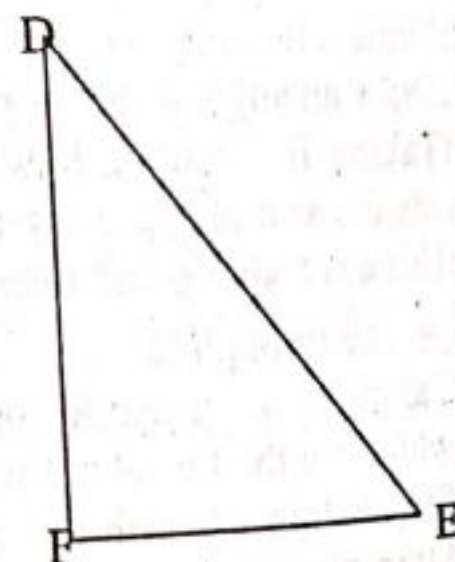
The line which divides the line segment into two equal parts and make right angle is called perpendicular bisector.

Q Draw angle bisectors for these shapes. Also draw perpendicular bisectors for these side

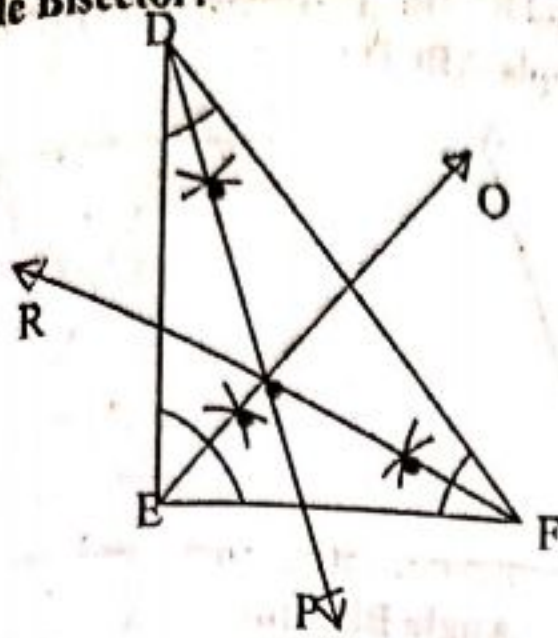
(a)

**Sol:** **Angle Bisector:** $\overline{AP}$, $\overline{BQ}$ and $\overline{CR}$ are the angle bisectors of $\triangle ABC$.**Sol:** **Perpendicular Bisector** $\overline{PQ}$, $\overline{RS}$ and $\overline{TU}$ are the perpendicular bisectors of $\triangle ABC$

(b)

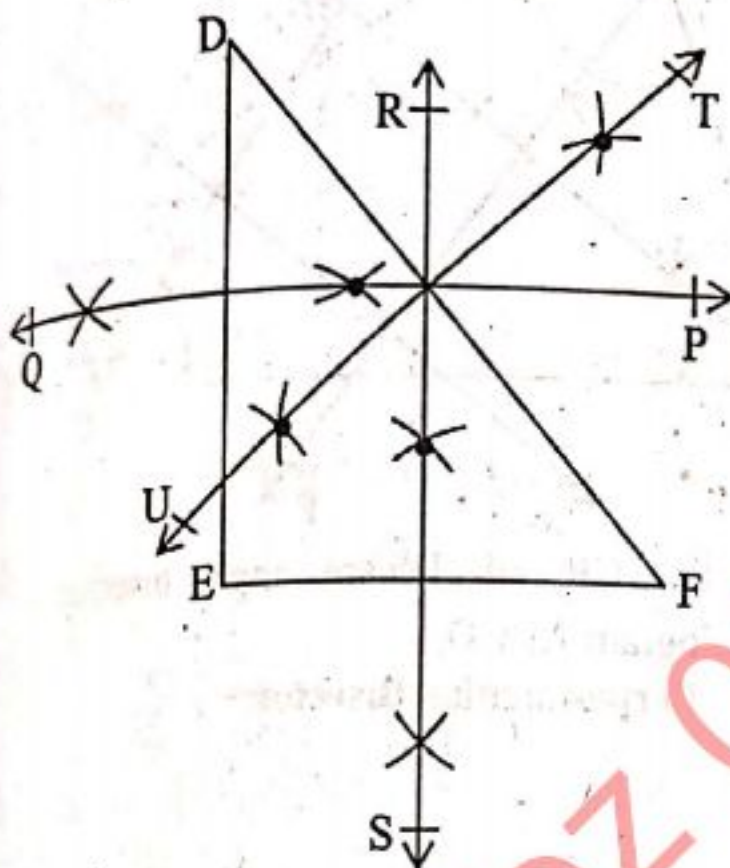


Sol: **Angle Bisector:**



$\overline{DP}$, $\overline{EQ}$ and $\overline{FR}$ are the angle bisectors of ΔDEF .

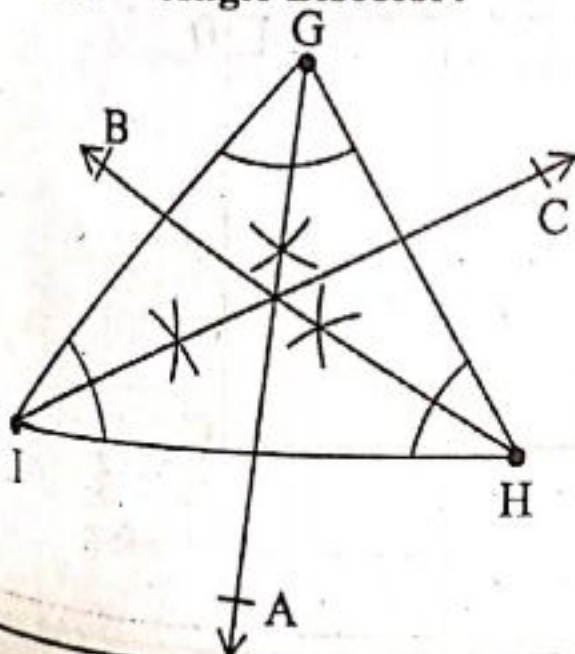
Sol: **Perpendicular Bisector**



$\overline{PQ}$, $\overline{RS}$ and $\overline{TU}$ are the perpendicular bisectors of ΔDEF .

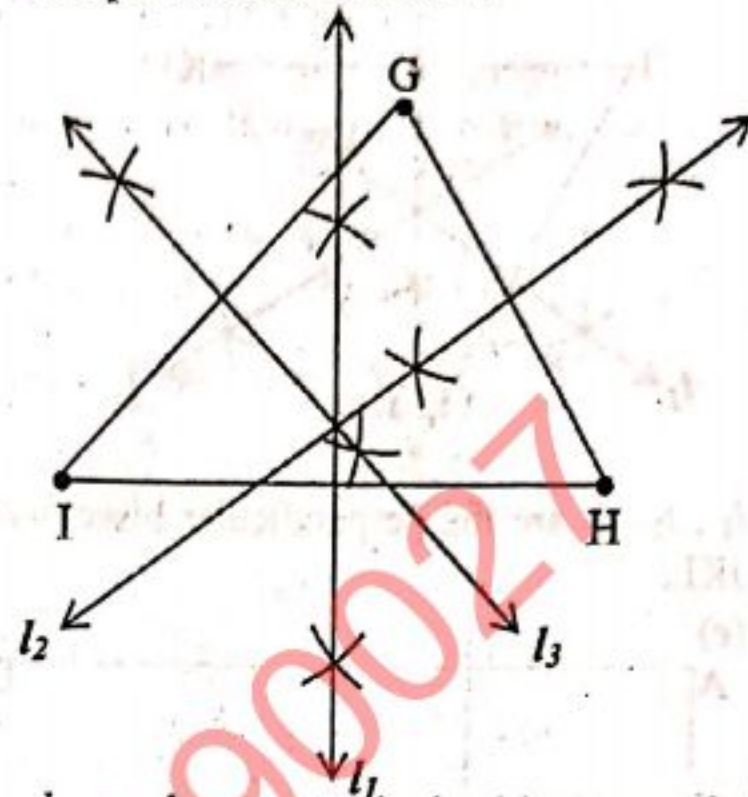
(c)

Sol: **Angle Bisector:**



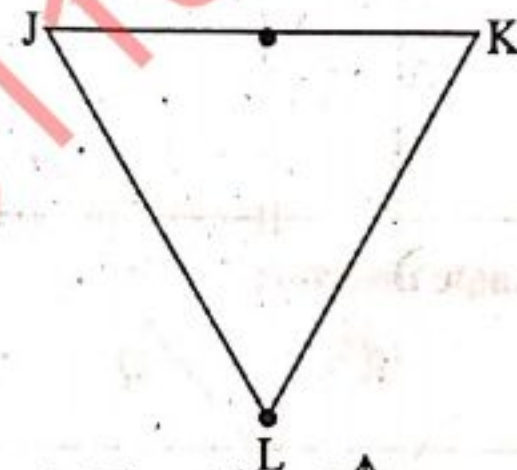
$\overline{GA}$, $\overline{HB}$ and $\overline{IC}$ are the angle bisectors of ΔGHI .

Sol: **Perpendicular Bisector:**

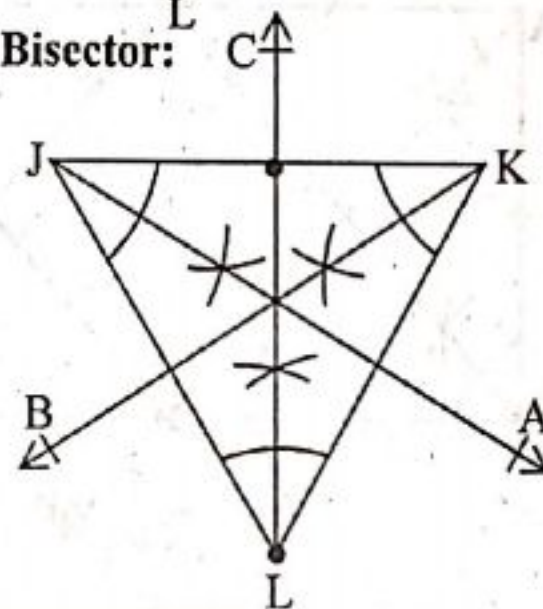


l_1 , l_2 , l_3 are the perpendicular bisectors of ΔGHI .

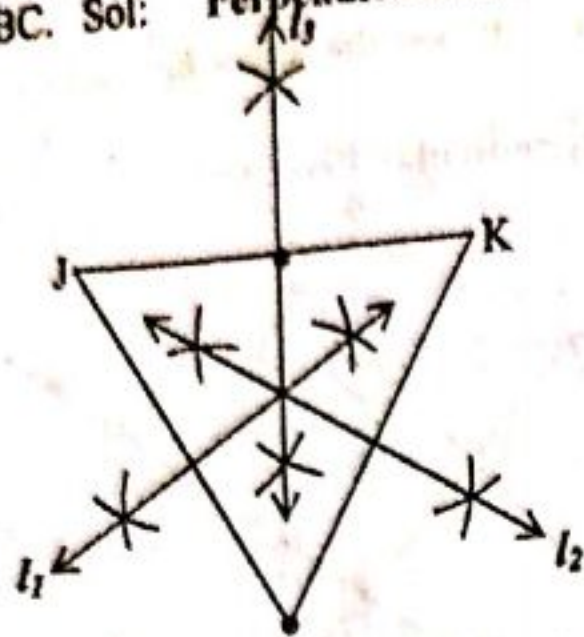
(d)



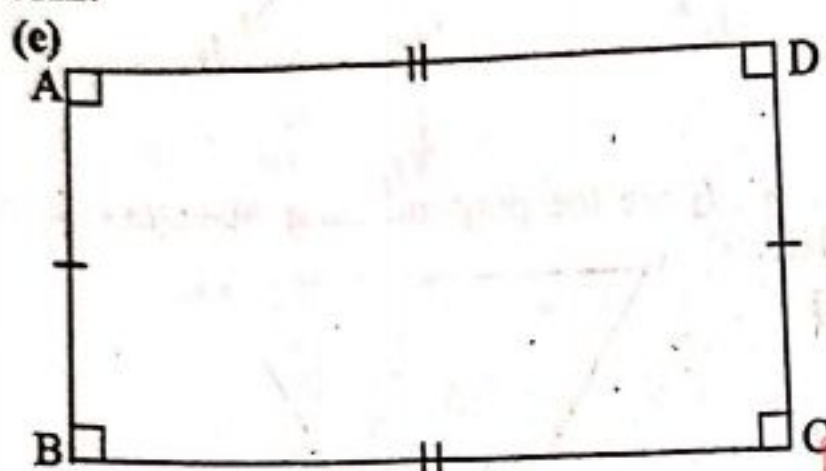
Sol: **Angle Bisector:**



$\overline{JA}$, $\overline{KB}$ and $\overline{LC}$ are the angle bisectors of $\triangle ABC$. Sol: Perpendicular Bisector:



l_1 , l_2 , l_3 are the perpendicular bisectors of $\triangle JKL$.

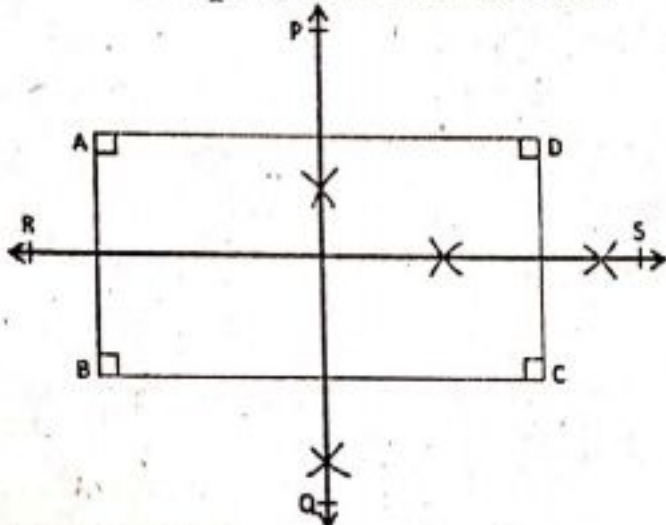


Sol: Angle Bisector:

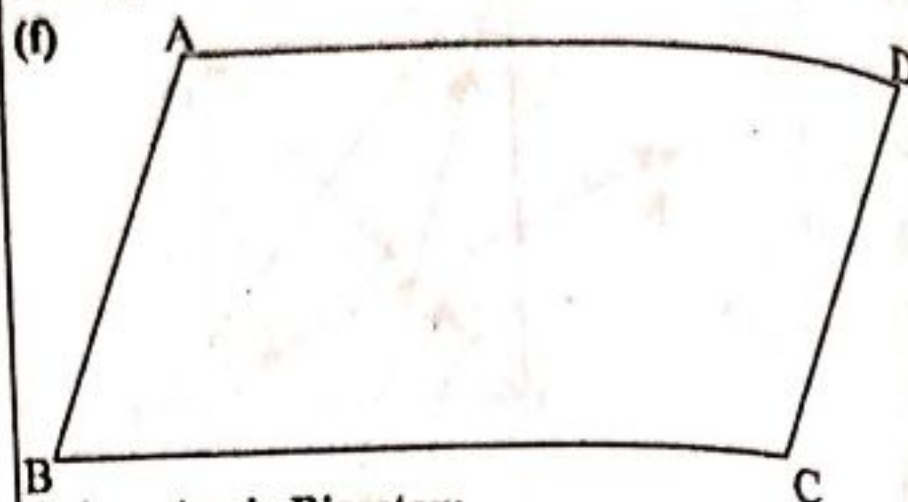


$\overline{AP}$, $\overline{BQ}$, $\overline{CR}$ and $\overline{DS}$ are the angle bisectors of rectangle ABCD.

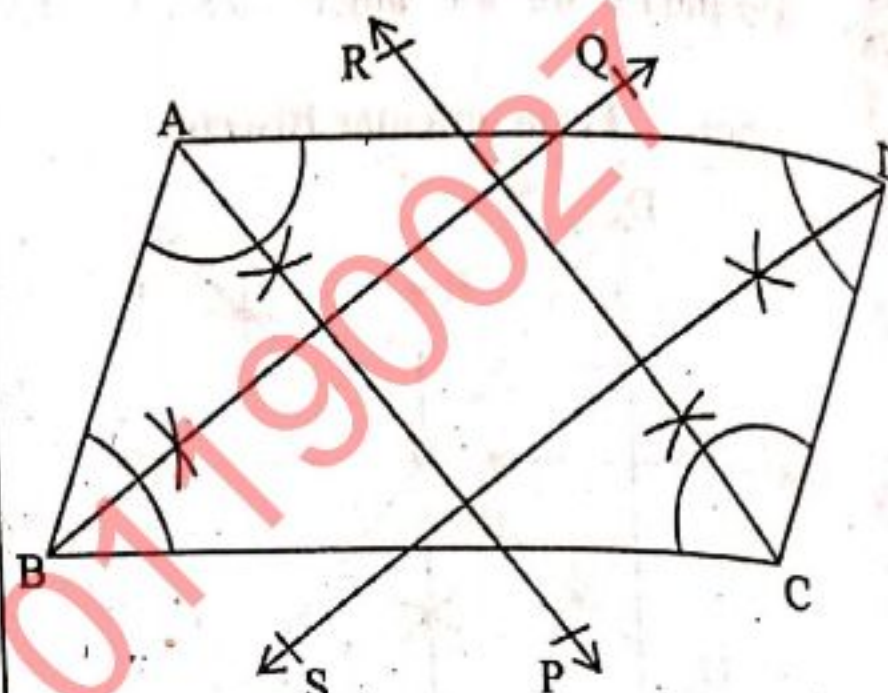
Sol: Perpendicular Bisector:



$\overline{PQ}$ and $\overline{RS}$ are perpendicular bisectors of a rectangle ABCD.

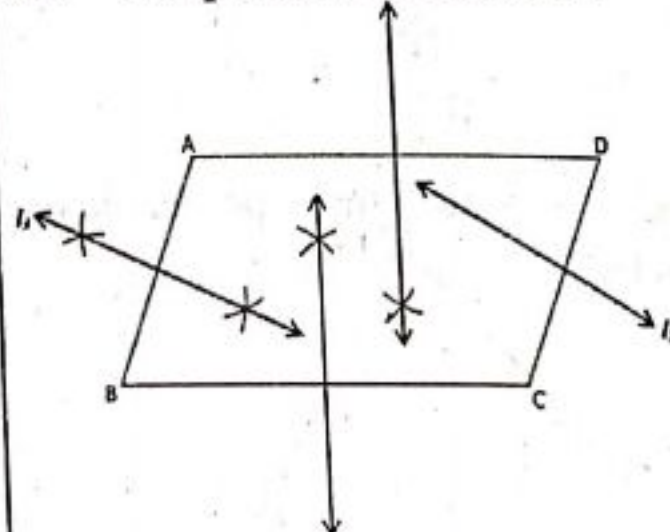


Sol: Angle Bisector:

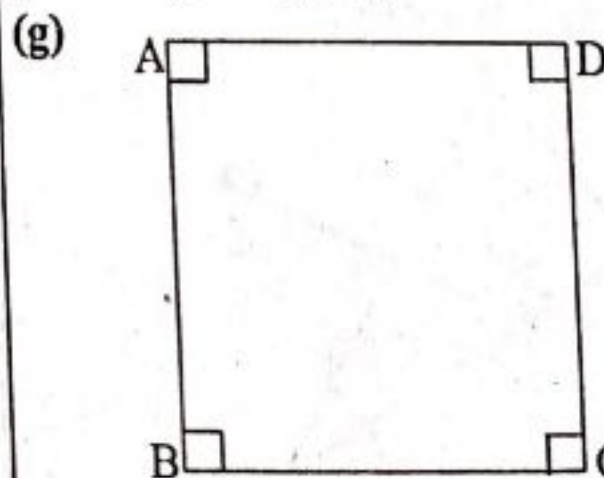


$\overline{AP}$, $\overline{BQ}$, $\overline{CR}$ and $\overline{DS}$ are angle bisectors of a parallelogram ABCD.

Sol: Perpendicular Bisector:

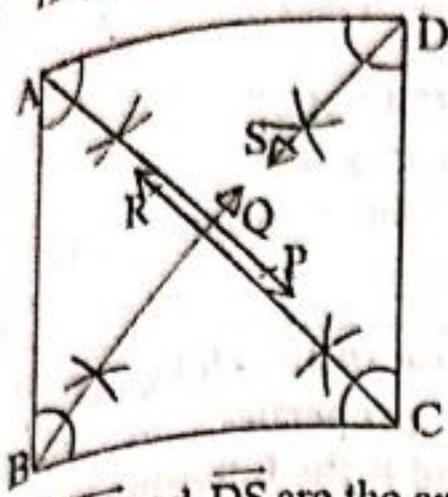


l_1 , l_2 , l_3 , l_4 are the perpendicular bisectors of a parallelogram ABCD.



Angle Bisector:

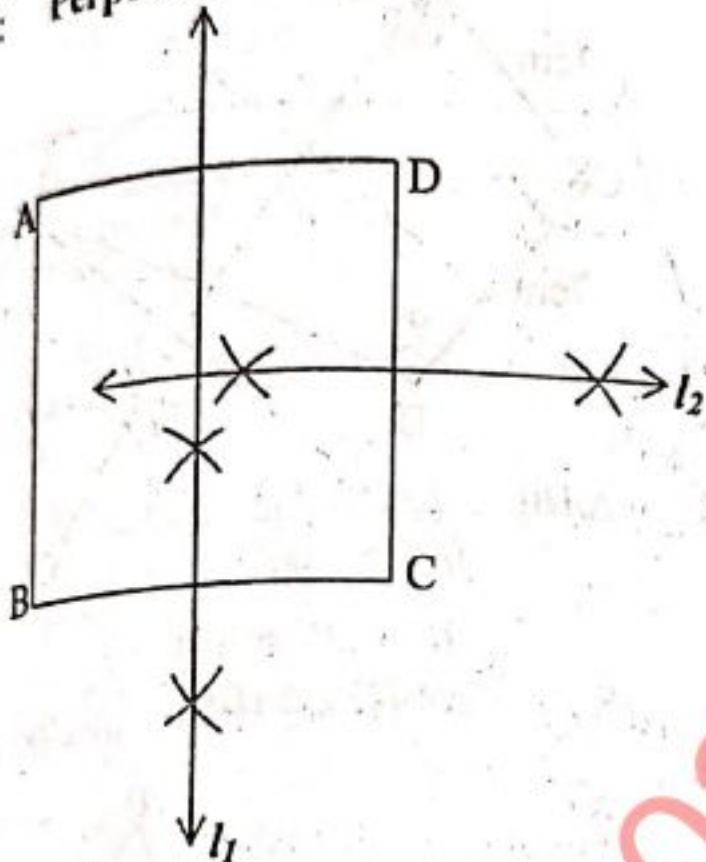
Sol:



$\overline{AP}$, $\overline{BQ}$, $\overline{CR}$ and $\overline{DS}$ are the angle bisectors of square ABCD.

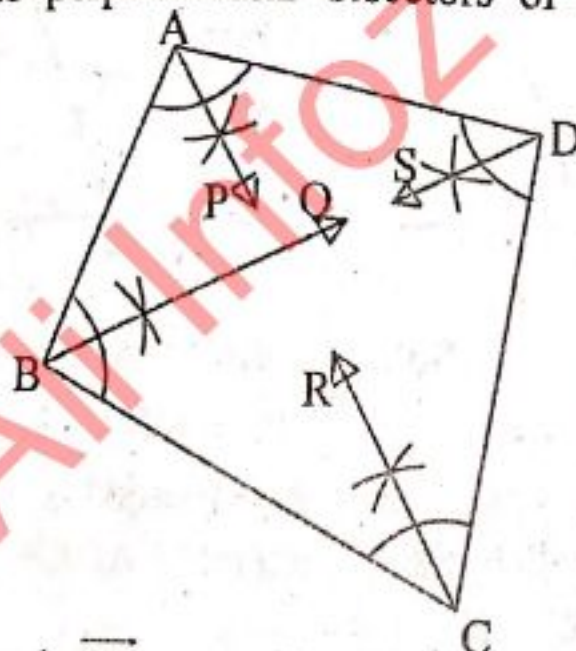
Perpendicular Bisector:

Sol:

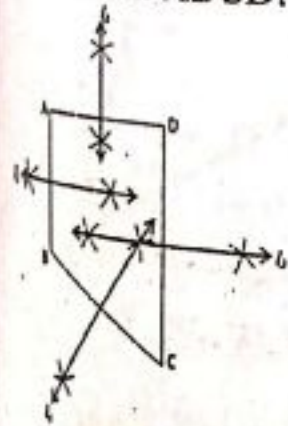


l_1 & l_2 are the perpendicular bisectors of a square ABCD.

(b)



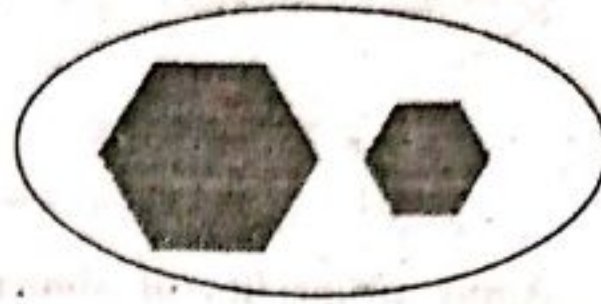
$\overline{AP}$, $\overline{BQ}$, $\overline{CR}$ and $\overline{DS}$ are angle bisectors of quadrilateral ABCD.



Exercise 10.9 (Tb Pg 263)

Q.1 Tick (✓) the pair of congruent figures and circle the pair of similar figures.

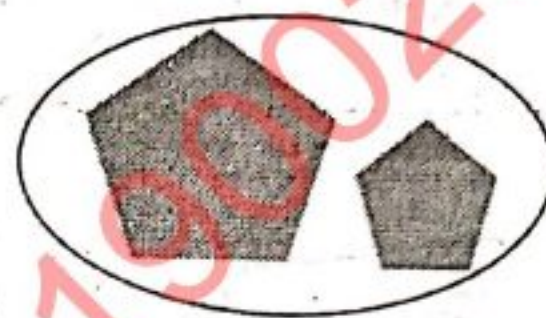
(a)



(b)



(c)



(d)



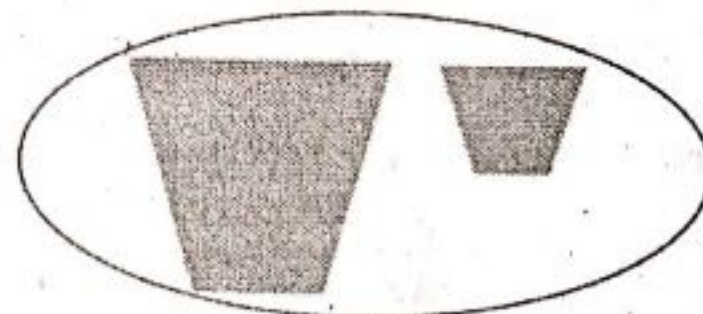
(e)



(f)



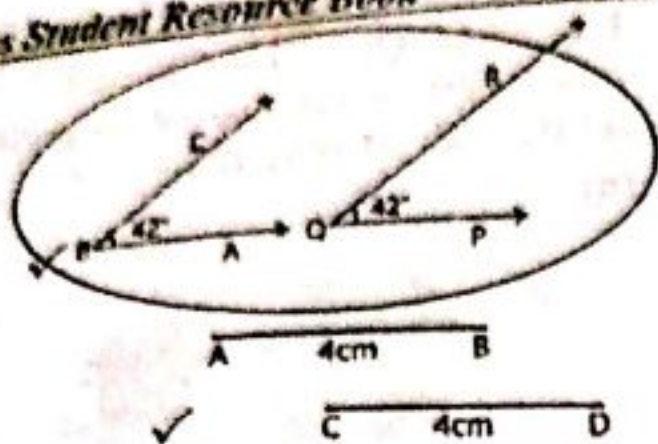
(g)



(h)

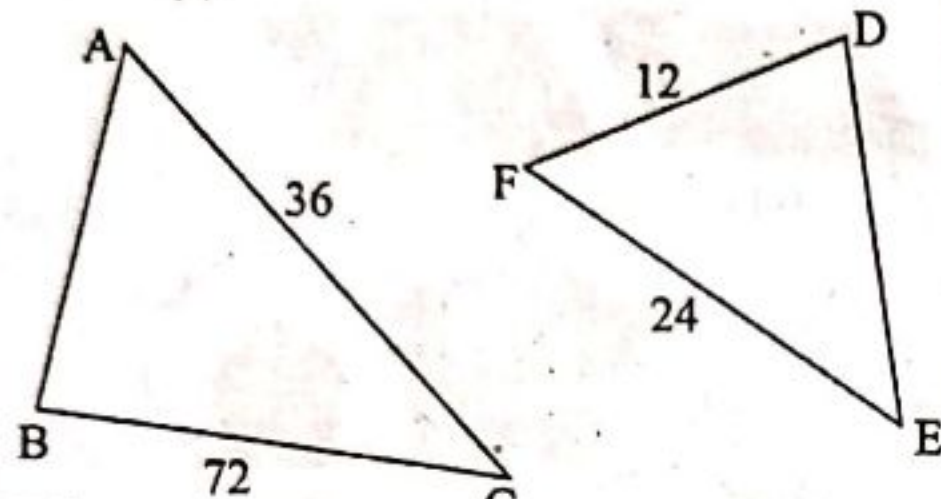


(j)



Q.2 Apply properties of similar figures and check if the triangles are similar or not.

(a)



Sol: $\triangle ABC \sim \triangle DEF$ (?)

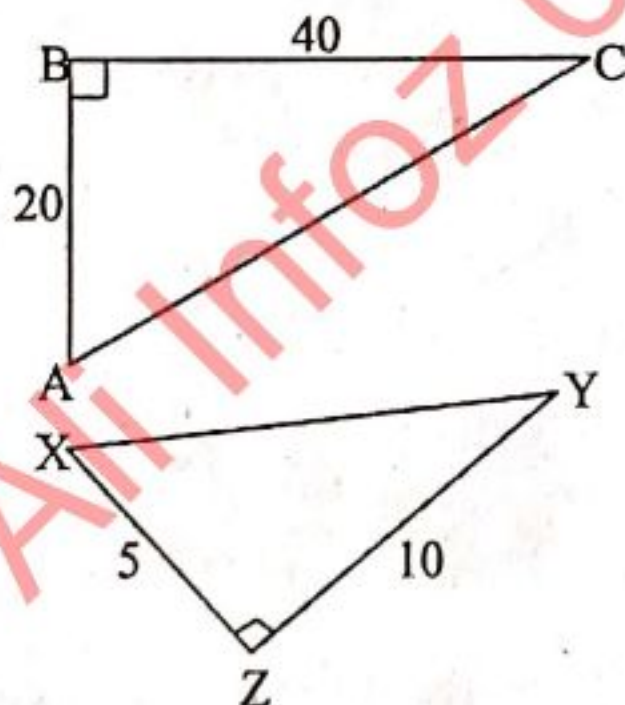
$$\frac{AB}{DE} = \frac{36}{12} = 3$$

$$\frac{BC}{EF} = \frac{72}{24} = 3$$

Since $\frac{AB}{DE} = \frac{BC}{EF}$

So, $\triangle ABC \sim \triangle DEF$ Ans

(b)



Sol: $\triangle ABC \sim \triangle XYZ$ (?)

$$\frac{AB}{XZ} = \frac{20}{5} = 4$$

$$\frac{BC}{YZ} = \frac{40}{10} = 4$$

Since $\frac{AB}{XZ} = \frac{BC}{YZ}$

So, $\triangle ABC \sim \triangle XYZ$

Properties of Congruent Triangle:

Property 1: $SSS \cong SSS$

Property 2: $SAS \cong SAS$

Property 3: $ASA \cong ASA$

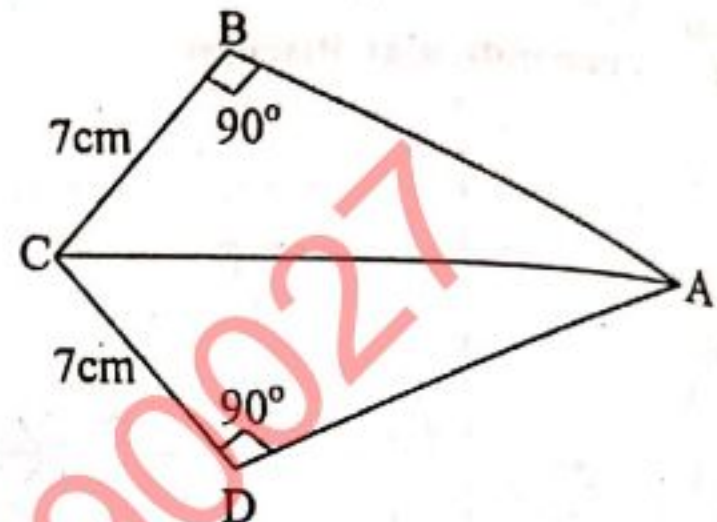
Property 4: $AAS \cong AAS$

Property 5: Right - Angle - Hypotenuse side ($RHS \cong RHS$)

Exercise 10.10 (Tb Pg 268)

Q.1 Apply properties of congruent triangle and find if the following triangle are congruent or not.

(a)



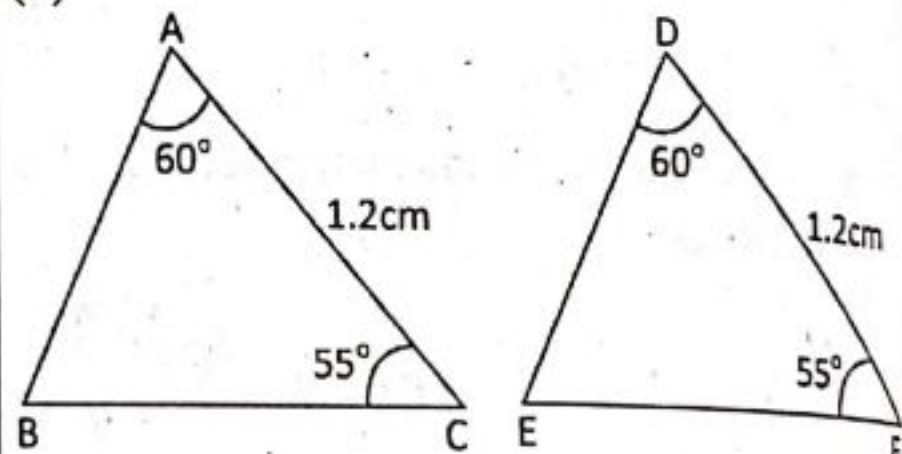
Sol: $\triangle ABC \cong \triangle ADC$ (?)

$$\hat{B} = \hat{D} = 90^\circ$$

$$\overline{BC} = \overline{DC} = 7\text{cm}$$

So, $\triangle ABC \cong \triangle ADC$

(b)



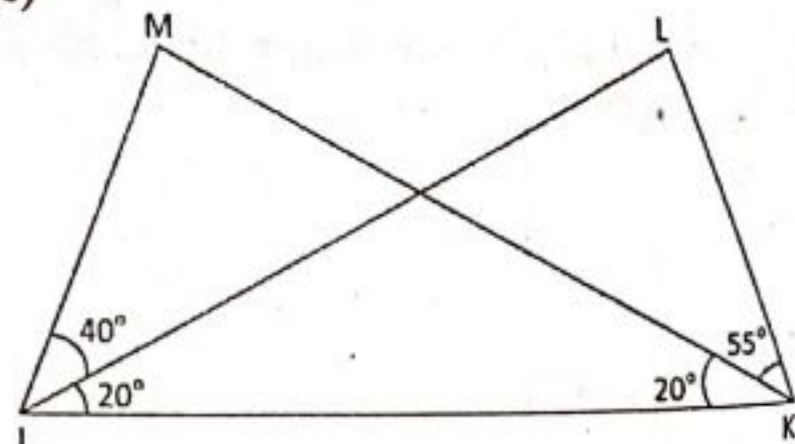
Sol: $\triangle ABC \cong \triangle DEF$ (?)

$$\overline{AC} = \overline{DF} = 1.2\text{cm}$$

$$\hat{C} = \hat{F} = 55^\circ$$

So, $\triangle ABC \cong \triangle DEF$

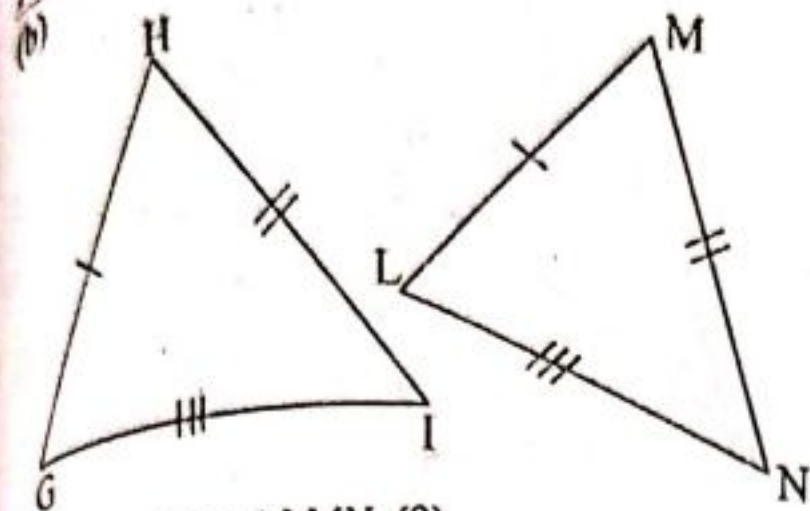
(c)



Sol: $\triangle MJK \cong \triangle LJK$ (?)

Since $\hat{MJK} \neq \hat{LJK}$

So, $\triangle MJK \not\cong \triangle LJK$

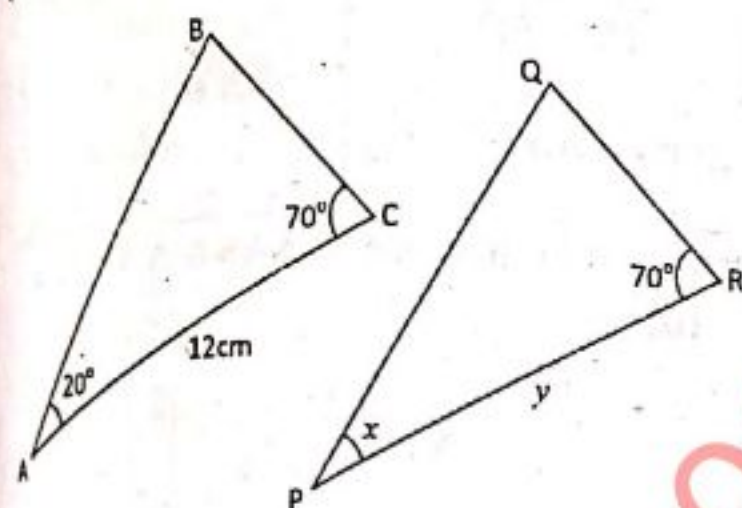


Sol: $\triangle GHI \cong \triangle LMN$ (?)
 As $\overline{GH} = \overline{LM}$,
 $\overline{HI} = \overline{MN}$,
 $\overline{GI} = \overline{LN}$,

So, $\triangle GHI \cong \triangle LMN$

Q.2 Find the unknown sides or angles of the given congruent triangles.

(a)



Sol: $x = ?$

As $\triangle ABC \cong \triangle PQR$

$$\hat{P} = \hat{A}$$

$$x = 20^\circ$$

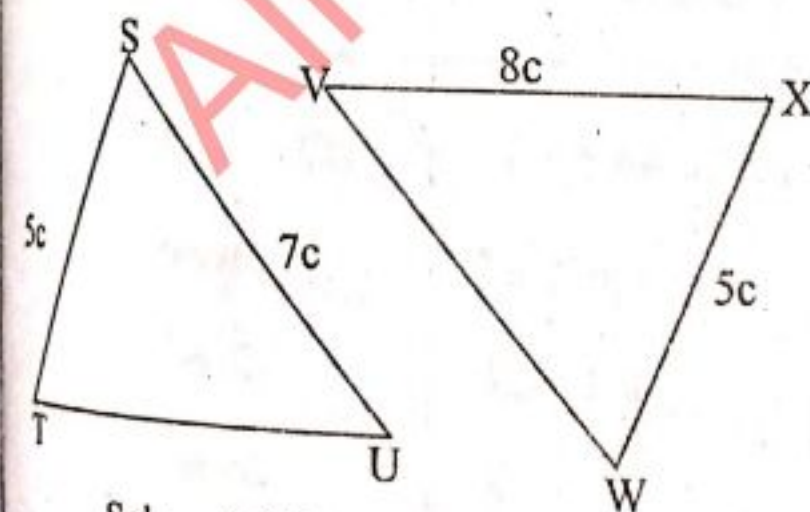
Ans

$$\overline{PR} = \overline{AC}$$

$$y = 12\text{cm}$$

Ans

(b)



Sol: $\triangle STU \cong \triangle VWX$

$$\overline{TU} = \overline{VX}$$

$$\overline{TU} = 8\text{cm}$$

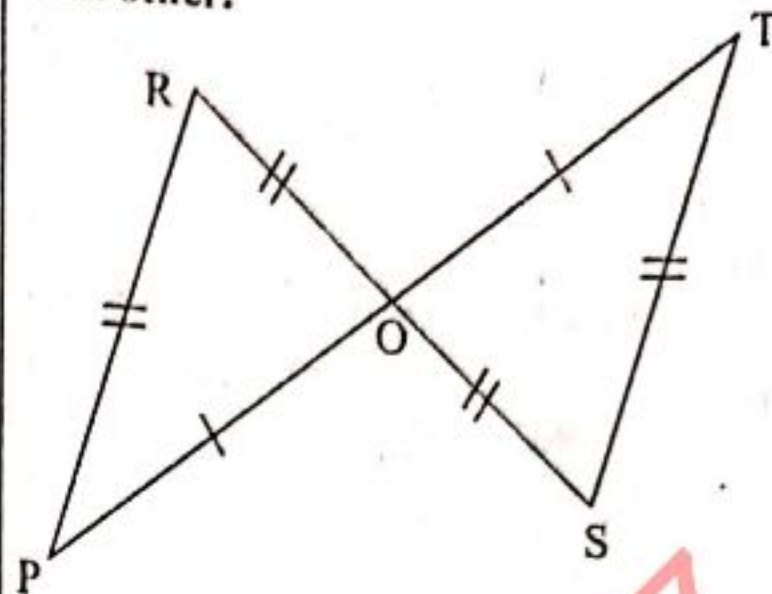
Ans

$$\overline{VW} = \overline{SU}$$

$$\overline{VW} = 7\text{cm}$$

Ans

Q.3 Look at the figure, $\overline{RS}$ and $\overline{TP}$ bisect each other.



(a) State the three pairs of equal sides in the two triangles POR and TOS.

Sol: $\overline{PO} = \overline{TO}$

$$\overline{PR} = \overline{TS}$$

$$\overline{OR} = \overline{OS}$$

are the required three pairs of equal in two $\triangle$ s.

(b) Which of the following statement are true?

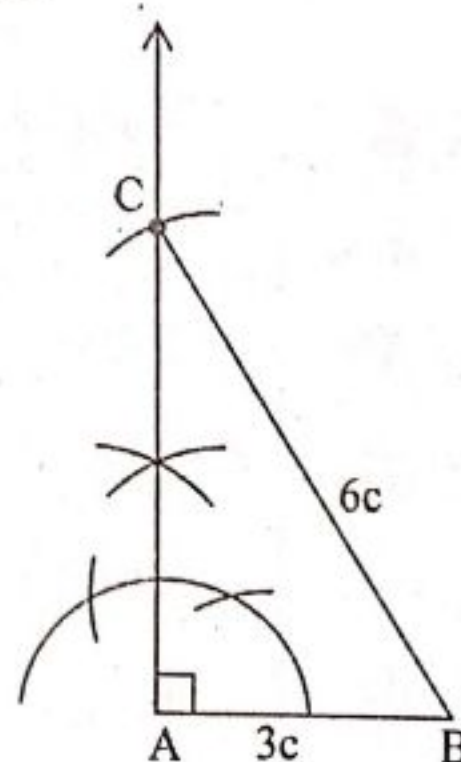
$$\triangle POR \cong \triangle STO$$

or

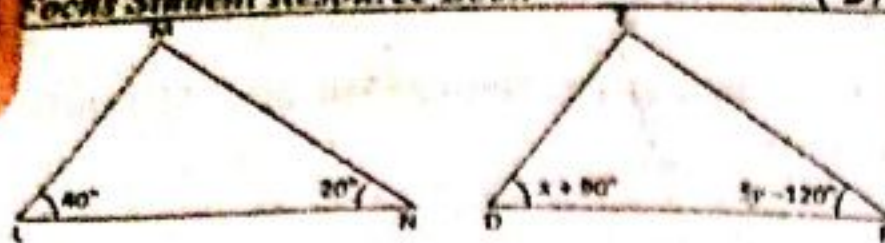
$$\triangle POR \cong \triangle TOS$$

Sol: $\triangle POR \cong \triangle TOS$ is true statement.

Q.4 The measure of one angle of a triangle is 90° . The measure of its hypotenuse and base is 6cm and 3cm respectively. Draw a triangle congruent to this triangle.



Q.5 $\triangle LMN$ and $\triangle DEF$ are congruent by Angle - Side - Angle congruent property. Find the value of x and y .



Sol: $x = ?$, $y = ?$

Given that

$$\triangle LMN \cong \triangle DEF$$

$$\angle D = \angle L$$

$$x + 90^\circ = 40^\circ$$

$$x = 40^\circ - 90^\circ$$

$$\boxed{x = -50^\circ}$$

$$\angle F = \angle N$$

$$5y - 120^\circ = 20^\circ$$

$$5y = 20^\circ + 120^\circ$$

$$5y = 140^\circ$$

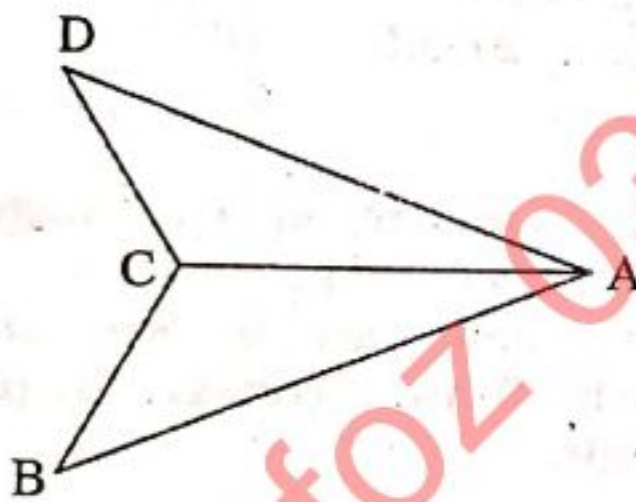
$$y = \frac{140^\circ}{5}$$

$$\boxed{y = 28^\circ}$$

$$\boxed{y = 24^\circ}$$

$$\therefore \text{Ans } x = -50^\circ, \quad y = 24^\circ$$

Q.6 In triangle ABC and ADC, $\overline{BC} = \overline{DC}$, $\overline{BA} = \overline{DA}$, prove that the triangles are congruent.



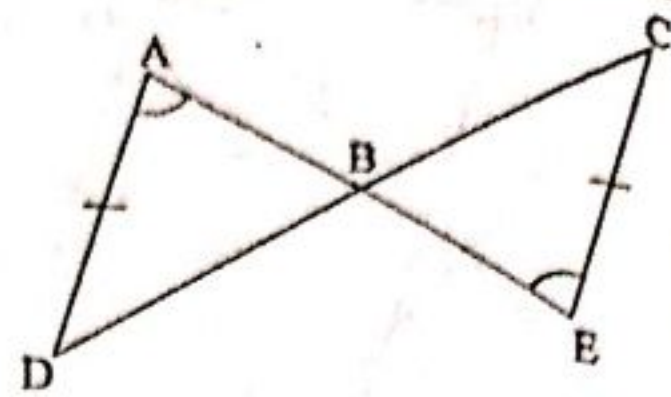
Sol:

Statement	Reasons
In $\triangle ABC \leftrightarrow \triangle ADC$	
$\overline{BC} \cong \overline{DC}$	Given
$\overline{BA} \cong \overline{DA}$	Given
$\overline{AC} \cong \overline{AC}$	Common
$\therefore \triangle ABC \cong \triangle ADC$	S.S.S $\cong$ S.S.S

So, the triangle ABC and ADC are congruent.

Q.7 Prove the congruence of these triangles. Also state the property that is applied to prove the congruence.

(a)

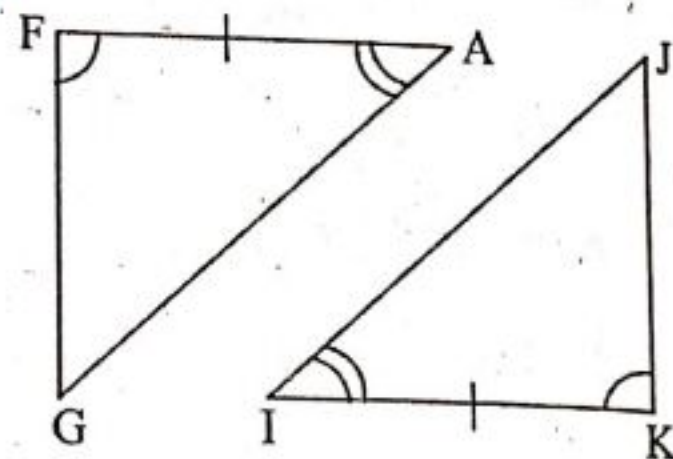


Sol:

Statement	Reasons
In $\triangle ABC \leftrightarrow \triangle BEC$	
$\angle A \cong \angle E$	Given
$\angle ABD \cong \angle ECB$	Vertical angles
$\overline{AD} \cong \overline{EC}$	Given
$\therefore \triangle BAD \cong \triangle BEC$	AAS $\cong$ AAS

Property used in this case is AAS $\cong$ AAS

(b)

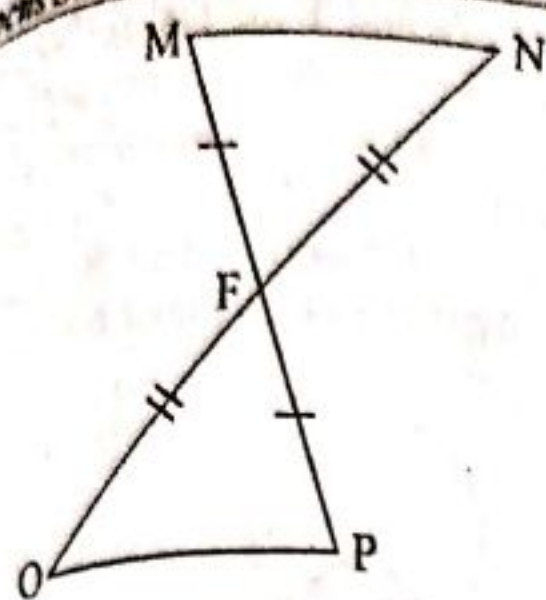


Sol:

Statement	Reasons
In $\triangle AFG \leftrightarrow \triangle IKJ$	
$\angle F \cong \angle K$	Given
$\angle A \cong \angle I$	Given
$\overline{AF} \cong \overline{IK}$	Given
$\therefore \triangle AFG \cong \triangle IKJ$	A.A.S $\cong$ A.A.S

Property used in this case is AAS $\cong$ AAS

(c)

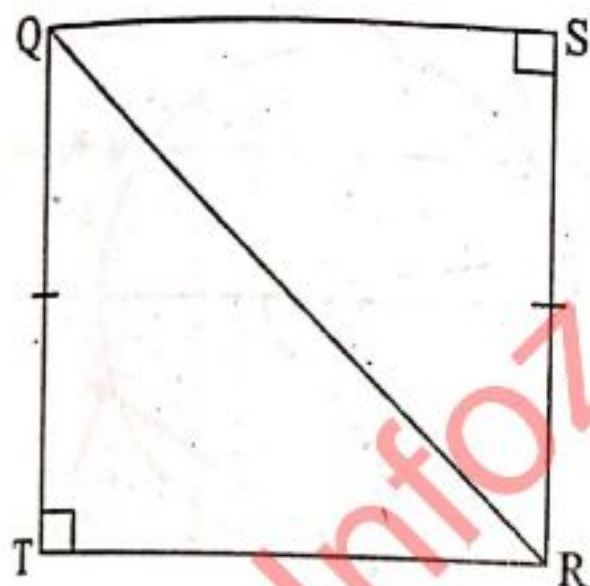


Sol:

Statement	Reasons
In $\Delta FMN \leftrightarrow \Delta FPO$	
$\overline{FM} \cong \overline{FP}$	Given
$\angle MFN \cong \angle PFO$	Vertical angles
$\overline{FN} \cong \overline{FO}$	Given
$\therefore \Delta FMN \cong \Delta FPO$	S.A.S $\cong$ S.A.S

Property used in this case is S.A.S $\cong$ S.A.S

(d)

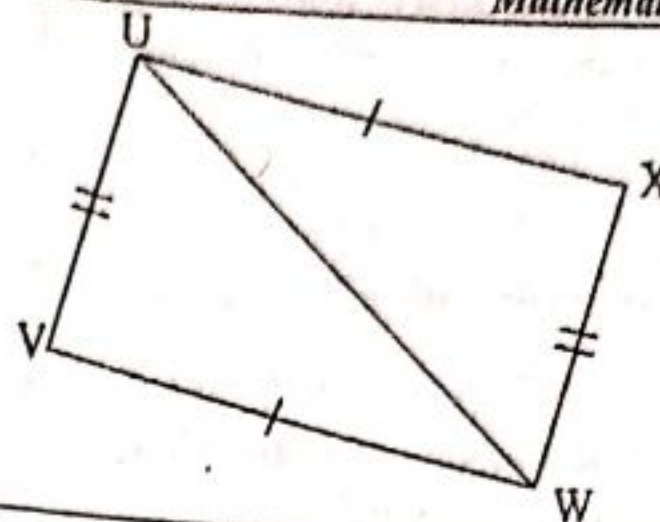


Sol:

Statement	Reasons
In $\Delta QSR \leftrightarrow \Delta RTQ$	
$\overline{SR} \cong \overline{TQ}$	Given
$\angle S \cong \angle T$	right $\angle$ s
$\overline{QR} \cong \overline{QR}$	Common
$\therefore \Delta QSR \cong \Delta RTQ$	RHS $\cong$ RHS

The Property used in this case is Right - Angle - Hypotenuse - Side RHS $\cong$ RHS

(e)



Sol:

Statement	Reasons
In $\Delta VWU \leftrightarrow \Delta XUW$	
$\overline{VW} \cong \overline{XU}$	Given
$\overline{VU} \cong \overline{XW}$	Given
$\overline{UW} \cong \overline{UW}$	Common
$\therefore \Delta VWU \cong \Delta XUW$	S.S.S $\cong$ S.S.S

The Property used in this case is S.S.S $\cong$ S.S.S

Review Exercise (Tb Pg 204)

Q.1 Choose the correct option.

(a) The sum of the angles of the triangle is:

- (i) 360° (ii) 220°
 (iii) 180° ✓ (iv) 90°

(b) A line which meets or touches a circle at only one point is called

- (i) Secant (ii) Tangent✓
 (iii) Sector (iv) Arc

(c) A line which passes through a circle and intersects it at two points is called:

- (i) Secant✓ (ii) Tangent
 (iii) Sector (iv) Arc

(d) Rhombus is a quadrilateral whose four sides are equal in length but none of its angles is:

- (i) Acute (ii) Right✓
 (iii) Obtuse (iv) Reflex

(e) A _____ is a quadrilateral whose opposite sides are equal and angles between their adjacent sides are 90°

- (i) Rectangle✓ (ii) Kite
 (iii) Rhombus (iv) Triangle

(f) Two or more circles with same centre but different _____ is called concentric circles.

- (i) Tangent (ii) Secant
 (iii) Radii✓ (iv) Arc

(g) The sum of angles of the quadrilateral is:

- (i) 120° (ii) 240°
(iii) 360° ✓ (iv) 180°

(h) A trapezium has _____ pair/s of parallel sides.

- (i) 1✓ (ii) 2 (iii) 0 (iv) 4

(i) The objects or shape that have same shape and size is called:

- (i) Congruent✓ (ii) Similar
(iii) Sector (iv) Equal

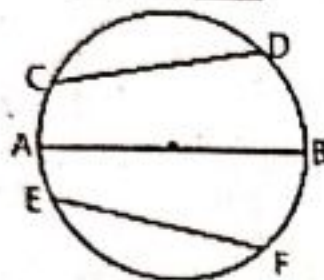
(j) The symbol for congruency is:

- (i) $\neq$ (ii) $=$ (iii) $<<$ (iv) $\cong$ ✓

Q.2 Define chord, secant, arc, sector and tangent of a circle.

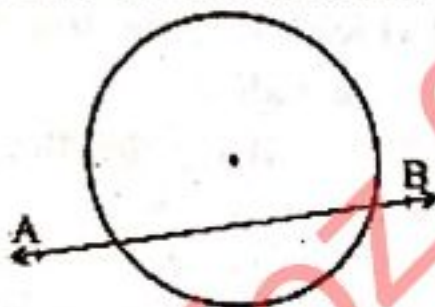
Chord:

A line segment with end points on the circle is called chord. In fig $\overline{AB}$, $\overline{CD}$ and $\overline{EF}$ are chords.



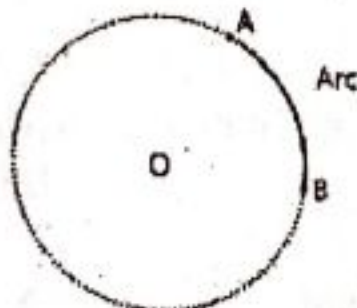
Secant to a Circle:

If a line intersects a circle at two distinct points, then this line is called secant to the circle. In the figure, the line $\overline{AB}$ is secant to the circle.



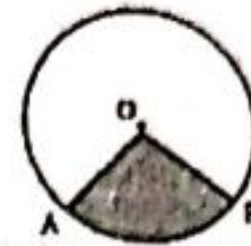
Arc:

A part or portion of the circumference of a circle is called an arc. Look at the circle. The arc $\widehat{AB}$ has two end points A and B. It is denoted by $\widehat{AB}$. An arc which is smaller than half of the circle is called minor arc. An arc which is more than half of the circle is called a major arc. Look at the circle. $\widehat{BC}$ is the minor arc and the arc $\widehat{BDC}$ is the major arc as it is more than half of the circle.



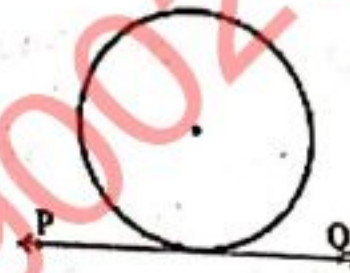
Sector of a Circle:

If we join points A and B of the circle with centre O, the circle is divided into two regions. One is a shaded region and the other is an unshaded region. Both regions are called sectors. The smaller region is called the minor sector and the larger region is called the major sector.

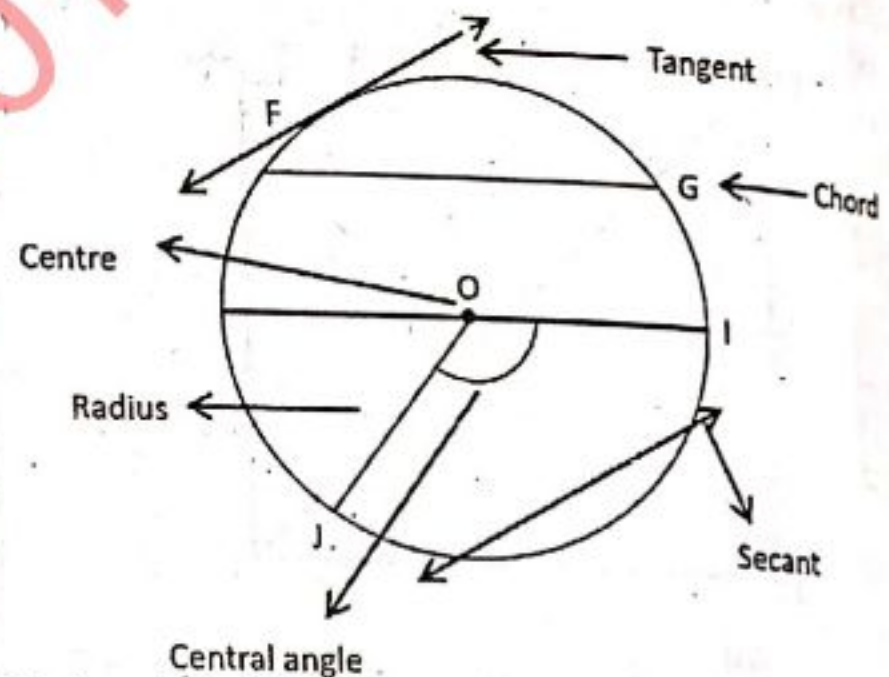


Tangent to a Circle:

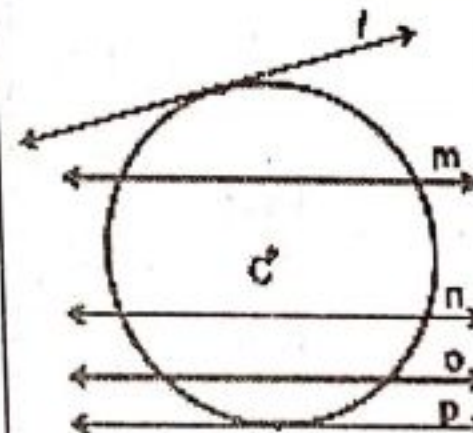
If a line touches a circle at only one point, then this line is called tangent to the circle. In the figure, the line PQ is tangent to the circle.



Q.3 Label the parts of a circle:



Q.4 Observe the given figure and write the name of secants and tangents.

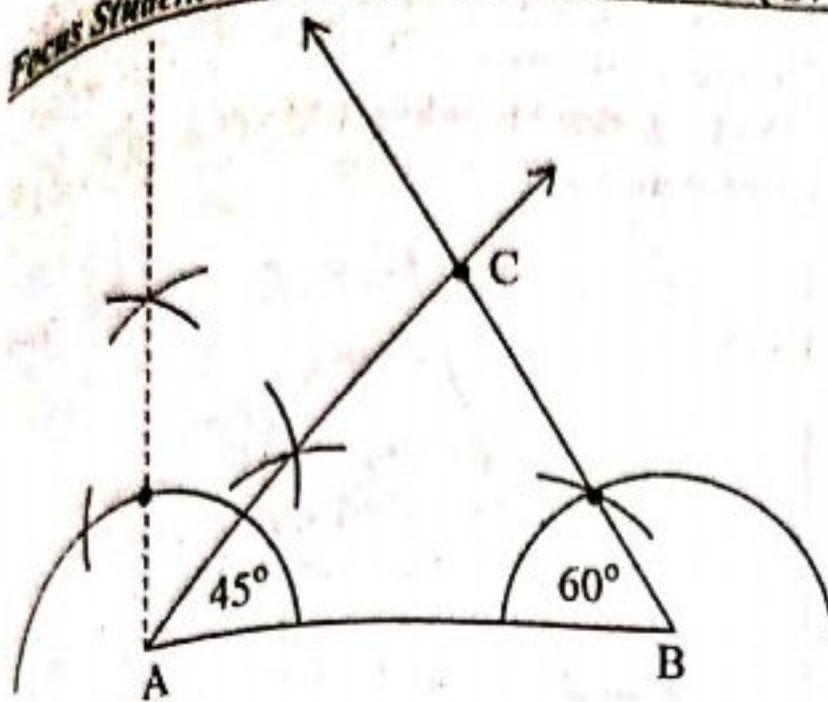


Sol: Secant lines are: o, n, m.

Tangent lines are: l and p. Ans

Q.5 Construct a triangle ABC when $\angle B = 60^\circ$, $\angle A = 45^\circ$ and the length of one side is 6cm.

Sol:



Steps of construction:

Step 1: Draw a line segment $\overline{AB} = 6\text{cm}$.

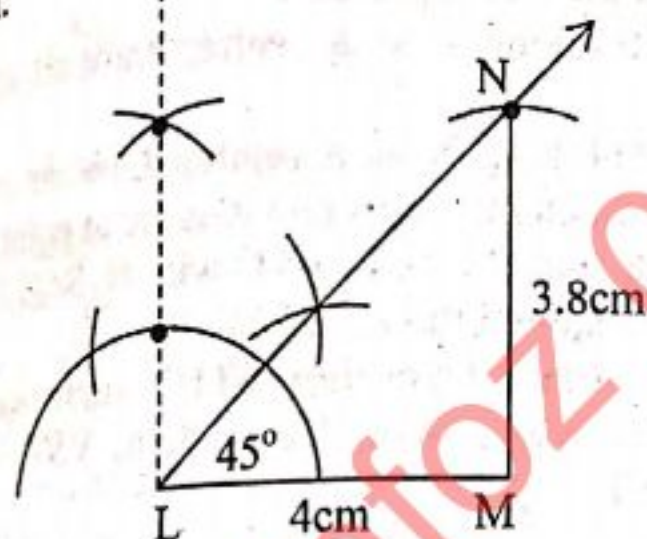
Step 2: Draw an angle of 45° at point A.

Step 3: Draw an angle of 60° at point B.

Step 4: Both angle lines intersect each other at point C. So, $\triangle ABC$ is our required triangle.

Q.6 Construct a triangle LMN when $\angle L = 45^\circ$ and length of two sides are 4cm and 3.8cm.

Sol:



Steps of construction:

Step 1: Draw a line segment $\overline{LM} = 4\text{cm}$.

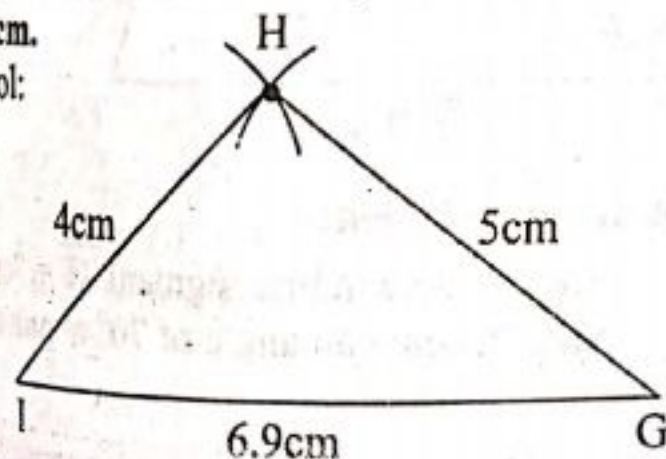
Step 2: Draw an angle of 45° at point L.

Step 3: Place the pointer of the compass at point M and draw an arc of length 3.8cm which cuts the arm of the angle at point N.

Step 4: Join N to M. So, $\triangle LMN$ is our required triangle.

Q.7 Construct a triangle GHI when its three sides $GH = 5\text{cm}$, $IG = 6.9\text{cm}$ and $HI = 4\text{cm}$.

Sol:



Steps of construction:

Step 1: Draw a line segment $\overline{IG} = 6.9\text{cm}$.

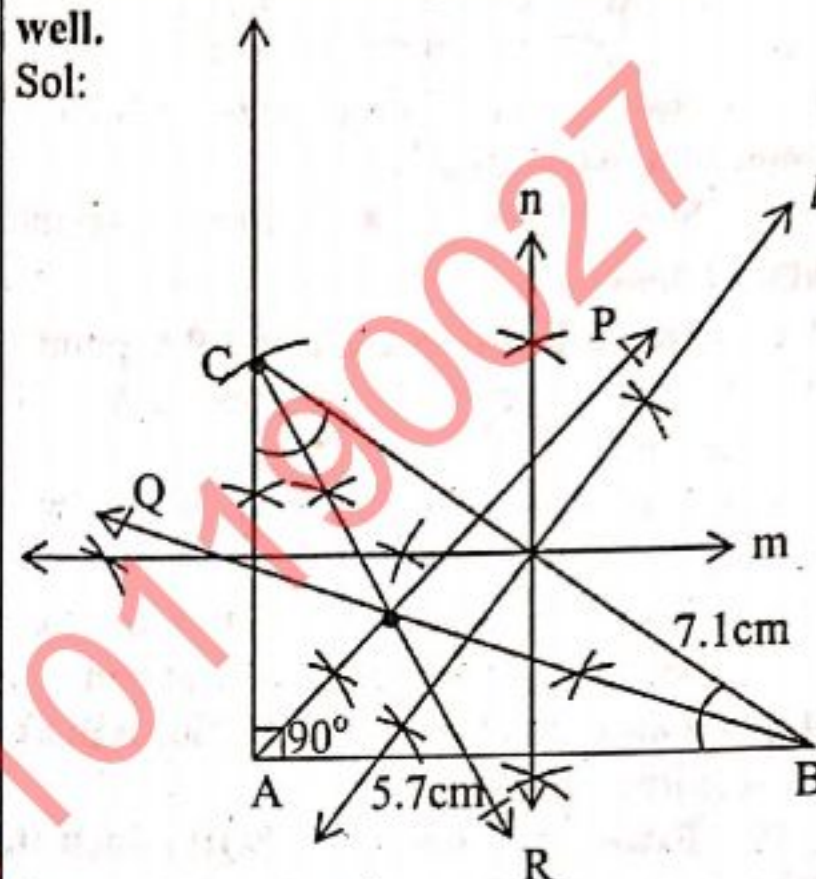
Step 2: Taking I as a centre, draw an arc of 4cm.

Step 3: Taking G as a centre, draw an arc of 5cm.

Step 4: Both arcs intersect each other at point H. So, $\triangle GHI$ is our required triangle.

Q.8 Draw right angle triangle when the length of its hypotenuse is 7.1cm and its base is 5.7cm. Draw its angle and side bisectors as well.

Sol:



Steps of construction:

Step 1: Draw a line segment $\overline{AB} = 5.7\text{cm}$.

Step 2: Draw an angle of 90° at point A.

Step 3: Draw an arc of 7.1cm at point B, which cuts the angle arm at point C.

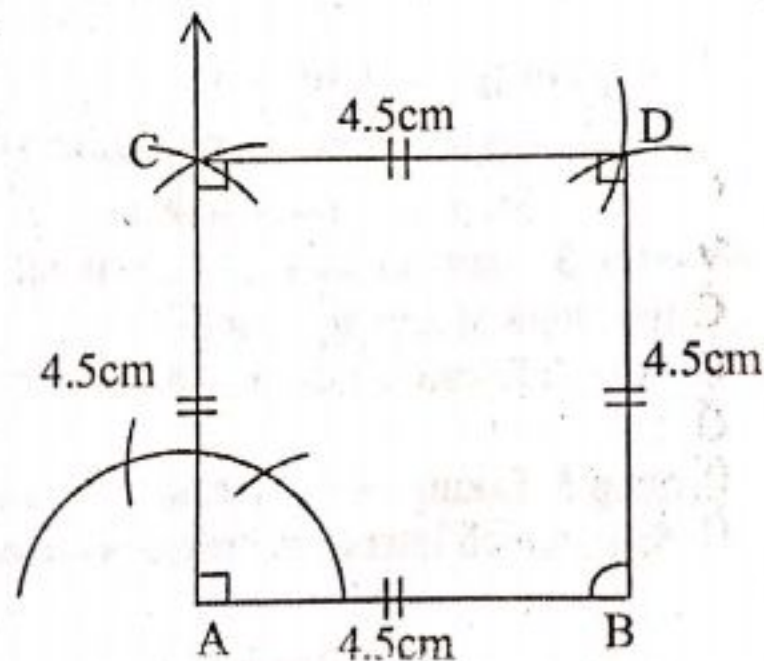
Step 4: Join C to B. So, $\triangle ABC$ is our required right angle triangle.

Angle Bisectors:

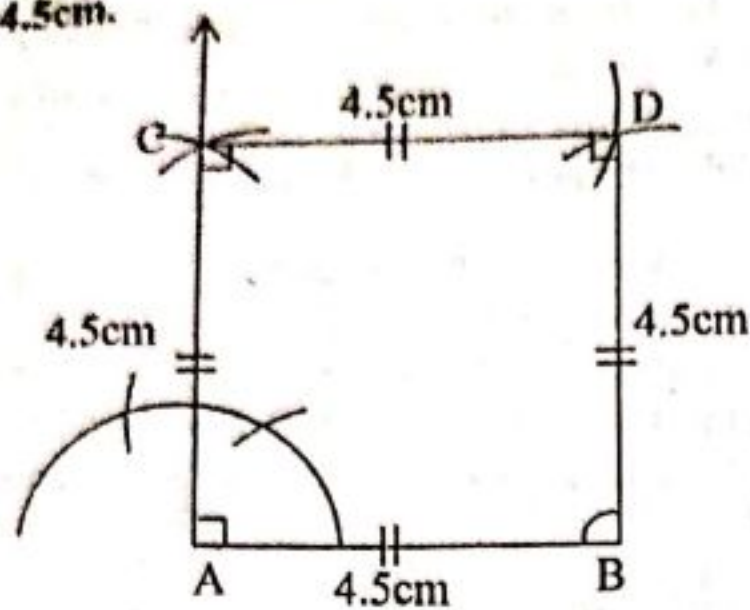
$\overline{AP}$, $\overline{BQ}$ and $\overline{CR}$ are the required angle bisectors of $\triangle ABC$.

Side Bisectors:

l , m , n are the required angle bisectors of $\triangle ABC$.



Q.9 Draw square ABCD with side AB = 4.5cm.



Steps of construction:

Step 1: Draw a line segment $\overline{AB} = 4.5\text{cm}$.

Step 2: Draw an angle of 90° at point A.

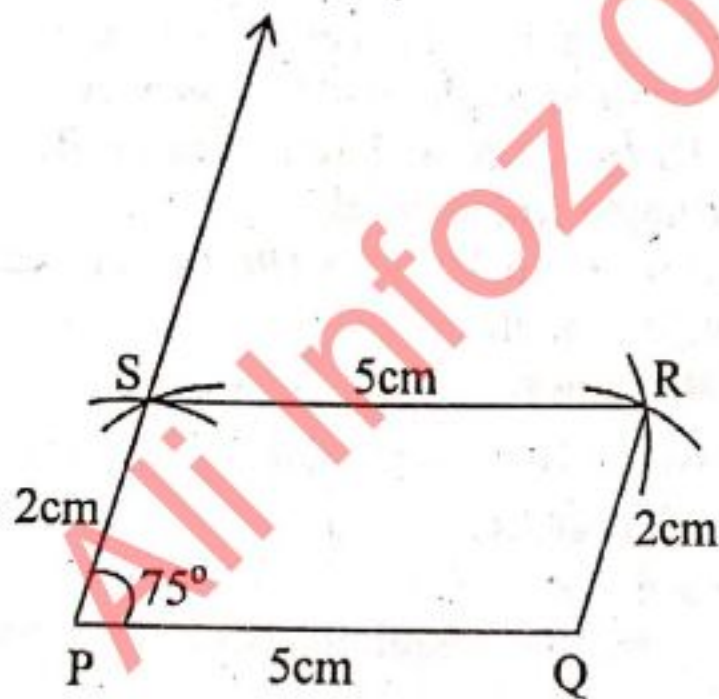
Step 3: Draw an arc of 4.5cm at point A, which cuts the angle line at point D.

Step 4: Taking B as a centre, draw an arc of 4.5cm.

Step 5: Taking D as a centre, draw an arc of 4.5cm, which cuts the previous arc at point C.

Step 6: Join C to B and C to D. So, ABCD is our required square.

Q.10 Draw parallelogram PQRS such that $PQ = 5\text{cm}$, $QR = 2\text{cm}$, $\angle SPQ = 75^\circ$.



Steps of construction:

Step 1: Draw a line segment $\overline{PQ} = 5\text{cm}$.

Step 2: Draw an angle of 75° at point P.

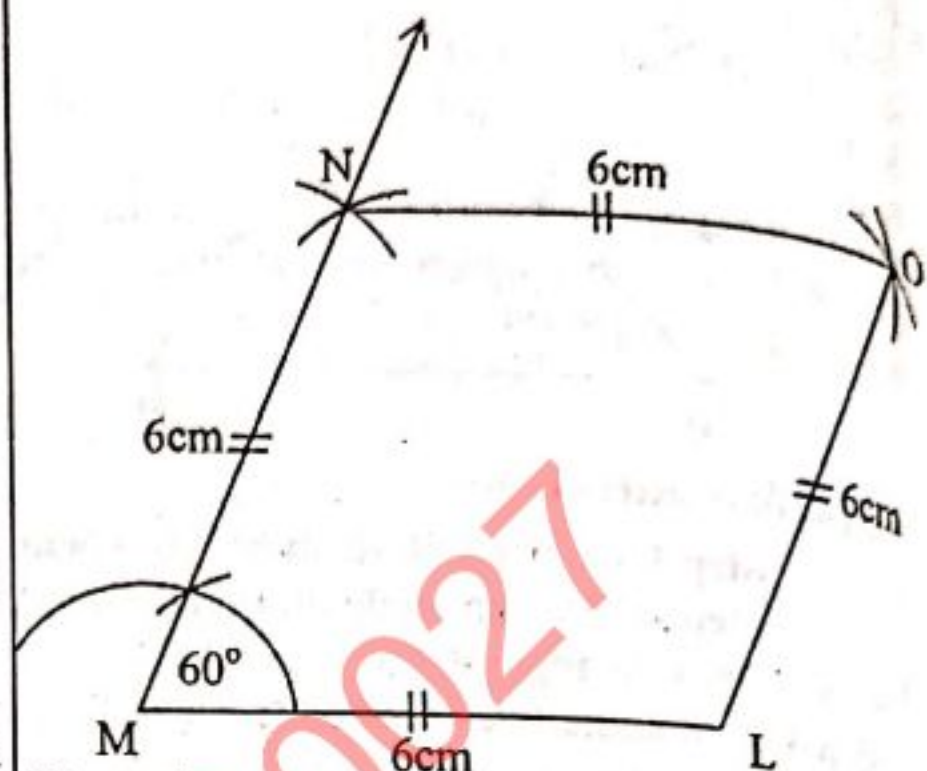
Step 3: Draw an arc of 2cm at point, which cuts the angle of arm at point S.

Step 4: Taking Q as a centre, draw an arc of 2cm.

Step 5: Taking S as a centre, draw an arc of 5cm, which intersects previous arc at point R.

Step 6: Join R with Q and R with S. So, PQRS is a parallelogram.

Q.11 Draw rhombus LMNO such that $LM = 6\text{cm}$ and $\angle LMN = 60^\circ$.



Steps of construction:

Step 1: Draw a line segment $\overline{LM} = 6\text{cm}$.

Step 2: Draw an angle of 60° at point M.

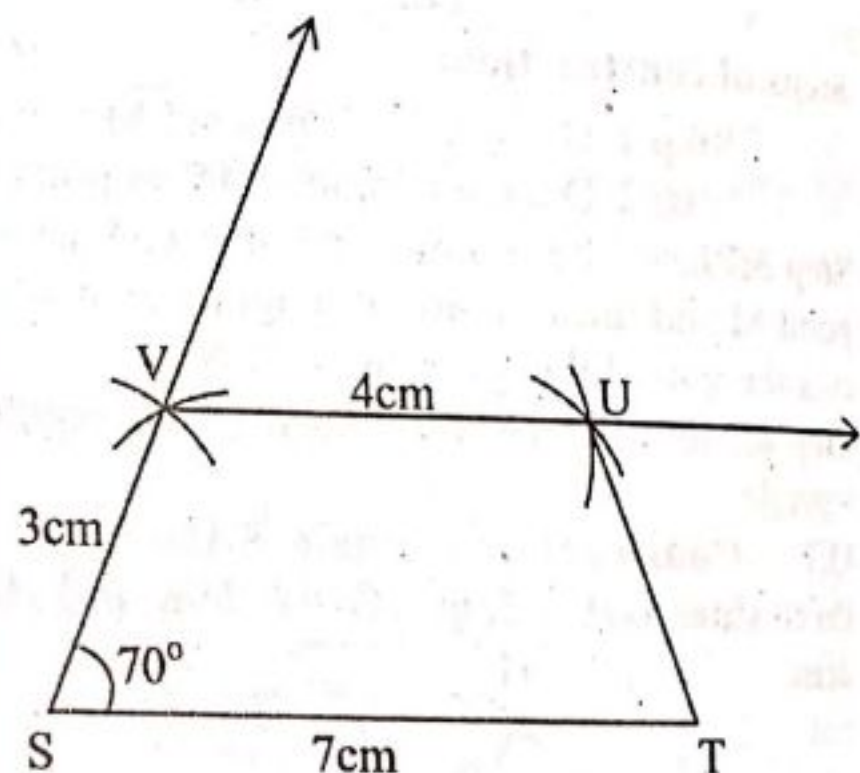
Step 3: Draw an arc of 6cm at point M, which cuts angle line at point N.

Step 4: Taking L as a centre, draw an arc of 6cm.

Step 5: Taking N as a centre, draw an arc of 6cm, which intersects previous arc at point.

Step 6: Join O with L and O with N. So, LMNO is our required rhombus LMNO.

Q.12 Draw trapezium STUV such that $ST = 7\text{cm}$, $SV = 3\text{cm}$, $VU = 4\text{cm}$, $\angle VST = 70^\circ$, $VU \parallel ST$.



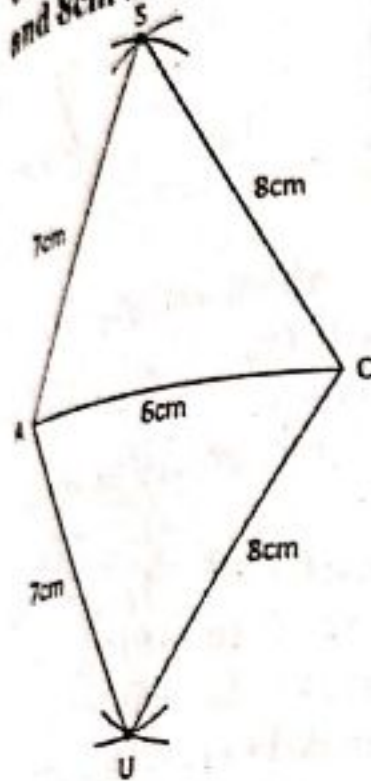
Steps of construction:

Step 1: Draw a line segment $\overline{ST} = 7\text{cm}$.

Step 2: Draw an angle of 70° at point S.

Step 3: Taking S as a centre, draw an arc of 3cm, which cuts the angle line at point V.
Step 4: Use a set square and ruler to draw a line parallel to ST through V.
Step 5: Taking V as a centre, draw an arc of 4cm, which intersects line at point U.
Step 6: Join U to T. So, STUV is the required trapezium.

Q.13 Construct a kite with length of diagonal 6cm and length of sides are 7cm and 8cm respectively.



Steps of construction:

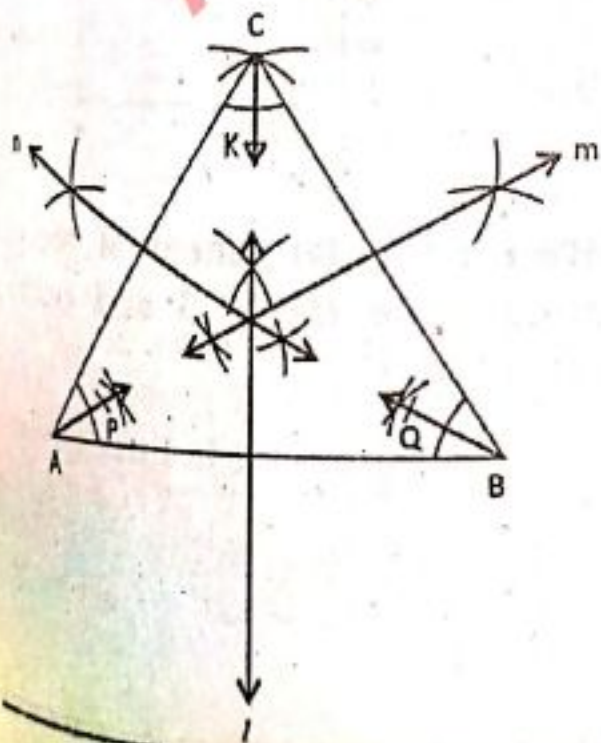
Step 1: Draw $\overline{AC} = 6\text{cm}$.

Step 2: With A as centre, draw arcs of radius 7cm above and below $\overline{AC}$.

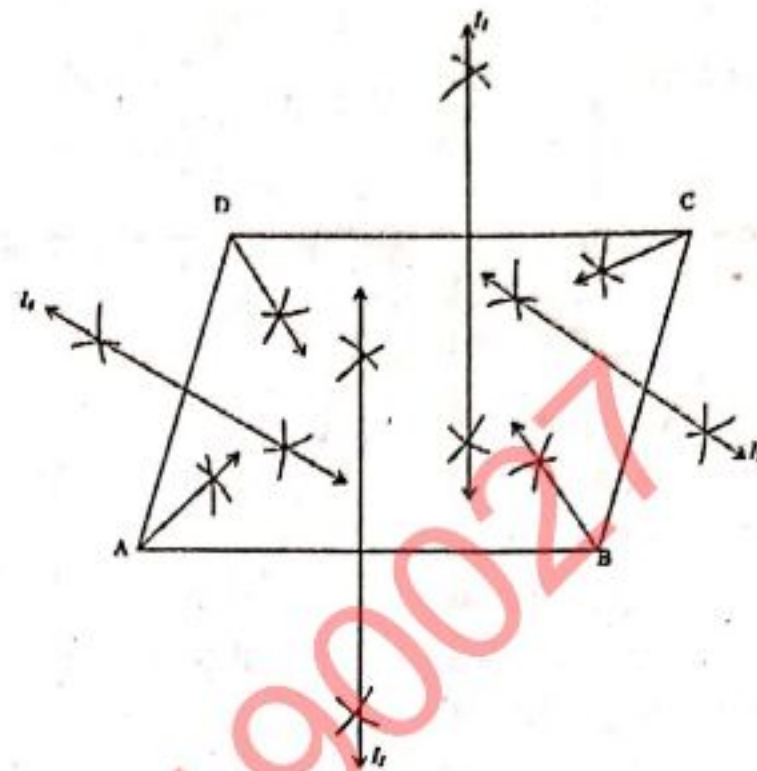
Step 3: With C as a centre, draw arcs of radius 8cm above and below $\overline{AC}$, which intersects the previous arcs at points B and D.

Step 4: Join A with B, B with C, C with D and D with A.

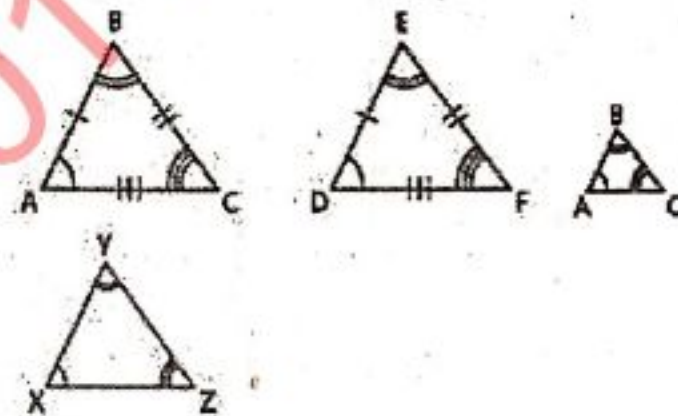
Q.14 Draw an equilateral triangle and then draw angle and line bisector that divides the given angles and sides of the triangle.



l, m, n are the perpendicular bisectors while $\overline{AP}, \overline{BQ}$ and $\overline{CR}$ are the angle bisectors of $\triangle ABC$.
Q.15 Draw parallelogram and then draw angles and line bisector to divide the angles and sides of the parallelogram.

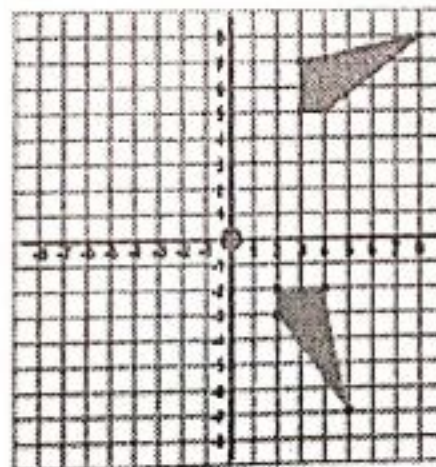
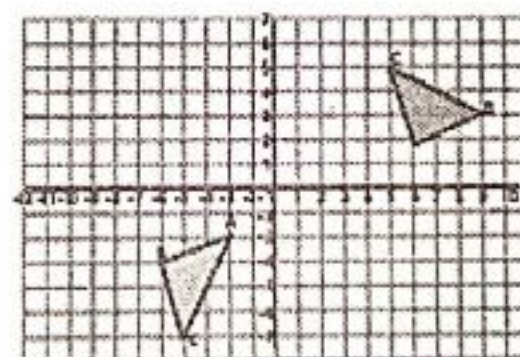


Q.16 Which pair of triangles is congruent?

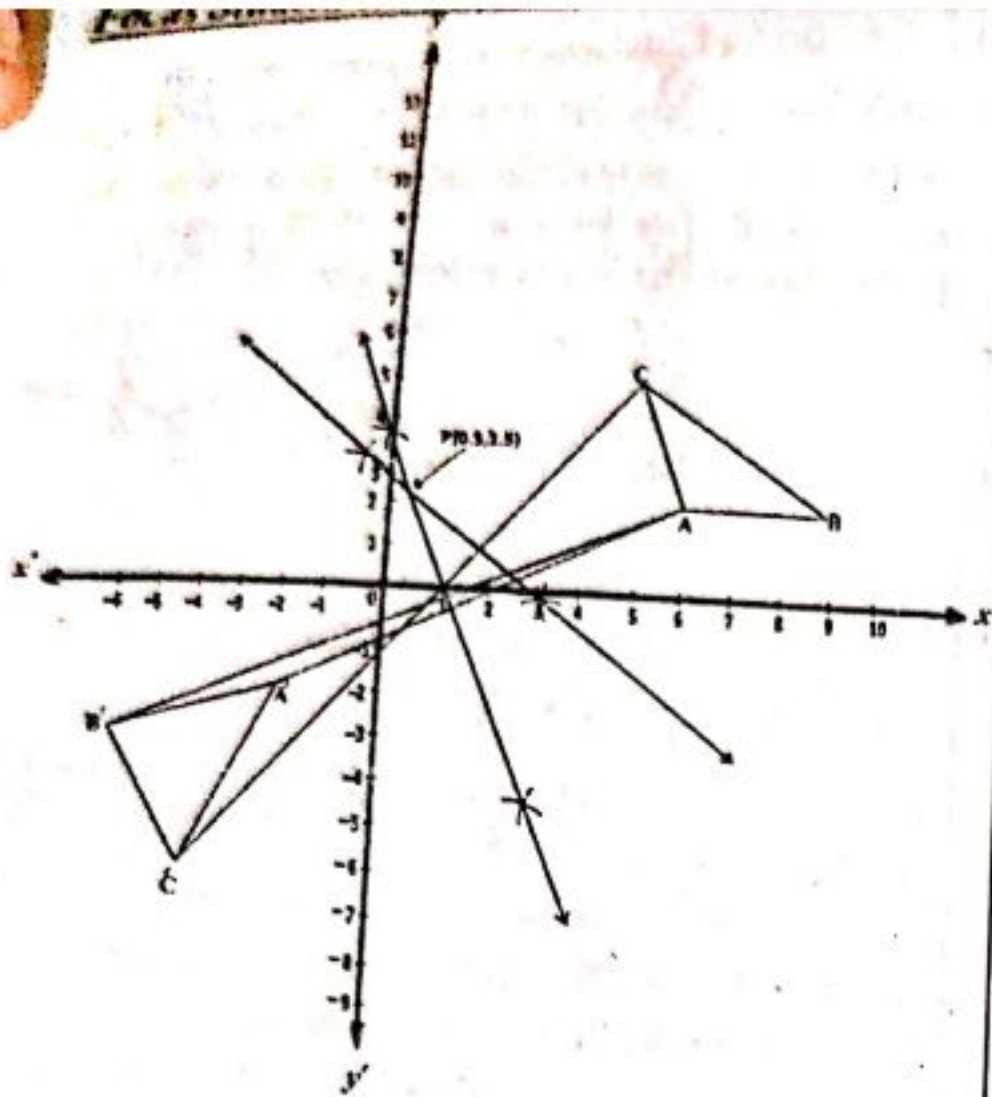


Sol: The first pair of triangle is congruent

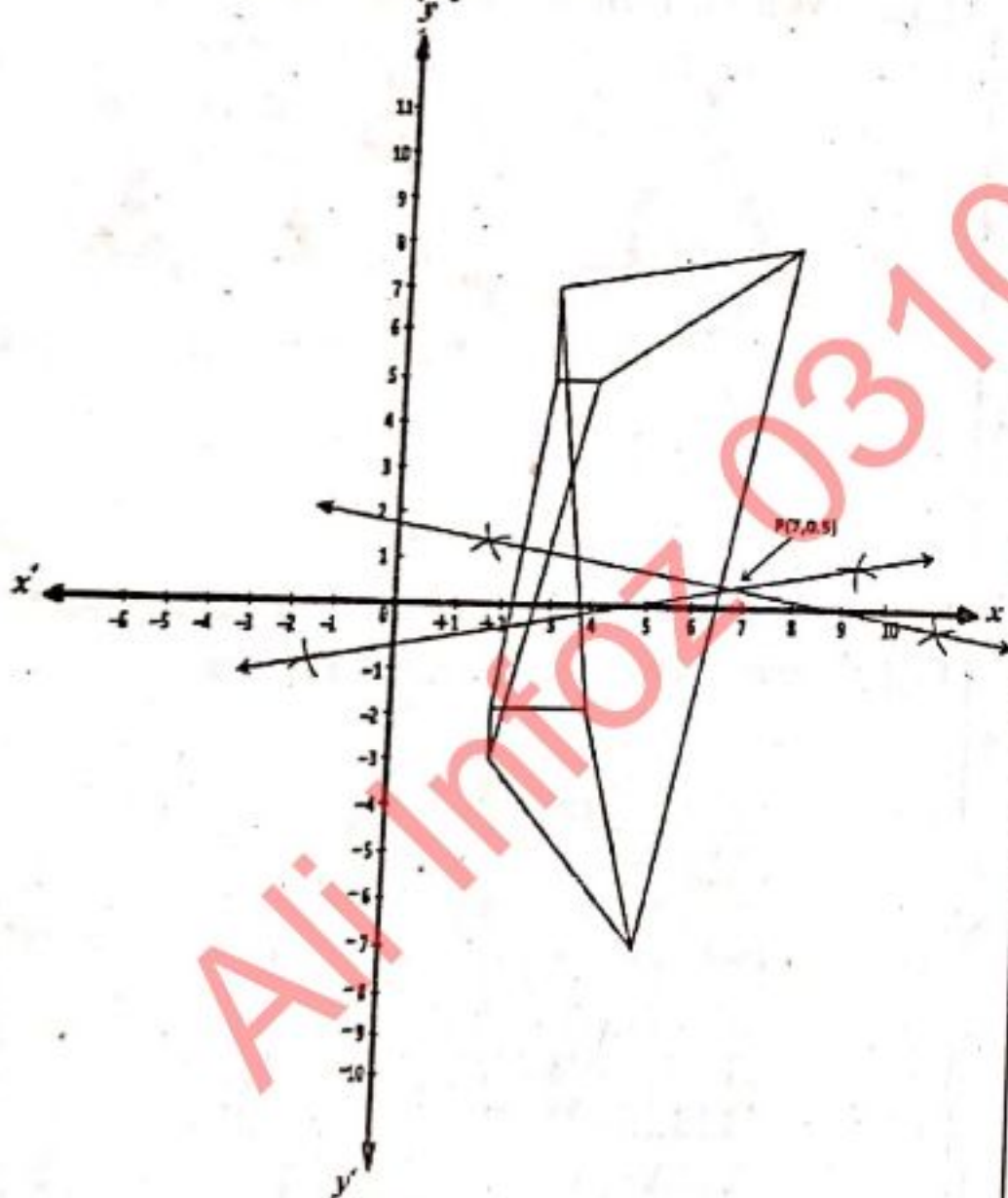
Q.17 Find the centre of rotation.



Solution of part (a):



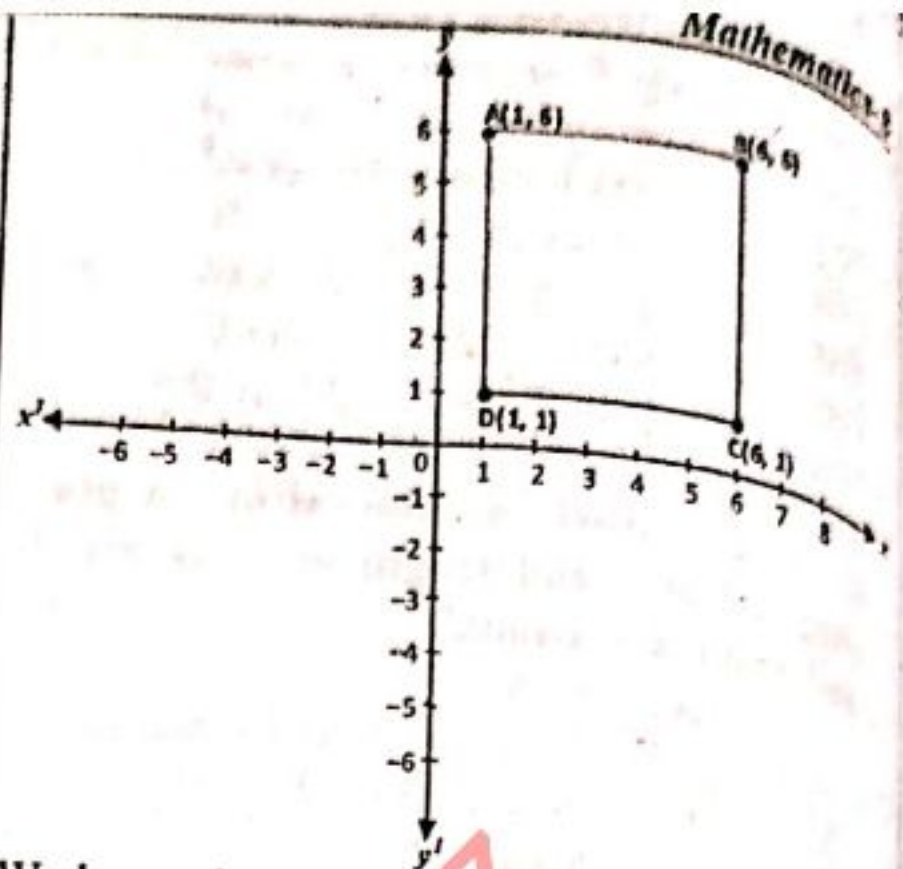
Solution of part (b):



Centre of rotation = P (7,0.5)

Q.18 . Draw a square on coordinate plane. Then rotate it through 90° clockwise about the origin.

Sol:



We know that

Rotating 90° clockwise about the origin.

$P(x, y) \rightarrow P'(y, -x)$ i.e. change the sign of x and then switch x, y .
Let's apply the rule to the vertices to create the new square $A'B'C'D'$.

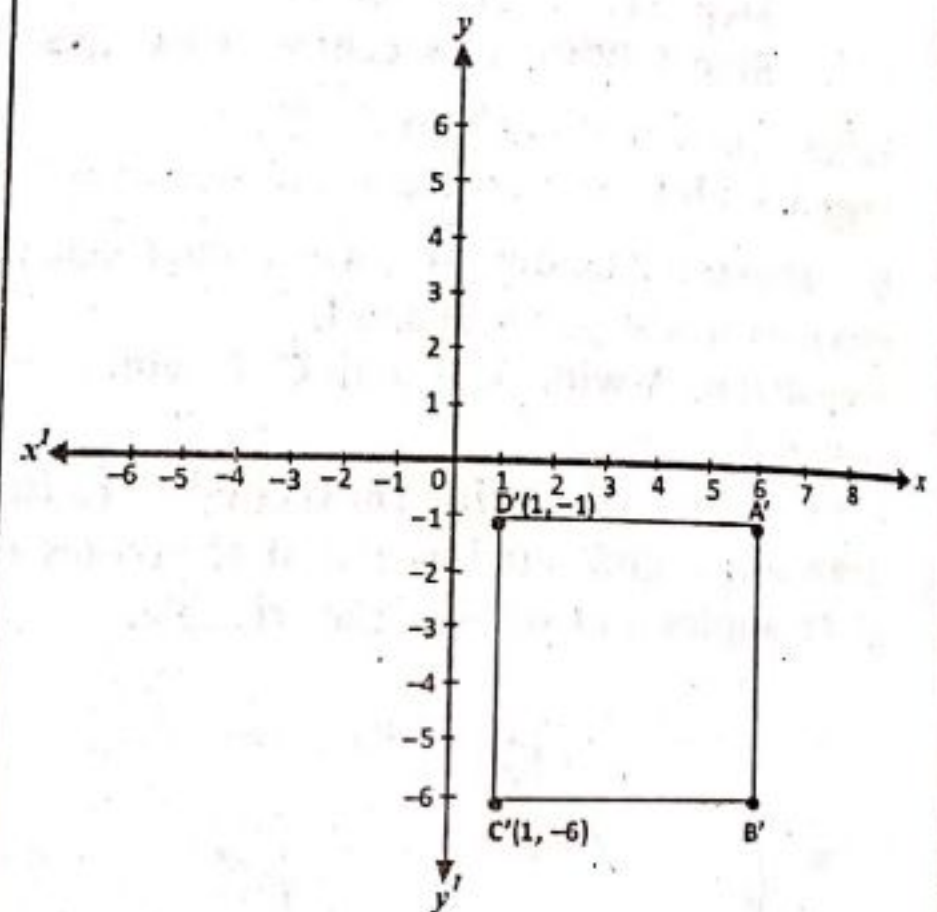
A (1, 6) becomes A' (6, -1)

B (6, 6) becomes B' (6, -6)

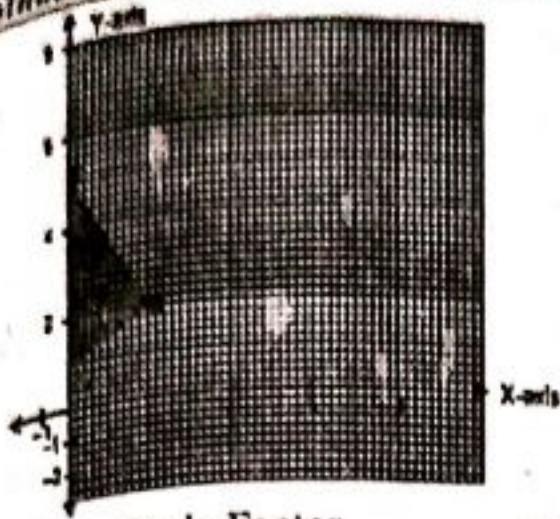
C (6, 1) becomes C' (1, -6)

D (1, 1) becomes D' (1, -1)

The square $A'B'C'D'$ is the required rotated image of square ABCD.



Q.19 Draw an enlargement of the given shape using scale factor 3 and centre of enlargement (-2, 1).



Sol: Scale Factor = 3
Centre of enlargement = $(-2, 1)$

From the graph

Vertices of $\triangle ABC$ are

$A(0, 1), B(2, 2), C(0, 5)$

Distance of C from A(0, 1) is
 $(0 + 2, 5 - 1) = (2, 4)$

As scale factor is 3, so

$$A'(2 \times 3, 0 \times 3) = A'(6, 0)$$

Distance of C from B(2, 2) is
 $(2 + 2, 5 - 2) = (4, 3)$

As scale factor is 3, so

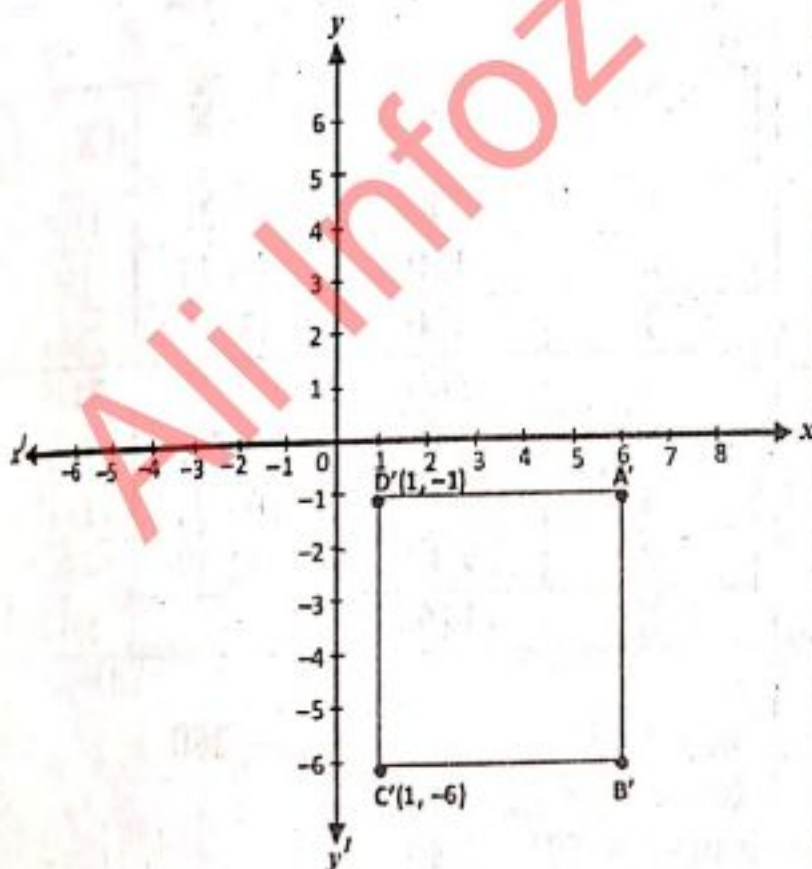
$$B'(4 \times 3, 1 \times 3) = B'(12, 3)$$

Distance of C from C(0, 5) is
 $(0 + 2, 5 - 1) = (2, 4)$

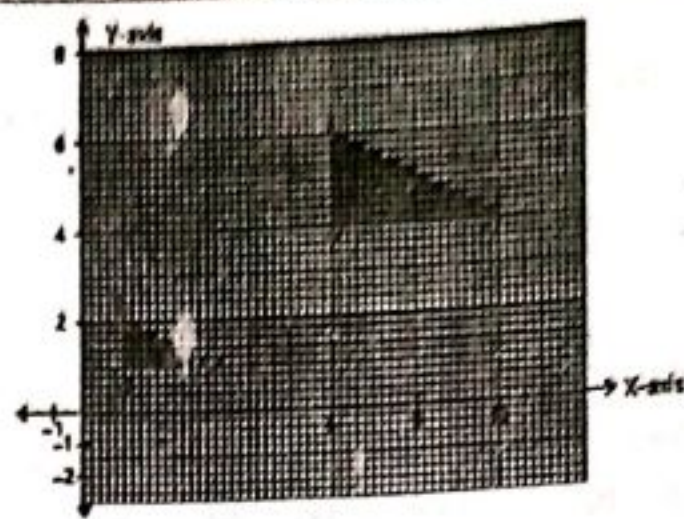
As scale factor is 3, so

$$C'(2 \times 3, 4 \times 3) = C'(6, 12)$$

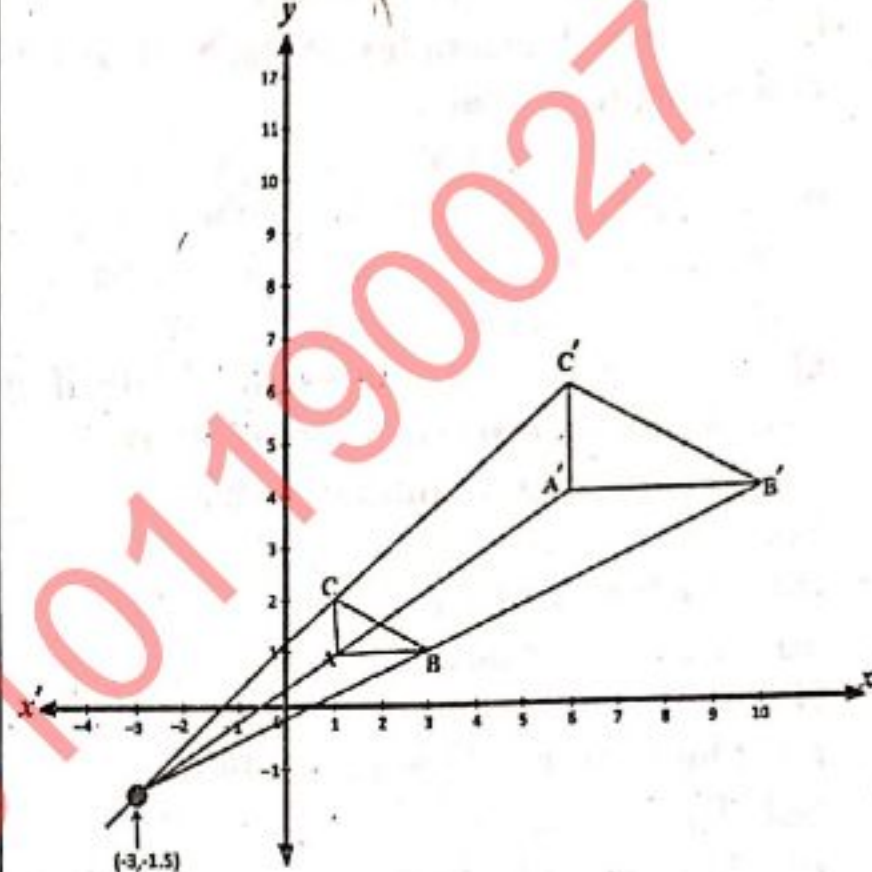
So, $\triangle A'B'C'$ is the required enlarged figure



Q.20 Finding the scale factor and centre of enlargement of these shapes.



Sol: Scale factor = ?
Centre of enlargement = ?



Unit.11
Data Management and Probability
Exercise 11.1
(TB Page. 278)

Q1: What do the terms discrete and continuous data mean?

Ans: (a) **Discrete Data:** Discrete data is quantitative data that is countable. It has a limited number of possible values.

(b) **Continuous Data:** Continuous data is data that can be measured. It has countless number of possible values within a particular range.

Q2: Write 2 examples of each of discrete and Continuous data.

Ans: Two examples of discrete data are number of days and number of plants in the garden

Two examples of continuous data are height of students and volume of water in a tank.

Q3: For each of the following, state if the data would be discrete or continuous

(a) The number of animals in a zoo.

Sol: Discrete data

(b) The length of a pencil.

Sol: Continuous data

Note: The book answer is wrong.

(c) The number of pages in a book.

Sol: Discrete data

(d) The mass of a chair

Sol: Continuous data

(e) The time taken to cook a dish.

Sol: Continuous data

(f) The number of books in a library.

Sol: Discrete data

(g) The capacity of a pool.

Sol: Continuous data

(h) The number of mathematics questions in an exercise.

Sol: Discrete data

(i) The mass of watermelon.

Sol: Continuous data

Exercise 11.2

(TB page 283)

Q1: Find the range, variance and standard deviation for the following set of data

(a) 35, 79, 44, 63, 92, 28, 20

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	35	-16.57	274.56
2	79	27.43	752.40

3	44	-7.57	57.30
4	63	11.43	130.64
5	92	40.43	1634.58
6	28	23.57	555.54
7	20	-31.57	996.66
Σ	361	-	4401.68

$$X_{\max} = 92, \quad X_{\min} = 20$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 92 - 20$$

$$\text{Range} = 72$$

$$\bar{X} = \frac{\sum X}{n} = \frac{361}{7} = 51.75$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{4401.68}{7}}$$

$$S = \sqrt{628.81}$$

$$S = 25.076$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{4401.68}{7}$$

$$S^2 = 628.81$$

(b) 400, 450, 520, 380, 495, 575, 444

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	400	-66.29	4394.36
2	450	-16.29	256.36
3	520	53.71	2884.76
4	380	-86.29	7445.96
5	495	28.71	824.26
6	575	108.71	11817.86
7	444	-22.29	496.84
Σ	3264	-	28129.4

$$X_{\max} = 575, \quad X_{\min} = 380$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 575 - 380$$

$$\text{Range} = 195$$

$$\bar{X} = \frac{\sum X}{n} = \frac{3264}{7} = 466.29$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{28129.4}{7}}$$

$$S = \sqrt{4018.48}$$

$$S = 63.39$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{28129.4}{7}$$

$$S^2 = 4018.48$$

(c) 6, 7, 10, 11, 14, 13, 16, 18, 25

S.No	X	X - $\bar{X}$	(X - $\bar{X}$) ²
1	6	-7.3	53.29
2	7	-6.3	36.69
3	10	-3.3	10.89
4	11	-2.3	5.29
5	14	0.7	0.49
6	13	-0.3	0.09
7	16	2.7	7.29
8	18	4.7	22.09
9	25	11.7	136.89
Σ	120	-	276.01

$$X_{\max} = 25, \quad X_{\min} = 6$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 25 - 6$$

$$\text{Range} = 19$$

$$\bar{X} = \frac{\sum X}{n} = \frac{120}{9} = 13.3$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{276.09}{9}}$$

$$S = \sqrt{30.67}$$

$$S = 5.38$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{276.01}{9}$$

$$S^2 = 30.67$$

(d) 83, 23, 24, 71, 52, 62, 63

Sol:

S.No	X	X - $\bar{X}$	(X - $\bar{X}$) ²
1	83	29	841
2	23	-31	961
3	24	-30	900
4	71	17	289
5	52	-2	4
6	62	8	64
7	63	9	81
Σ	378	-	3140

$$X_{\max} = 83$$

$$X_{\min} = 23$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 83 - 23$$

$$\text{Range} = 60$$

$$\bar{X} = \frac{\sum X}{n} = \frac{378}{7} = 54$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{3140}{7}}$$

$$S = \sqrt{448.57}$$

$$S = 21.179$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{3140}{7}$$

$$S^2 = 448.57$$

(e) 63, 25, 43, 28, 72, 61, 45, 46, 13

Sol:

S.No	X	X - $\bar{X}$	(X - $\bar{X}$) ²
1	63	19	361
2	25	-19	361
3	43	-1	1
4	28	-16	256
5	72	28	784
6	61	17	289
7	45	1	1
8	46	2	4
9	13	-31	961
Σ	396	-	3018

$$X_{\max} = 72$$

$$X_{\min} = 13$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 72 - 13$$

$$\text{Range} = 59$$

$$\bar{X} = \frac{\sum X}{n} = \frac{396}{9} = 44$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{3018}{9}}$$

$$S = \sqrt{335.53}$$

$$S = 18.31$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{3018}{9}$$

$$S^2 = 335.53$$

(f) 8, 9, 11, 13, 15, 10, 18, 20

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	8	-4.4	19.36
2	9	-3.4	11.56
3	8	-4.4	19.36
4	11	-1.4	1.96
5	13	0.6	0.36
6	15	2.6	6.76
7	10	-2.4	5.76
8	18	5.6	31.36
9	20	7.6	57.76
Σ	112	-	154.24

$$X_{\max} = 20$$

$$X_{\min} = 8$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 20 - 8$$

$$\text{Range} = 12$$

$$\bar{X} = \frac{\sum X}{n} = \frac{112}{9} = 12.4$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{154.24}{9}}$$

$$S = \sqrt{17.14}$$

$$S = 4.14$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{154.24}{9}$$

$$S^2 = 17.14$$

Q2: The following data shows the marks obtained by 11 students in mathematics terminal exams.

82, 83, 59, 94, 70, 76, 32, 80, 87, 94, 62

Calculate:

(a) Range (b) Variance (c) Standard deviation for this data.

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	82	7.55	57.00
2	83	8.55	73.10
3	59	-15.45	238.70
4	94	19.55	382.20
5	70	-4.45	19.80
6	76	1.55	2.40
7	32	-42.45	1802.00
8	80	5.55	30.80
9	87	12.55	157.50
10	94	19.55	382.20
11	62	-12.45	155.00
Σ	819	-	3300.7

(a) Range = ?

$$X_{\max} = 94$$

$$X_{\min} = 32$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 94 - 32$$

$$\text{Range} = 62$$

$$\bar{X} = \frac{\sum X}{n} = \frac{819}{11} = 74.45$$

(b) Variance = ?

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{3300.7}{11}$$

$$S^2 = 300.06$$

(c) Standard deviation = ?

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{3300.7}{11}}$$

$$S = \sqrt{300.06}$$

$$S = 17.32$$

Q3: The following data shows the age of 10 teachers in a school. 28, 31, 45, 35, 30, 50, 54, 38, 40, 36. Calculate (a) Range (b) Variance (c) Standard Deviation for this data

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	28	-10.7	114.49
2	31	-7.7	59.29
3	45	6.3	39.69
4	35	-3.7	13.69
5	30	-8.7	75.69
6	50	11.3	127.69
7	54	15.3	234.09
8	38	-0.7	0.49
9	40	1.3	1.69
10	36	-2.7	7.29
Σ	387	-	674.1

(a) Range = ?

$$X_{\max} = 54, \quad X_{\min} = 28$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 54 - 28$$

$$\text{Range} = 26$$

(b) Variance = ?

$$\bar{X} = \frac{\sum X}{n} = \frac{387}{10} = 38.7$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{674.1}{10}$$

$$S^2 = 67.41$$

(c) Standard Deviation = ?

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{674.1}{10}}$$

$$S = \sqrt{67.41}$$

$$S = 8.21$$

Q4: According to a library's weekly record, 42, 45, 58, 62, 70, 66 and 88 books were issued during the last 7 days. Find the range and standard deviation for this data.

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	42	-19.57	382.98
2	45	-16.57	274.56
3	58	-3.57	12.74
4	62	0.43	0.18
5	70	8.43	71.06
6	66	4.43	19.62
7	88	26.43	698.54
Σ	431	-	1459.68

$$X_{\max} = 88, \quad X_{\min} = 42$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 88 - 42$$

$$\text{Range} = 46$$

$$\bar{X} = \frac{\sum X}{n} = \frac{431}{7} = 61.57$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{1459.68}{7}}$$

$$S = \sqrt{208.53}$$

$$S = 14.44$$

Q5: The following data shows the number of pages of 8 books. 120, 225, 100, 154, 188, 204, 212, 170. Find the variance for this data. Also calculate the range.

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	120	-51.63	2665.66
2	225	53.37	2848.36
3	100	-71.63	5130.86
4	154	-17.63	310.82
5	188	16.37	267.97

Focus Student Resource Book			
6	204	32.37	1047.82
7	212	40.37	1629.73
8	170	-1.62	2.66
Σ	1373	-	13903.88

$$X_{\max} = 225, \quad X_{\min} = 100$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 225 - 100$$

$$\text{Range} = 125$$

$$\bar{X} = \frac{\sum X}{n} = \frac{1373}{8} = 171.63$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{13903.88}{8}$$

$$S^2 = 1737.98$$

Q6: The weekly income of 10 employees of a factory is Rs 6000, Rs 65230, Rs 78600, Rs 8000, Rs 9350, Rs 9680, Rs 1030, Rs 1236, Rs 14340, Rs 15000. Calculate the range standard deviation and variance for this data.

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	6000	-14.846.6	220,421,531.6
2	65230	44383.4	1,969,886,196
3	78600	57753.4	3,335,455,212
4	8000	-12846.6	165,035,131.6
5	9350	-11496.9	132,171,811.6
6	9680	-11166.6	124,692,955.6
7	1030	-19816.6	392,697,635.6
8	1236	-19610.6	384,575,632.4
9	14340	-6506.6	42,335,843.56
10	15000	-5846.6	34,182,731.56
Σ	208446	-	6,801,454,682

$$X_{\max} = \text{Rs } 78,600$$

$$X_{\min} = \text{Rs } 1030$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = \text{Rs } 78,600 - \text{Rs } 1030$$

$$\text{Range} = \text{Rs } 77,570$$

$$\bar{X} = \frac{\sum X}{n} = \frac{208446}{10} = 20844.6$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{6,801,454,682}{10}}$$

$$S = \sqrt{680,145,468.2}$$

$$S = 26,079.59$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{6,801,454,682}{10}$$

$$S^2 = 680,145,468.2$$

Exercise 11.3 (TB Page 289)

Q1: Make frequency distribution table of weights in kilogram of 20 students of Class VIII

30, 39, 36.2, 42, 38, 42, 45, 39, 38.2, 41.5, 34, 44.8, 36.2, 38, 41.5, 44.8, 35, 41.5, 39, 42.

Sol:

Weights in Kg	Tally	Frequency (F)
30	1	1
34	1	1
35	1	1
36.2	11	2
38	1	1
38.2	1	1
39	1111	4
41.5	111	3
42	111	3
44.8	11	2
45	1	1
Σ	-	20

Q2: Marks obtained by 21 students in a certain class test out of a total mark 30 are given below

25, 19, 26, 15, 25, 28, 25, 27, 19, 28, 28, 19, 19, 15, 28, 19, 19, 25, 27, 25, 28

a) Construct a frequency distribution table having equal class interval

Class Interval	Tally	Frequency (F)
15-17	11	2
18-20	1111	6
21-23	-	0
24-26	1111	6

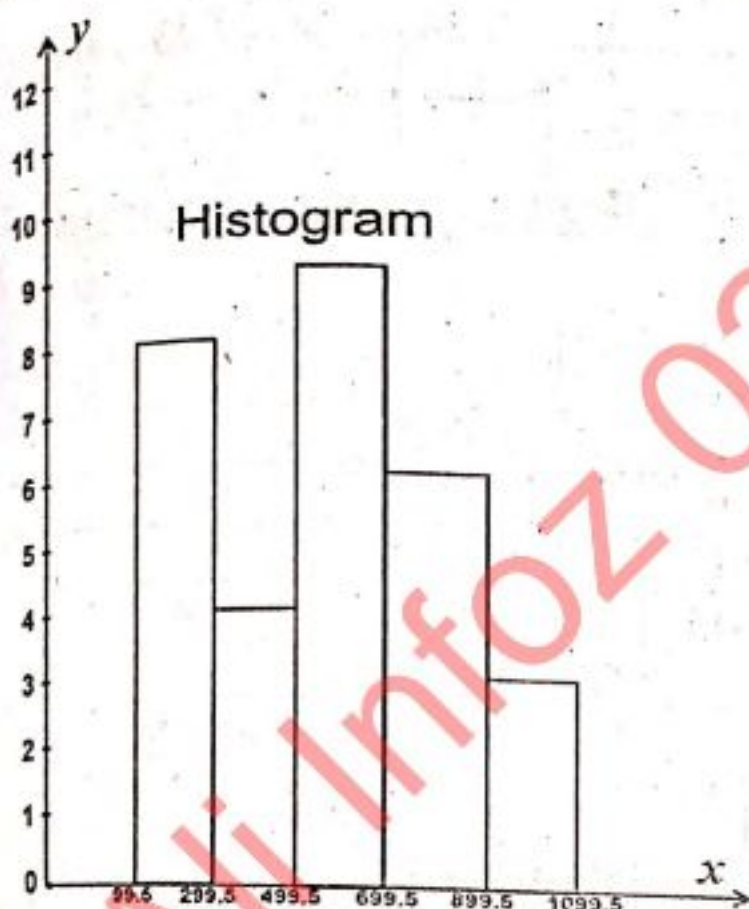
27-29	-11	7
Σ	-	21

(b) What is the total number of students having highest marks.
Ans: There are 7 students who have the highest marks.

Q3: Draw histogram for the following data values.

a) 228, 640, 772, 264, 937, 514, 763, 770, 908, 864, 950, 328, 306, 574, 233, 265, 163, 431, 807, 130, 532, 553, 576, 639, 675, 738, 205, 535, 368, 140.

Class Interval	Tally	F	CB
100-299	-111	8	99.5-299.5
300-499		4	299.5-499.5
500-699	-1111	9	499.5-699.5
700-899	-1	6	699.5-899.5
900-1099		3	899.5-1099.5
Σ	-	30	-



Class Boundaries

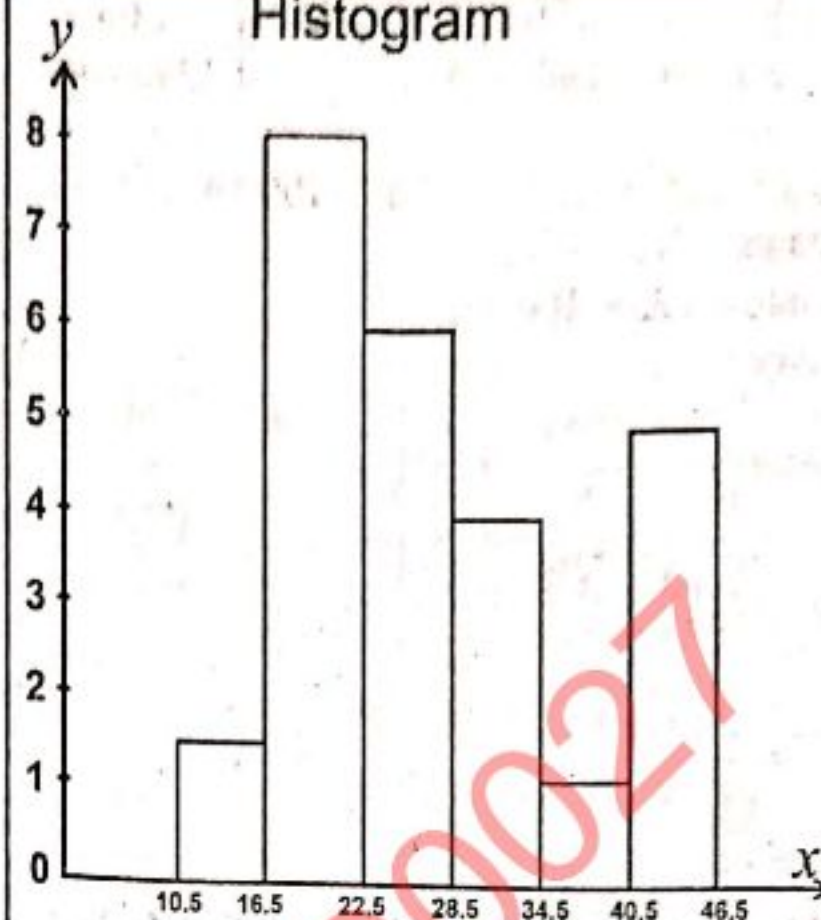
b) 18, 25, 21, 20, 27, 18, 16, 17, 19, 19, 19, 23, 45, 12, 32, 30, 31, 36, 28, 25, 27, 30, 42, 40, 43, 44

Solution: Here smallest value = 12
and largest value = 45

Class Interval	Tally	F	CB
11-16		2	10.5-16.5
17-22	-111	8	16.5-22.5
23-28	-1	6	22.5-28.5
29-34		4	28.5-34.5
35-40		1	34.5-40.5

41-46		5	40.5-46.5
Σ	-	26	-

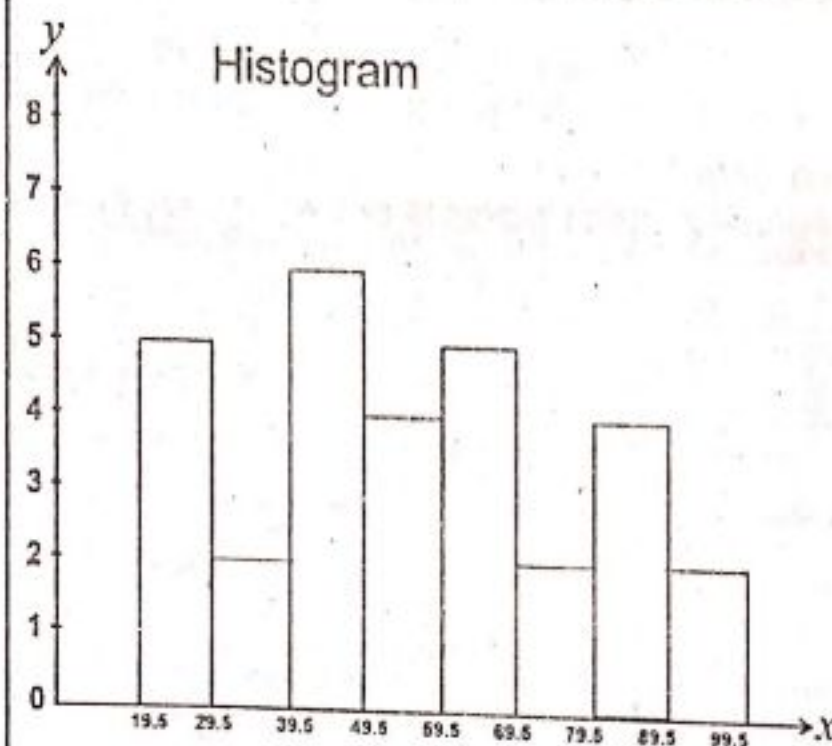
Histogram



Class Interval

Q4: The following data shows the number of people who visited the park daily during a month.
42 64 36 62 41 47 87 69 65 55 83 79 34 68 25
28 46 51 74 27 29 44 59 96 40 20 50 88 86 93

Class Interval	Tally	(F)	Class Boundaries
20-29		5	19.5-29.5
30-39		2	29.5-39.5
40-49	-1	6	39.5-49.5
50-59		4	49.5-59.5
60-69		5	59.5-69.5
70-79		2	69.5-79.5
80-89		4	79.5-89.5
90-99		2	89.5-99.5
Σ	-	30	-



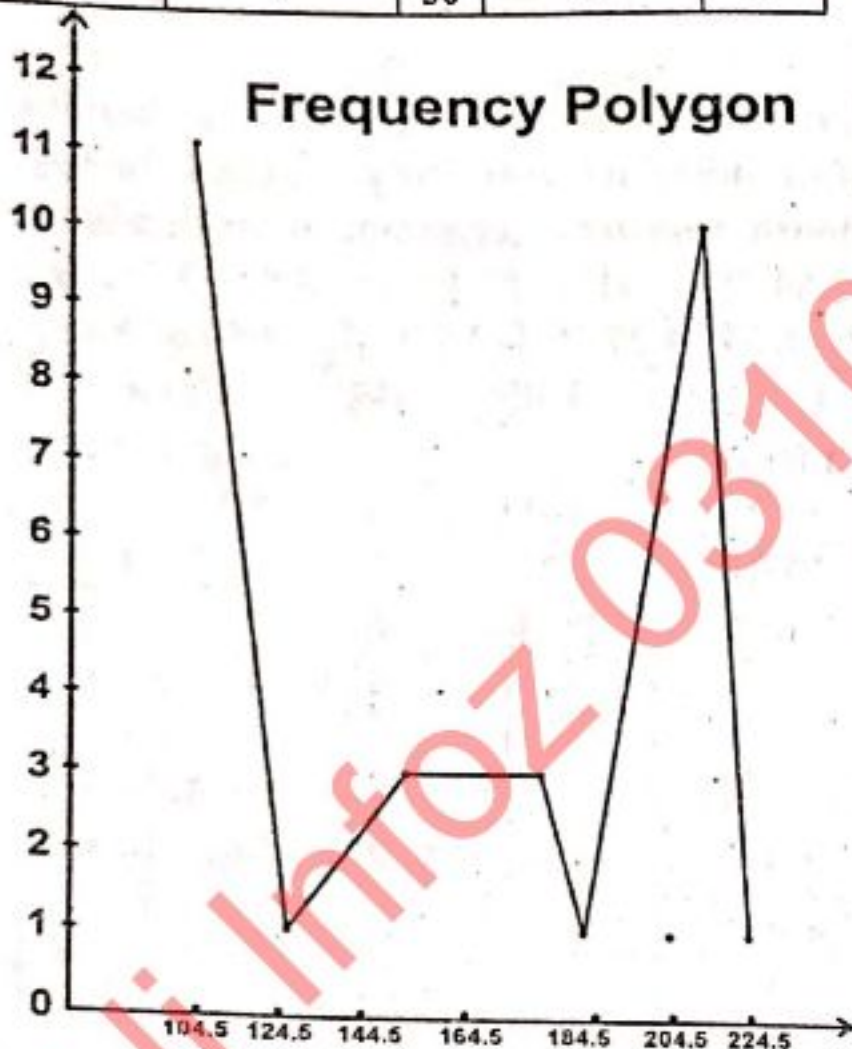
Class Interval

Q5: The following data consists of number of pages in 30 books of a home library. Construct a frequency polygon for this data.
195, 206, 100, 98, 150, 210, 195, 106, 195, 168, 180, 212, 104, 195, 100, 216, 195, 209, 112, 99, 206, 116, 195, 100, 142, 100, 135, 98, 160, 155

Sol: Here smallest value = 98

And largest value = 216

Class Interval	Tally	F	CB	Mid point (x)
95-114	- 1	11	94.5-114.5	104.5
115-134	1	1	114.5-134.5	124.5
135-154	111	3	134.5-154.5	144.5
155-174	111	3	154.5-174.5	164.5
175-194	1	1	174.5-194.5	184.5
195-214	- 10	10	194.5-214.5	204.5
215-234	1	1	214.5-234.5	224.5
Σ	-	30	-	-



Class Boundaries

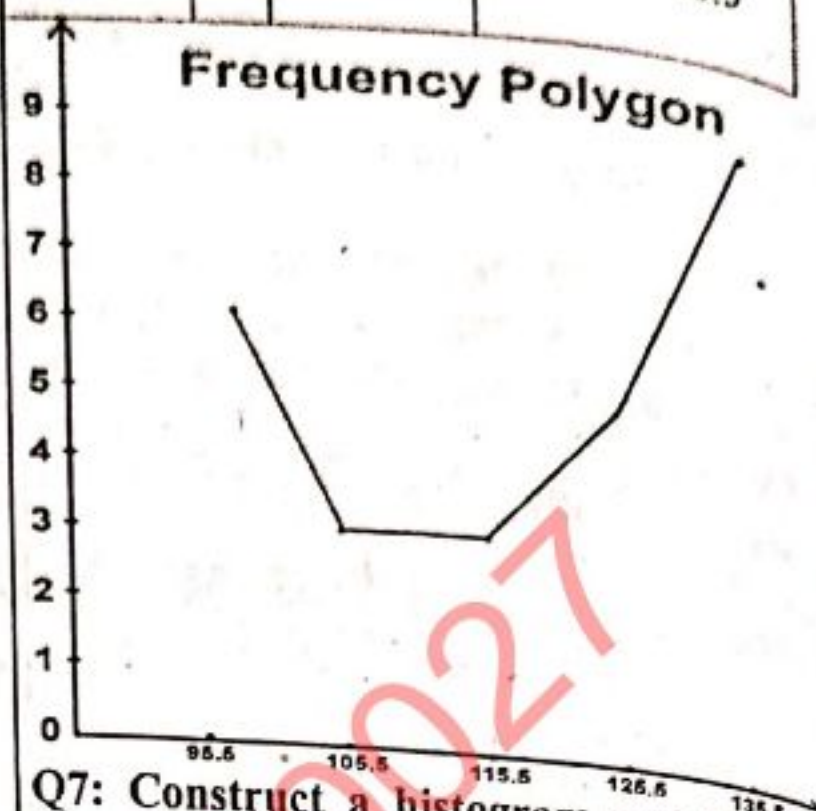
Q6: Construct a frequency polygon for the given data

Class Interval	Frequency
91-100	6
101-110	3
111-120	3
121-130	5
131-140	8

Sol:

Class Interval	F	Midpoint (x)	Class Boundaries
91-100	6	95.5	90.5-100.5
101-110	3	105.5	100.5-110.5

111-120	3	115.5	110.5-120.5
121-130	5	125.5	120.5-130.5
131-140	8	135.5	130.5-140.5

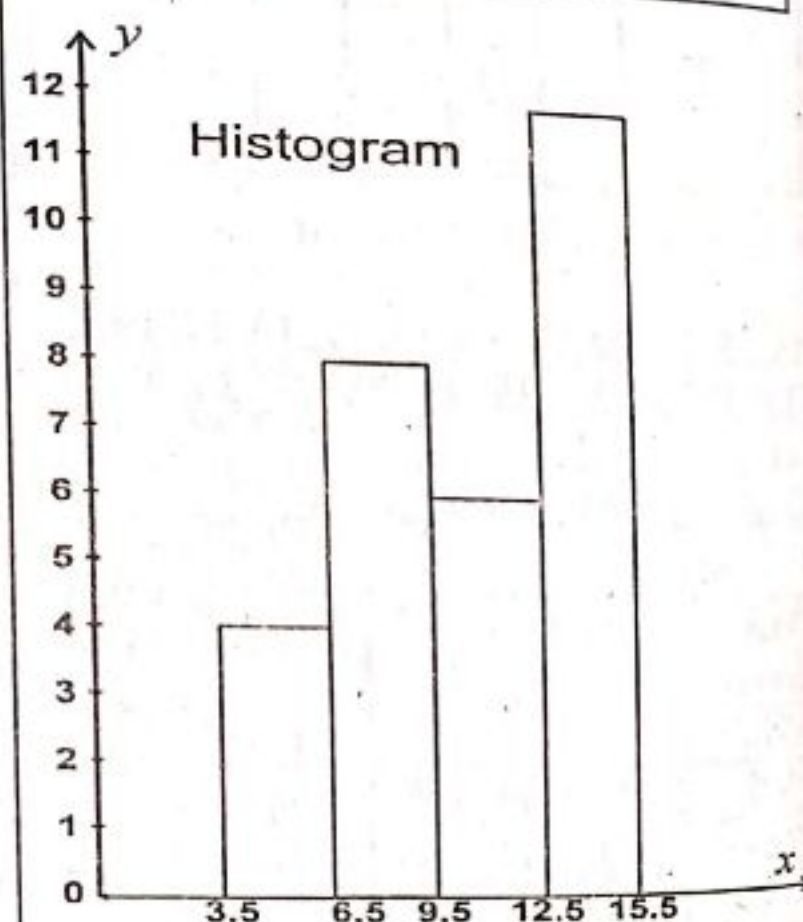


Q7: Construct a histogram and frequency polygon for the following data.

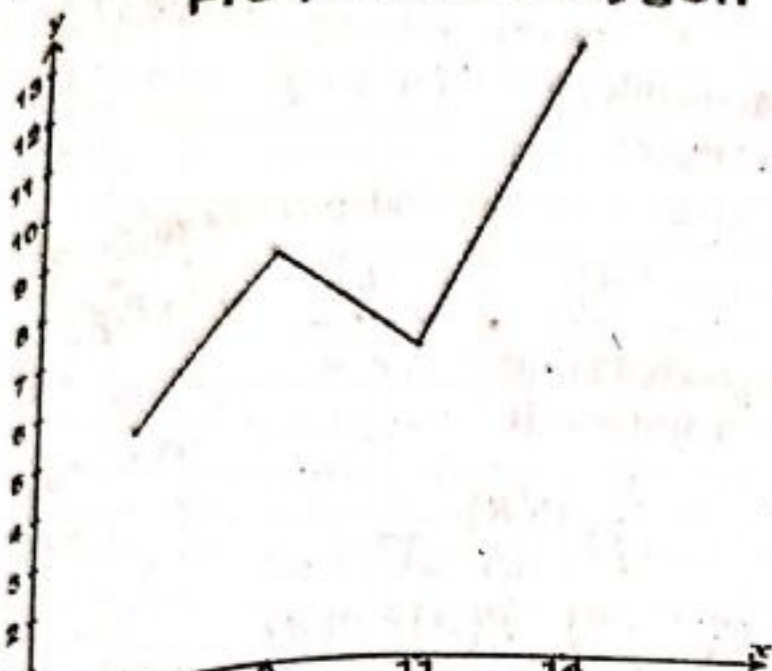
Class Interval	Frequency
4 - 6	4
7 - 9	8
10 - 12	6
13 - 15	12

Sol:

Class Interval	F	C.B	Midpoint (x)
4-6	4	3.5-6.5	5
7-9	8	6.5-9.5	8
10-12	6	9.5-12.5	11
13-15	12	12.5-15.5	14



Frequency Polygon

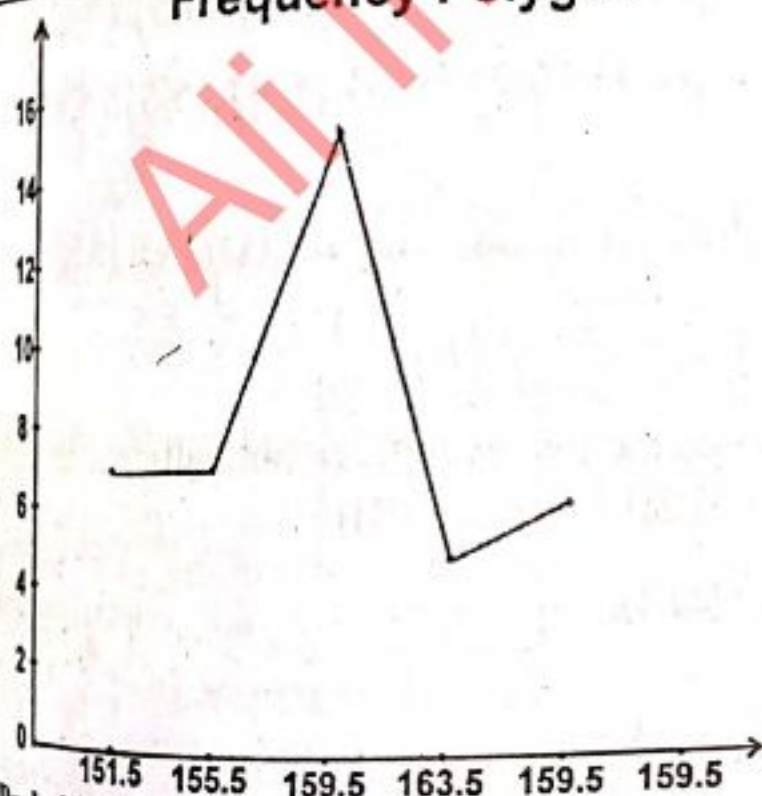


Q8: Construct a frequency polygon for the given data.

Class Interval	Frequency
150 - 153	7
154 - 157	7
158 - 161	15
162 - 165	10
166 - 169	5
170 - 173	6

Class Interval	F	Midpoint (x)	Class Boundaries
150-153	7	151.5	149.5-153.5
154-157	7	155.5	153.5-157.5
158-161	15	159.5	157.5-161.5
162-165	10	163.5	161.5-165.5
166-169	5	167.5	165.5-169.5
170-173	6	171.5	169.5-173.5

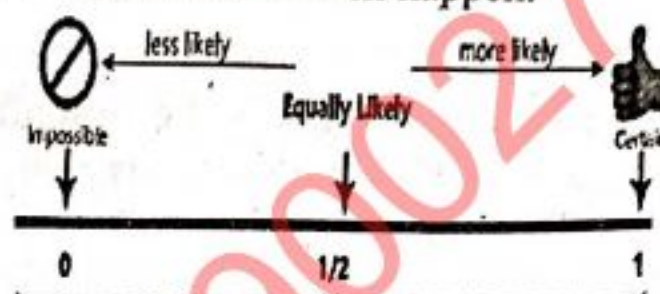
Frequency Polygon



Probability Line:

The probability of any event is a value that is between 0 and 1.

- If the probability of an event is 0, the event is impossible i.e the chance of happening of that event is 0%
- If the probability of an event is 1, the event is certain,
- When there is 50% chance of an event, i.e $\frac{1}{2}$, then the event is said to be equally likely.
- When the probability of an event is between $\frac{1}{2}$ and 1, we say that it is more likely that the event will happen.
- If the probability of an event is between 0 and $\frac{1}{2}$, we say that it is less likely that the event will happen.



Probability line for desired outcome of "picking up an even number randomly"

Exercise 11.4

(Tb page 297)

Q1: A spinner is spun



Event A: The arrow landed on a purple

Event B: The arrow landed on yellow

Find:

a) If the two events mutually exclusive

Sol: Since the two events mutually exclusive

$$\text{then } P(A) = \frac{3}{8}, P(B) = \frac{2}{8}$$

b) $P(A \cup B)$

$$\text{Sol: } P(A \cup B) = P(A) + P(B)$$

$$P(A \cup B) = \frac{3}{8} + \frac{2}{8}$$

$$P(A \cup B) = \frac{3+2}{8} = \frac{5}{8}$$

c) $P(A \cap B)$

$$P(A \cap B) = 0$$

Q2: A dice is rolled. What is the probability that the dots on the top are less than 3?

Sol: $S = \{1, 2, 3, 4, 5, 6\}$

$$n(S) = 6$$

$$A = \{1, 2\}$$

$$n(A) = 2$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A) = \frac{2}{6}$$

$$P(A) = \frac{1}{3}$$

Q3: A dice is rolled. What is the probability of getting a 3 or 4? Are the events mutually exclusive.

Sol: $S = \{1, 2, 3, 4, 5, 6\}$

$$A = \{3\}, B = \{4\}$$

$$n(S) = 6, n(A) = 1, n(B) = 1$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{1}{6}$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{1}{6}$$

$$P(A \text{ or } B) = P(A \cup B)$$

$$P(A \text{ or } B) = P(A) + P(B)$$

$$P(A \text{ or } B) = \frac{1}{6} + \frac{1}{6}$$

$$P(A \text{ or } B) = \frac{1+1}{6} = \frac{2}{6}$$

$$P(A \text{ or } B) = \frac{1}{3}$$

Yes, the events A and B are mutually exclusive.

Q4: A bag contains 5 blue, 7 red, 3 green and 2 yellow marbles. Ali picked a marble randomly and recorded the result. Then he put the marbles back in the bag. He again picked a marble randomly. Tell if the events are independent or not. Explain your answer. Also calculate the probability that the first marble is green and the second marble is red.

Sol: Blue marbles = 05

Red marbles = 07

Green marbles = 03

Yellow marbles = 02

Total marbles = 5 + 7 + 3 + 2

Total marbles = 17

The given events are independent so,

$$P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$$

Let green marbles = A and

Red marbles = B

$$P(A) = \frac{3}{17}, P(B) = \frac{7}{17}$$

$$\therefore P(A \cap B) = P(A) \times P(B)$$

$$P(A \cap B) = \frac{3}{17} \times \frac{7}{17} = \frac{21}{289}$$

Note: The book answer is wrong.

Q5: Two dice are rolled:

Event A: the sum of the numbers shown on the dice is 3

Event B: both the numbers are odd

Find:

a) The sample space

b) If the two events mutually exclusive

c) $P(A \cup B)$

d) $P(A \cap B)$

Sol: (a)

$$S = \left\{ \begin{array}{l} (1,1), (1,2), (1,3), (1,4), (1,5), (1,6) \\ (2,1), (2,2), (2,3), (2,4), (2,5), (2,6) \\ (3,1), (3,2), (3,3), (3,4), (3,5), (3,6) \\ (4,1), (4,2), (4,3), (4,4), (4,5), (4,6) \\ (5,1), (5,2), (5,3), (5,4), (5,5), (5,6) \\ (6,1), (6,2), (6,3), (6,4), (6,5), (6,6) \end{array} \right\}$$

$$\text{Sol(b): } A = \{(1,2), (2,1)\}; B = \{(1,1), (3,3), (5,5)\}$$

$$P(A) = \frac{2}{36}, P(B) = \frac{3}{36}$$

Since the two events are mutually exclusive, so

$$P(A \cup B) = P(A) + P(B)$$

$$P(A \cup B) = \frac{2}{36} + \frac{3}{36}$$

$$P(A \cup B) = \frac{2+3}{36}$$

$$P(A \cup B) = \frac{5}{36}$$

$$\text{Sol (c): } P(A \cup B) = P(A) + P(B)$$

$$P(A \cup B) = \frac{2}{36} + \frac{3}{36}$$

$$P(A \cup B) = \frac{2+3}{36}$$

$$P(A \cup B) = \frac{5}{36}$$

$$\text{Sol (d): } P(A \cap B) = 0$$

Q6: A coin is tossed 4 times. What is the probability of every time getting a tail?

Sol: Consider flipping of 4 coins.

The probability of getting one tail = $\frac{1}{2}$

The probability of getting 'n tails' in general = $\left(\frac{1}{2}\right)^n$

The probability of getting 4 tails = $\left(\frac{1}{2}\right)^4 = \frac{1}{16}$

Therefore, the probability of every time getting a tail is $\frac{1}{16}$

Q7: Nida picks a card randomly.

4 7 7 0 3 8

Event A: randomly selected card will have a 7.

Event B: randomly selected card will be even.

a) If the events mutually exclusive.

b) $P(A \cup B)$

c) $P(A \cap B)$

(a) Sol: $S = \{4, 7, 7, 0, 3, 8\}$; $A = \{7, 7\}$; $B = \{4, 0, 8\}$

$$n(S) = 6, n(A) = 2, n(B) = 3$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{2}{6}$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{6}$$

(b) Sol: $P(A \cup B) = P(A) + P(B)$

$$P(A \cup B) = \frac{2}{6} + \frac{3}{6} = \frac{5}{6}$$

(c) Sol: $P(A \cap B) = 1$

Exercise 11.5

TB page No 301

Q1: What is the difference between theoretical and experimental probability?

Ans: Probability of an event built on facts is called **theoretical probability** while probability of an event that is built on the

outcome obtained by performing an experiment is known as **experimental probability**.

Q2: Zara performed an experiment. She tossed a coin 50 times. The results are represented in the table below.

Outcome	Frequency
Head	28
Tail	22

(a) Calculate the experimental probability of getting a head and compare it with the theoretical probability of getting a head.

Ans: Theoretical probability = $\frac{1}{2}$

$$\text{Experimental Probability} = \frac{28}{50} = \frac{14}{25}$$

(b) Calculate the experimental probability of getting a tail and compare it with the theoretical probability of getting a tail

Ans: Theoretical probability = $\frac{1}{2}$

$$\text{Experimental Probability} = \frac{22}{50} = \frac{11}{25}$$

Q3: Nida performed an experiment. She rolled a dice 50 times. The results are represented in the table below

Outcome	Frequency
1	8
2	6
3	7
4	9
5	4
6	6

a) Calculate the experimental probability of getting a 5 and compare it with the theoretical probability of getting a five.

Ans: Theoretical probability = $\frac{1}{6}$

$$\text{Experimental Probability} = \frac{4}{40} = \frac{1}{10}$$

b) Calculate the experimental probability of getting an odd number and compare it with the theoretical probability of getting an odd number.

$$\text{Ans: Theoretical probability} = \frac{3}{6} = \frac{1}{2}$$

$$\text{Experimental Probability} = \frac{8+7+4}{40} = \frac{19}{40}$$

c) Calculate the experimental probability of getting a number less than 2 and compare it with the theoretical probability of getting a number less than 12.

$$\text{Ans: Theoretical probability} = \frac{1}{6}$$

$$\text{Experimental Probability} = \frac{8}{40} = \frac{1}{5}$$

d) Calculate the experimental probability of getting a factor of 12 and compare it with the theoretical probability of getting a factor of 12.

$$\text{Ans: Theoretical probability} = \frac{5}{6}$$

$$\text{Experimental probability} = \frac{8+6+7+9+6}{40} = \frac{36}{40} = \frac{9}{10}$$

e) Calculate the experimental probability of getting a multiple of 3 and compare it with the theoretical probability of getting a multiple of 3.

$$\text{Ans: Theoretical probability} = \frac{2}{6} = \frac{1}{3}$$

$$\text{Experimental probability} = \frac{7+6}{40} = \frac{13}{40}$$

Q4: Shrish performed an experiment. She had a bag of buttons containing 3 red, 4 yellow, 6 blue and 5 green buttons. She picked one button at a time without looking into the bag and recorded the outcome. He put the button back and in the same way he repeated this experiment and recorded the results in a table.

Flavour of the candy as outcome	
Red	
Yellow	
Blue	
Green	



Find the experimental probability of the following events.

Also compare the results with the theoretical probabilities of these events.

a) Picking a red button

$$\text{Sol: Theoretical probability} = \frac{3}{18} = \frac{1}{6}$$

$$\text{Experimental probability} = \frac{10}{40} = \frac{1}{4}$$

b) Picking a blue button

$$\text{Sol: Theoretical probability} = \frac{6}{18} = \frac{1}{3}$$

$$\text{Experimental probability} = \frac{10}{40} = \frac{1}{4}$$

c) Not picking a green button

$$\text{Sol: Theoretical probability} = \frac{1}{18}$$

$$\text{Experimental probability} = \frac{28}{40} = \frac{7}{10}$$

d) Picking a yellow button

$$\text{Sol: Theoretical probability} = \frac{4}{18} = \frac{2}{9}$$

$$\text{Experimental probability} = \frac{8}{40} = \frac{1}{5}$$

Q5: Ahmad performed an experiment. He spun the spinner 45 times and recorded the outcomes.

Flavour of the candy as outcome	Frequency
Red	18
Yellow	12
Blue	15
	$\Sigma = 45$

Calculate the probabilities and complete the table.

Events	Theoretical probability	Experimental probability
Arrow landed on red		
Arrow landed on blue		
Arrow landed on yellow		

Sol:

Events	Theoretical Probability	Experimental Probability
Arrow landed on red	$\frac{3}{8} = \frac{1}{2}$	$\frac{18}{45} = \frac{2}{5}$
Arrow landed on blue	$\frac{3}{8}$	$\frac{15}{45} = \frac{1}{3}$
Arrow landed on yellow	$\frac{1}{8}$	$\frac{12}{45} = \frac{4}{15}$

Review Exercise

Tb Page 304

1. Choose the correct option.

a) Discrete data is in the form of

- i) Fraction
ii) Rational number
iii) The length of different iron rods is the example of the data:
i) Grouped data
ii) ungrouped data
iii) Continuous data
iv) discrete data✓
c) The presentation of frequency distribution in vertical rectangle bars with no gap is called:
i) bar graph
ii) multiple bar graph
iii) histogram✓
iv) block graph
d) The _____ of each bar in a histogram represent the size of the class.
i) length
ii) width✓
iii) area
iv) height
e) Two events that not occur at the same time is called
i) independent event
ii) combined event
iii) Mutually exclusive event✓
iv) Equally likely event
f) _____ event is not affected by the previous event:
i) Independent event✓
ii) combined event
iii) Mutually exclusive event
iv) equally likely event
g) The formula to find the standard deviation is:

i) $\sqrt{\frac{\sum(x-\bar{x})^2}{n}}$
ii) $\sqrt{\frac{\sum(y-\bar{x})^2}{n}}$
iii) $\sqrt{\frac{\sum(x+\bar{x})^2}{n}}$
iv) $\sqrt{\frac{\sum(x-\bar{x})^2}{2n}}$

(i) is the correct option.

b) When we plot class marks along x-axis and frequency along y-axis and representation of data is in form of closed polygon then it is called:

- i) Frequency distribution
ii) histogram
iii) line graph
iv) frequency polygon ✓

i) The difference between the highest and the lowest value of the data is called:

- i) Variance ✓
ii) class boundary
iii) Range
iv) standard deviation

j) When a coin is tossed 6 times. The theoretical probability of the coin head is:

- i) 1/6 ✓
ii) 2/6
iii) 4/6
iv) 1/2

Q2: Define the following terms.

a) Variance:

The variance is another measure of dispersion. Variance actually tells us about the spread of data i.e how broadly the values in a group diverge. If one or more observation within the given data values diverges significantly from the mean, the variance values increases and vice versa. If all the values in a data are same, the value of variance will be zero. The value of variance is always positive. A small result of variance shows that the values in a data set are close to the mean of the data and a high variance indicates that the values of the given data have spread widely around the mean. Variance is denoted by S^2 .

$$\text{Variance} = S^2 = \frac{\sum(x-\bar{x})^2}{n}$$

Where,

$\bar{x}$ is the mean

n is the total number of data values

x stands for each data value.

b) Histogram:

The word histogram comes from the Greek word *histos*, meaning pole, and *gram*, which means chart or graph. So, we can say that a histogram is a pole chart. A histogram is used to represent data where the class intervals (or boundaries) are along x-axis and the corresponding frequencies are on the y-axis. The histogram is drawn in such a way that there is no gap between the bars while in a bar graph, there is proper equal spacing between the bars. A histogram is drawn by dividing the range of the given data into a smaller intervals or boundaries.

c) Ungrouped data:

Ungrouped data is the raw data which has just been collected from any survey, experiment, or study. It is not grouped in any form like categories, classes, intervals etc.

d) Standard deviation:

The standard deviation is another measure the dispersion of a data values (relative to its mean). It is the positive square root of the variance. We use the symbol σ or S to show standard deviation.

$$\text{Standard deviation} = S = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

e) Polygon frequency:

A frequency polygon is a multi-sided closed figure. It is constructed by plotting the class frequencies against their corresponding class marks (mid-points). Then the points obtained are joined through straight lines.

f) Mutually exclusive events:

Suppose you are travelling

Case 1: Is it possible that the vehicle's movement direction is towards east as well as towards west at the same time.

Case 2: Is it possible that the vehicle's movement direction is towards east and you are smiling.

In case 2, the events can occur simultaneously.

So, in case 1, the events are **mutually exclusive** as they cannot occur at the same time.

- When tossing a coin, the event of getting head and tail are mutually exclusive as we cannot get a head and tail at the same time.

When a die is rolled the events '1' and '3' are mutually exclusive, as they cannot be occurred at the same time.

(g) Independent events:

If the occurrence or happening of one event doesn't affect the probability of another event, then these events are known as independent events.

- If we roll a dice two times, the outcome of the first roll doesn't affect the outcome of the second roll, so these two events are independent event.
- If we toss a coin and spun the spinner, the outcome of tossing a coin doesn't affect the outcome of the spinning of the spinner.

So, all these events are independent events.

Q3: Calculate the standard deviation for the data: 4,9,5,1,2 and 8

Sol: Standard deviation = ?

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	4	-0.83	0.69
2	9	4.67	21.81
3	5	0.67	0.45
4	1	-3.33	11.09

5	2	-2.33	5.43
6	8	3.67	13.47
Σ	29	-	52.94

$$\bar{X} = \frac{\sum X}{n} = \frac{29}{6} = 4.83$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{52.94}{6}}$$

$$S = 2.97$$

Q4: Calculate the variance and standard deviation for the given data: 3, 5, 7, 11, 13, 17, 19 and 23.

Sol: Variance = $S^2 = ?$

Standard Deviation = $S = ?$

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	3	-9.25	85.26
2	5	-7.25	52.56
3	7	-5.25	27.56
4	11	-1.25	1.56
5	13	0.75	0.56
6	17	4.75	22.56
7	19	6.75	45.56
8	23	10.75	115.56
Σ	98	-	351.48

$$\bar{X} = \frac{\sum X}{n} = \frac{98}{8} = 12.25$$

$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{351.48}{8}$$

$$S^2 = 43.93$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{351.48}{8}}$$

$$S = \sqrt{43.93}$$

$$S = 6.63$$

Q5: Calculate the range for the following observations.

45.2, 67.9, 88.5, 33.2, 11.6, 99.2, 101.5

Sol: Smallest value = 11.6

Longest value = 101.5

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 101.5 - 11.6$$

$$\text{Range} = 89.9$$

Q6: Sara collected data of marks out of 50 students of grade 8. The data is: 32, 47, 49, 43, 39, 28, 35, 45, 41, 50, 47, 43, 49. Calculate (a) Range, (b) Standard deviation (c) Variance

Sol:

S.No	X	$X - \bar{X}$	$(X - \bar{X})^2$
1	32	-10.15	103.02
2	47	4.85	23.52
3	49	6.85	46.92
4	43	0.85	0.72
5	39	-3.15	9.92
6	28	-14.15	200.22
7	35	-7.15	51.12
8	45	2.85	8.12
9	41	-1.15	1.32
10	50	7.85	61.62
11	47	4.85	23.52
12	43	0.85	0.72
13	49	6.85	46.92
Σ	548	-	577.66

$$X_{\max} = 50 ; X_{\min} = 28$$

$$\text{Range} = X_{\max} - X_{\min}$$

$$\text{Range} = 50 - 28$$

$$\text{Range} = 22$$

$$\bar{X} = \frac{\sum X}{n} = \frac{548}{13} = 42.15$$

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S = \sqrt{\frac{577.66}{13}}$$

$$S = \sqrt{44.44}$$

$$S = 6.67$$

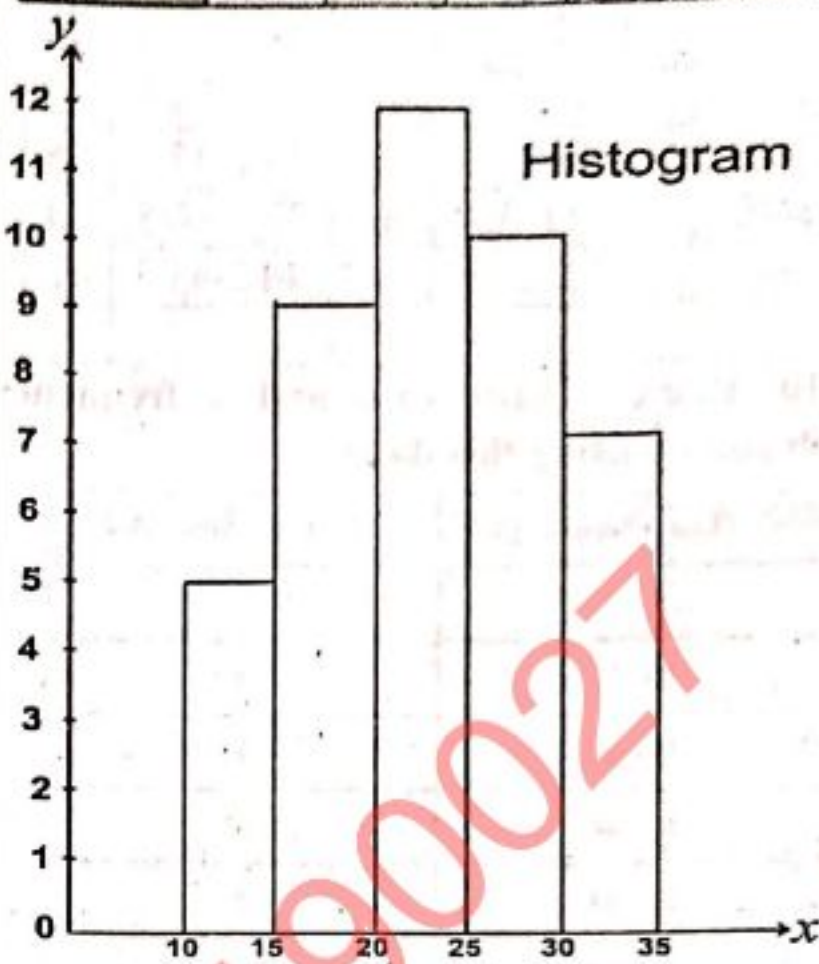
$$S^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S^2 = \frac{577.66}{13}$$

$$S^2 = 44.44$$

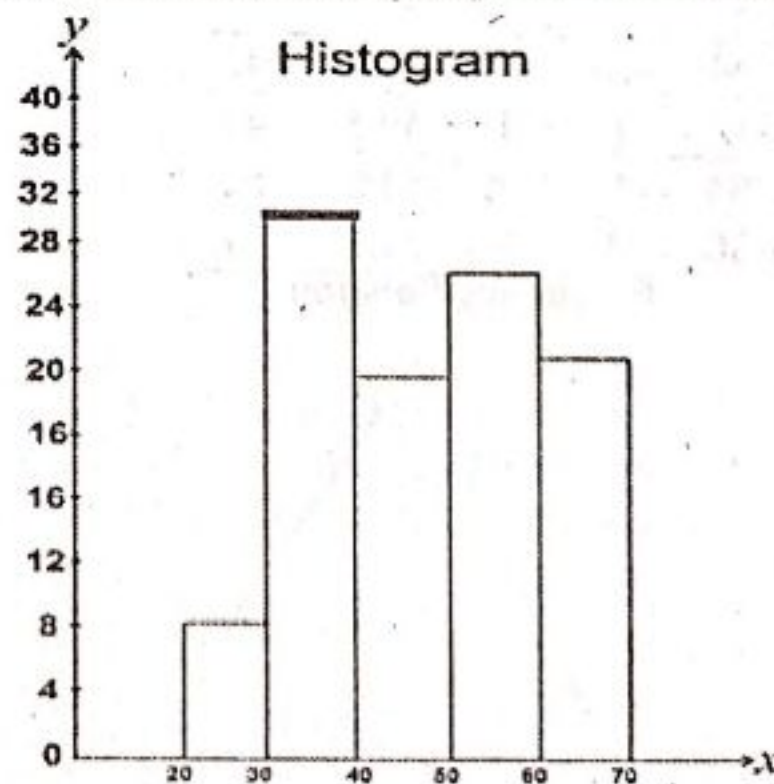
Q7: Construct the histogram for the given frequency distribution

Class Intervals	10-15	15-20	20-25	25-30	30-35
Frequency	5	9	12	10	7



Q8: The following data shows the ages of different people who came for the issuance of smart id card on a certain day. Draw a histogram for this data.

Class Intervals	20-30	30-40	40-50	50-60	60-70
Frequency	8	30	20	25	22



Q9: The given data is the temperature of the Lahore in 30 days of May is

31°, 33°, 35°, 37°, 32°, 31°, 31°, 34°, 38°, 40°, 30°, 32°, 32°, 33°, 34°, 34°, 33°, 30°, 30°, 35°, 34°, 29°, 42°, 39°, 42°, 40°, 39°, 42°, 40°, 41°.

Draw frequency distribution table for the given data.

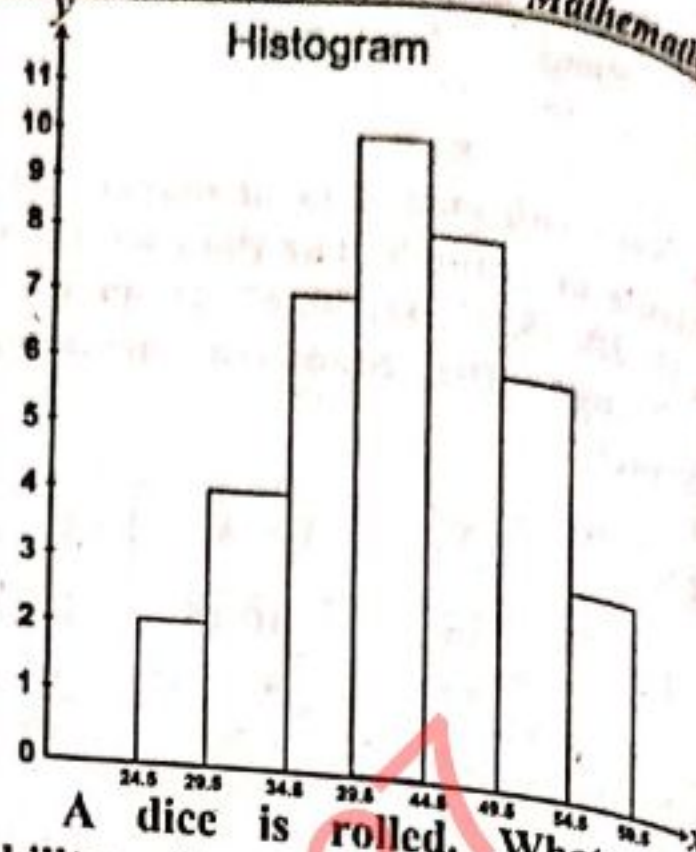
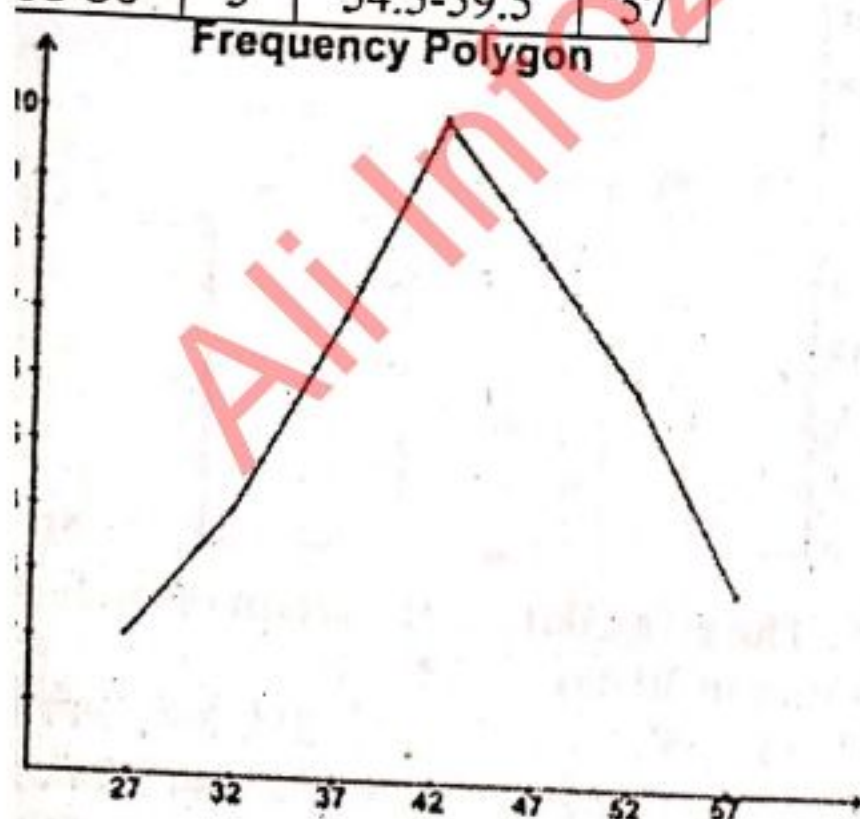
Sol: Smallest value = 29 Largest value = 42

Class Interval	Tally	F	C.B	X
20-31	11	7	28.5-31.5	30
32-34		10	31.5-34.5	33
35-37		3	34.5-37.5	36
38-40	1	6	37.5-40.5	39
41-43		4	40.5-43.5	42
Σ	-	30	-	-

Q10. Draw a histogram and a frequency polygon by using this data

Class intervals	Frequency (f)
25 - 29	2
30 - 34	4
35 - 39	7
40 - 44	10
45 - 49	8
50 - 54	6
55 - 59	3

Class Interval	F	C.B	X
25-29	2	24.5-29.5	27
30-34	4	29.5-34.5	32
35-39	7	34.5-39.5	37
40-44	10	39.5-44.5	42
45-49	8	44.5-49.5	47
50-54	6	49.5-54.5	52
55-59	3	54.5-59.5	57



Q11: A dice is rolled. What is the probability of rolling an even or odd number?

Sol: $S = \{1, 2, 3, 4, 5, 6\}$

Number of even numbers on a dice = 3
 $\{2, 4, 6\}$

Total number of possible outcomes = 6

Probability of getting an even number = $\frac{3}{6} = \frac{1}{2}$

Number of odd numbers on a dice = 3
 $\{1, 3, 5\}$

Total number of possible outcomes = 6

Probability of getting an odd number = $\frac{3}{6} = \frac{1}{2}$

Thus, the probability of rolling an even or odd number is $\frac{1}{2}$

Q12: Two dice are rolled. What is the probability of getting a factor of 6s on both?

Ans: Factors are 1, 2, 3, and 6

If both dice must be factors = $\frac{4}{6} \times \frac{4}{6} = \frac{16}{36} = \frac{4}{9}$

The probability of getting a factor of 6s on both = $\frac{4}{9}$

Q13: Ahmad is rolling dice what is probability that a dice shows 3 or 6.

Sol: $S = \{1, 2, 3, 4, 5, 6\}$, $A = \{3\}$, $B = \{6\}$

$n(S) = 6$, $n(A) = 1$, $n(B) = 1$

$$P(A) = \frac{n(A)}{n(S)} = \frac{1}{6}$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{1}{6}$$

$$P(A \text{ or } B) = P(A \cup B)$$

$$P(A \text{ or } B) = P(A) + P(B)$$

$$P(A \text{ or } B) = \frac{1}{6} + \frac{1}{6}$$

$$P(A \text{ or } B) = \frac{1+1}{6}$$

$$P(A \text{ or } B) = \frac{2}{6}$$

$$P(A \text{ or } B) = \frac{1}{3}$$

Q14: In a box there are 4 blue beads, 6 red beads and 2 yellow beads. Sara picked a bead randomly and recorded the result. Then she put the bead back in the bag. She again picked a bead randomly. Tell if the events are independent or not. Explain your answer. Also calculate the probability that the first bead is blue and the second bead is yellow.

Sol: blue beads = 4

Red beads = 6

Yellow beads = 2

Total beads = 4 + 6 + 2 = 12

Let blue bead = A and yellow bead = B

The given events are independent so,

$$P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$$

Let green marbles = A and

Red marbles = B

$$P(A) = \frac{4}{12} = \frac{1}{3}, P(B) = \frac{2}{12} = \frac{1}{6}$$

$$\therefore P(A \cap B) = P(A) \times P(B)$$

$$P(A \cap B) = \frac{1}{3} \times \frac{1}{6} = \frac{1}{18}$$

Q15: Zaman performed an experiment. He rolled a dice 30 times. The results are represented in the table below.

Outcome	Frequency
1	5
2	4
3	3
4	6
5	5
6	7

(a) Calculate the experimental probability of getting a 6 and compare it with the theoretical probability of getting a head.

Sol: Theoretical probability = $\frac{1}{6}$

Experimental probability = $\frac{7}{30}$

(b) Calculate the experimental probability of getting an odd number and compare it with the theoretical probability of getting a tail.

Sol: Theoretical probability = $\frac{3}{6} = \frac{1}{2}$

Experimental probability = $\frac{5+3+5}{30} = \frac{13}{30}$

(c) Calculate the experimental probability of getting an odd number and compare it with the theoretical probability of getting a head.

Sol: Theoretical probability = $\frac{3}{6} = \frac{1}{2}$

Experimental probability = $\frac{12}{30}$

(d) Calculate the experimental probability of getting a factor of 6 and compare it with the theoretical probability of getting a tail.

Sol: Theoretical probability = $\frac{4}{6} = \frac{2}{3}$

Experimental probability = $\frac{5+4+3+7}{30} = \frac{19}{30}$