1. (a) (AXC) ⊂ (BXD).
2. (c) $2 - 4x$
3. (a) 0,1,8
4. (d) A is larger than B by 1
5. (d) 1
6. (d) row matrix
7. (b) 70°
8. (a) 120°
9. (b) Parallel to y – axis
10. (c) 2
11. (c) 6 cm
12. (a) 2 : 1
13. (b) 160900
14. (c) $\frac{23}{26}$

15. $A \times B$ ={(3,2), (3,4), (5,2), (5,4)}
We have A = {set of all first coordinates of elements of $A \times B$}.
Therefore, A = {3,5}
B = {set of all second coordinates of elements of A × B}.
Therefore, B = {2,4}
Thus A = {3,5} and B = {2,4}.

16. **Solution:**
f(x) = 2x – 1
f(1) = 2(1) – 1 = 2 – 1 = 1
f(2) = 2(2) – 1 = 4 – 1 = 3
f(3) = 2(3) – 1 = 6 – 1 = 5
f(4) = 2(4) – 1 = 8 – 1 = 7 ..... etc
co–domain = {1, 2, 3, 4, 5.....}
Range = {1, 3, 5, 7.....}
It is one – one because distinct elements of first set have distinct images in 2nd set. It is not onto because the co–domain and the range are not same.

17. **Solution:**
For any value $n \in N$, 2^n is an even number.
For any value $m \in N$, 5^m is an odd number.
(end with 5)
So the product $2^n \times 5^m$ ends in "0" (zero)
So there are no values to find n and m.

18. $a_n = \begin{cases} n^2 & \text{if } n \text{ is odd} \\ \frac{n^2}{2} & \text{if } n \text{ is even} \end{cases}$

$a_3 = 3^2 = 9$

$a_4 = \frac{4^2}{2} = \frac{16}{2} = 8.$

19.

$$\sum_{n=1}^{10} n^2 = 1^2+2^2+3^2+\dots+10^2$$

$$= \frac{10(11)(21)}{6}$$

$$= \frac{770}{2}$$

$$= 385 \longrightarrow (1)$$

$$2^2+4^2+6^2+\dots+20^2 = 2^2.1^2+2^2.2^2+2^2 3^2+\dots+2^2.10^2$$

$$= 2^2(1^2+2^2+3^2+\dots+10^2)$$

$$= 2^2(385) \quad [\because \text{using } (1)]$$

$$= 4(385)$$

$$= 1540$$

20.

Given that, $\Delta = 0$.

$$b^2-4ac = 0$$

$$\Rightarrow (3k)^2 - 4(9)(4) = 0$$

$$\Rightarrow 9k^2 - 9(16) = 0$$

$$\Rightarrow 9(k^2-16) = 0$$

$$k^2-16 = 0$$

$$k^2 = 16$$

$$k = \sqrt{16}$$

$$k = \pm 4$$

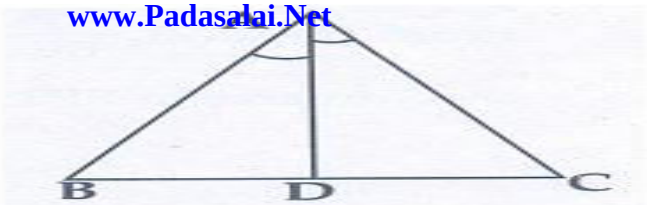
$$k = \pm 4$$

21.

Solution :

$$-A = \begin{bmatrix} \sqrt{7} & 3 \\ \sqrt{5} & -2 \\ -\sqrt{3} & 5 \end{bmatrix} \therefore -A^T = \begin{bmatrix} -\sqrt{7} & \sqrt{5} & -\sqrt{3} \\ 3 & -2 & 5 \end{bmatrix}$$

22.



i) $\frac{AB}{AC} = \frac{5}{10} = \frac{1}{2}$ --- (1)

$\frac{BD}{DC} = \frac{1.5}{3.5} = \frac{3}{7}$ --- (2)

From (1) & (2) $\frac{AB}{AC} \neq \frac{BD}{DC}$

$\therefore$ AD is not a bisector of $\angle A$

23. (14, 10) and (14, - 6)

The Slope = $\frac{-6-10}{14-14} = \frac{-16}{0} = \infty$

The slope is undefined.

24.

$$\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sec\theta + \tan\theta$$

$$\text{LHS} = \sqrt{\frac{1+\sin\theta}{1-\sin\theta} \times \frac{1+\sin\theta}{1+\sin\theta}}$$

$$= \sqrt{\frac{(1+\sin\theta)^2}{1-\sin^2\theta}}$$

$$= \sqrt{\frac{(1+\sin\theta)^2}{\cos^2\theta}} = \frac{1+\sin\theta}{\cos\theta}$$

$$= \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}$$

$$= \text{Sec}\,\theta + \tan\theta = \text{RHS.}$$

25. Let r be the radius of the sphere.
Given that, surface area of sphere = 154 m^2
$4\pi r^2 = 154$

$$4 \times \frac{22}{7} \times r^2 = 154$$

gives $r^2 = 154 \times \frac{1}{4} \times \frac{7}{22}$

hence, $r^2 = \frac{49}{4}$ we get $r = \frac{7}{2}$

Therefore, diameter is 7 m

26. Let r be the radius of the hemisphere.
Given that, base area = πr^2 = 1386 sq. m
T.S.A. = $3\pi r^2$ sq.m
= 3 ×1386 = 4158
Therefore, T.S.A. of the hemispherical solid is 4158 m^2

27. L = 125, S= 63
Range = L – S = 125 – 63 = 62.
Coefficient of Range = $\frac{L-S}{L+S} = \frac{62}{188}$ = 0.33

28. $R = 5$ cm, $r = 3$ cm, $h = 9$ cm

Volume of hollow cylinder $= \pi(R^2 - r^2)h$ cu.units

$= \frac{22}{7} \times (5^2 - 3^2) \times 9$ cm^3

$= \frac{22}{7} \times (25 - 9) \times 9$ cm^3

$= \frac{22}{7} \times 16 \times 9$ cm^3

$= \frac{3168}{7}$ cm^3

$= 452.571$ cm^3.

$= 452.57$ cm^3.

29. Let A = {1, 2, 3, 4, 5, 6, 7} B = {2, 3, 5, 7} C = {2}

i) $(A \cap B) \times C = (A \times C) \cap (B \times C)$

L.H.S $(A \cap B) \times C$

$A \cap B = \{1, 2, 3, 4, 5, 6, 7\} \cap \{2, 3, 5, 7\}$

$= \{2, 3, 5, 7\}$

$A \cap B \times C = \{2, 3, 5, 7\} \times \{2\}$

$= \{(2, 3)\ (3, 2)\ (5, 2)\ (7, 2)\}$ ——— ❶

R.H.S $(A \times C) \cap (B \times C)$

$A \times C = \{1, 2, 3, 4, 5, 6, 7\} \times \{2\}$

$= \{(1, 2)\ (2, 2)\ (3, 2)\ (4, 2)\ (5, 2)\ (6, 2)\ (7, 2)\}$

$B \times C = \{2, 3, 5, 7\} \times \{2\}$

$= \{(2, 2)\ (3, 2)\ (5, 2)\ (7, 2)\}$

$(A \times C) \cap B \times C = \{(2, 2)\ (3, 2)\ (5, 2)\ (7, 2)\}$ ——— ❷

L.H.S = R.H.S

30. $A = \{1, 2, 3, 4\}$; $B = \{2, 5, 8, 11, 14\}$; $f(x) = 3x - 1$

$f(1) = 3(1) - 1 = 3 - 1 = 2$; $f(2) = 3(2) - 1 = 6 - 1 = 5$

$f(3) = 3(3) - 1 = 9 - 1 = 8$; $f(4) = 4(3) - 1 = 12 - 1 = 11$

(i) Arrow diagram

Let us represent the function : $A \to B$ by an arrow diagram (Fig.1.19).

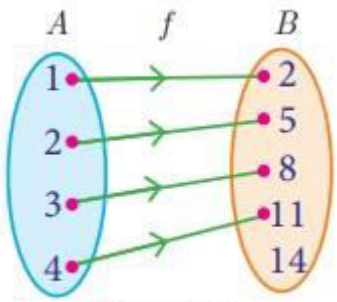


Fig. 1.19

(ii) Table form

The given function f can be represented in a tabular form as given below

x	1	2	3	4
$f(x)$	2	5	8	11

(iii) Set of ordered pairs

The function f can be represented as a set of ordered pairs as

$f = \{(1,2),(2,5),(3,8),(4,11)\}$

(iv) Graphical form

In the adjacent xy -plane the points

(1,2), (2,5), (3,8), (4,11) are plotted (Fig.1.20).

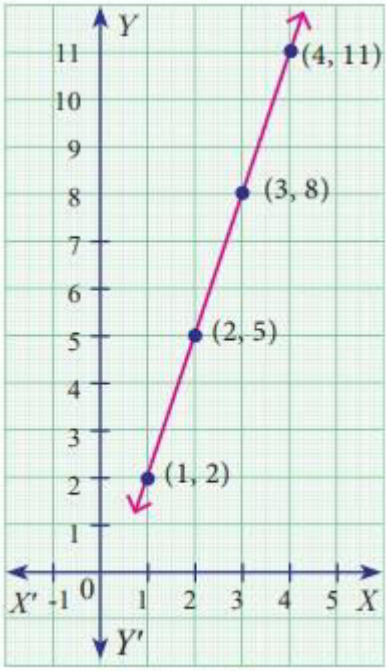


Fig. 1.20

31. The natural numbers between 100 and 1000 which are divisible by 11.

ie., 110, 121, ..., 990.

Here $a = 110$, $d = 11$, $l = 990$.

$$n = \left(\frac{l-a}{d}\right) + 1$$

$$= \left(\frac{990 - 110}{11}\right) + 1$$

$$= \left(\frac{880}{11}\right) + 1$$

$$= 80 + 1$$

$$n = 81$$

$$S_n = \frac{n}{2}(a + l)$$

$$S_{81} = \frac{81}{2}(110 + 990) = \frac{81}{2}(1100) = \frac{89100}{2}$$

$$= \frac{89100}{2} = 44550.$$

32.

$6x + 2y - 3z = 13$

$3x + 3y - 2z = 13 \rightarrow (2)$

$7x + 5y - 3z = 26 \rightarrow (3)$

$(1) \times 2 \Rightarrow 12x + 4y - 10z = 26$

$(2) \times 5 \Rightarrow 15x + 15y - 10z = 65$

$(-) \quad (-) \quad (+) \quad (-)$

$-3x - 11y = -39$

$3x + 11y = 39 \rightarrow (4)$

$(2) \times 3 \Rightarrow 9x + 9y - 6z = 39$

$(3) \times 2 \Rightarrow 14x + 10y - 6z = 52$

$(-) \quad (-) \quad (+) \quad (-)$

$5x - y = -13 \rightarrow (5)$

$(4) \times 5 \Rightarrow 15x + 55y = 195$

$(5) \times 3 \Rightarrow 15x - 3y = -39$

$(-) \quad (+) \quad (+)$

$58y = 234$

$y = \frac{234}{58}$

$\boxed{y = \frac{117}{29}} \rightarrow (6)$

Using equ (6) in (5),

$5x - \frac{117}{29} = -13$

$5x = -13 + \frac{117}{29}$

$= \frac{-377 + 117}{29}$

$5x = \frac{-260}{29}$

$\boxed{x = \frac{-52}{29}} \rightarrow (7)$

Using equ (6), (7) in equ (2)

$3x + 3y - 2z = 13$

$\Rightarrow 3\left(\frac{-52}{29}\right) + 3\left(\frac{117}{29}\right) - 2z = 13$

$\Rightarrow \frac{-156}{29} + \frac{351}{29} - 2z = 13$

$\Rightarrow \frac{195}{29} - 2z = 13$

$-2z = 13 - \frac{195}{29}$

$= \frac{377 - 195}{29}$

$-2z = \frac{182}{29}$

$\boxed{z = \frac{-91}{29}}$

$\therefore$ The solution is

$\boxed{x = \frac{-52}{29},\ y = \frac{117}{29},\ z = \frac{-91}{29}}$

Verification: (Check up)

From (1) $\Rightarrow 6\left(\frac{-52}{29}\right) + 2\left(\frac{117}{29}\right) - 5\left(\frac{-91}{29}\right) = 13$

$\Rightarrow \frac{-312}{29} + \frac{234}{29} + \frac{455}{29} = 13$

$\frac{-312 + 234 + 455}{29} = 13$

$\frac{377}{29} = 13$

$\boxed{13 = 13}$

33.

$f(x) = x^4 + 3x^3 - x - 3$

$g(x) = x^3 + x^2 - 5x + 3$

$$
\begin{array}{r|l}
 & x + 2 \\
\hline
x^3 + x^2 - 5x + 3 & x^4 + 3x^3 + 0x^2 - x - 3 \\
 & x^4 + x^3 - 5x^2 + 3x \quad (-) \\
\hline
 & 2x^3 + 5x^2 - 4x - 3 \\
 & 2x^3 + 2x^2 - 10x + 6 \quad (-) \\
\hline
 & 3x^2 + 6x - 9
\end{array}
$$

$= 3(x^2 + 2x - 3) \neq 0$

$$
\begin{array}{r|l}
 & x - 1 \\
\hline
x^2 + 2x - 3 & x^3 + x^2 - 5x + 3 \\
 & x^3 + 2x^2 - 3x \quad (-) \\
\hline
 & -x^2 - 2x + 3 \\
 & -x^2 - 2x + 3 \quad (-) \\
\hline
 & 0
\end{array}
$$

GCD = $x^2 + 2x - 3$.

34.

$$\frac{x^2}{y^2} - \frac{10x}{y} + 27 - \frac{10y}{x} + \frac{y^2}{x^2}$$

$$= \frac{x^4 - 10x^3y + 27x^2y^2 - 10xy^3 + y^4}{x^2y^2}$$

$$x^2 - 5xy + y^2$$

$$\begin{array}{r|l}
x^2 & x^4 - 10x^3y + 27x^2y^2 - 10xy^3 + y^4 \\
 & x^4 \\
 & (-) \\
\hline
2x^2 - 5xy & -10x^3y + 27x^2y^2 \\
 & -10x^3y + 25x^2y^2 \\
 & (+) \quad (-) \\
\hline
2x^2 - 10xy + y^2 & 2x^2y^2 - 10xy^3 + y^4 \\
 & 2x^2y^2 - 10xy^3 + y^4 \\
 & (-) \quad (+) \quad (-) \\
\hline
 & 0
\end{array}$$

$$\therefore \sqrt{\frac{x^2}{y^2} - \frac{10x}{y} + 27 - \frac{10y}{x} + \frac{y^2}{x^2}}$$

$$= \sqrt{\frac{x^4 - 10x^3y + 27x^2y^2 - 10xy^3 + y^4}{x^2y^2}}$$

$$= \left| \frac{x^2 - 5xy + y^2}{xy} \right| .$$

$$= \left| \frac{x}{y} - 5 - \frac{y}{x} \right| .$$

35.

LHS $(AB)^T$

$$AB = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix}_{2\times3} \times \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}_{3\times2}$$

$$= \begin{pmatrix} 2-2+0 & -1+8+2 \\ 4+1+0 & -2-4+2 \end{pmatrix} = \begin{pmatrix} 0 & 9 \\ 5 & -4 \end{pmatrix}$$

$$(AB)^T = \begin{pmatrix} 0 & 9 \\ 5 & -4 \end{pmatrix}^T = \begin{pmatrix} 0 & 5 \\ 9 & -4 \end{pmatrix} \quad \ldots(1)$$

RHS $(B^T A^T)$

$$B^T = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 4 & 2 \end{pmatrix}, \; A^T = \begin{pmatrix} 1 & 2 \\ 2 & -1 \\ 1 & 1 \end{pmatrix}$$

$$B^T A^T = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 4 & 2 \end{pmatrix}_{2\times3} \times \begin{pmatrix} 1 & 2 \\ 2 & -1 \\ 1 & 1 \end{pmatrix}_{3\times2}$$

$$= \begin{pmatrix} 2-2+0 & 4+1+0 \\ -1+8+2 & -2-4+2 \end{pmatrix}$$

$$B^T A^T = \begin{pmatrix} 0 & 5 \\ 9 & -4 \end{pmatrix} \quad \ldots(2)$$

From (1) and (2), $(AB)^T = B^T A^T$.

Hence proved.

36. **Angle Bisector Theorem**

Statement

The internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the corresponding sides containing the angle.

Proof

Given : In ΔABC, AD is the internal bisector

To prove : $\frac{AB}{AC} = \frac{BD}{CD}$

Construction : Draw a line through C parallel to AB. Extend AD to meet line through C at E

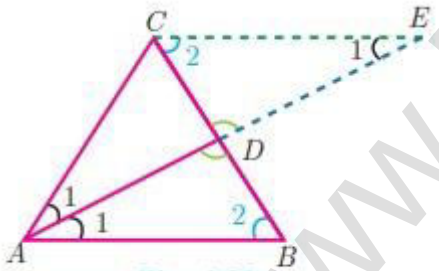


Fig. 4.33

No	Statement	Reason
1.	$\angle AEC = \angle BAE = \angle 1$	Two parallel lines cut by a transversal make alternate angles equal.
2.	ΔACE is isosceles AC = CE … (1)	In $\Delta ACE, \angle CAE = \angle CEA$
3.	$\Delta ABD \sim \Delta ECD$ $\frac{AB}{CE} = \frac{BD}{CD}$	By AA Similarity
4.	$\frac{AB}{AC} = \frac{BD}{CD}$	From (1) $AC = CE$. Hence proved.

37. **Solution:**

Given vetices are (–4, –2), (–3, k), (3, –2) and (2, 3). Given area 28 sq. units.

$$\frac{1}{2}\begin{Bmatrix} -9 & -8 & 1 & 2 & -9 \\ -2 & -4 & -3 & 2 & -2 \end{Bmatrix} = 28$$

$$\frac{1}{2}\{(-4k+6+9-4) - (6+3k-4-12)\} = 28$$

$$(-4k+11) - (3k-10) = 28 \times 2$$

$$-4k+11-3k+10 = 56$$

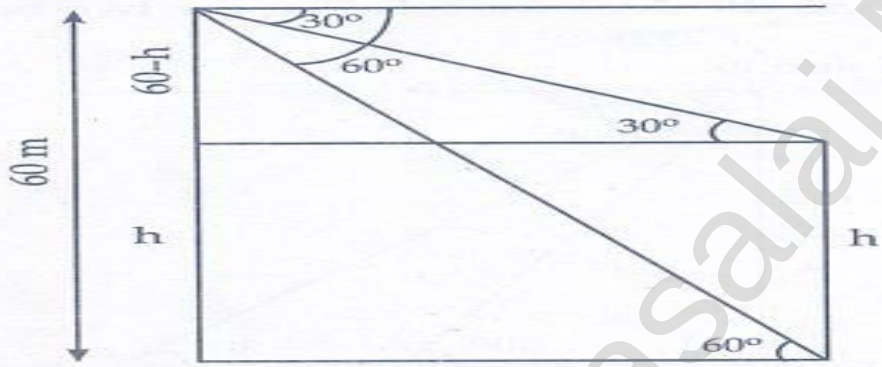
$$-7k + 21 = 56$$

$$-7k = 56-21$$

$$k = \frac{35}{-7}$$

$$\boxed{k = -5}$$

38. **Solution:**



$$\tan\theta = \frac{opp}{adj}$$

$$\tan 38^\circ = \frac{60-h}{x}$$

$$0.7813 = \frac{60-h}{x}$$

$$x = \frac{60-h}{0.7813} \text{ --------(1)}$$

$$\tan 60^\circ = \frac{60}{x}$$

$$\sqrt{3} = \frac{60}{x}$$

$$x = \frac{60}{\sqrt{3}} = 20\sqrt{3} \text{ ---------(2)}$$

From (1) & (2)

$$\frac{60-h}{0.7813} = 20\sqrt{3}$$

$$60 - h = 20(1.732) \times 0.7813$$

$$60 - h = 27.06$$

$$h = 60 - 27.06 = 32.94$$

$$h = 32.94 \text{ m}$$

39. **Solution:**

Given:

$h_1 = 9cm, \quad r_1 = 10\ cm$

$h_2 = 4cm, \quad r_2 = 5\ cm$

Volume of Cylinders

$$V_1+V_2 = \pi r_1^2 h + \pi r_2^2 h$$
$$= \pi(10\times10\times9+5\times5\times4)$$
$$= \pi(900\times100)$$
$$= 1000\pi\ cm^2$$

Height of the water level is h_3 cm

$$\pi r^2 h_3 = 1000\pi$$
$$\pi\times10\times10\times h_3 = 1000\pi$$
$$h_3 = \frac{1000\pi}{100\pi} = 10$$

Raise of the water in glass

$$= h_3 - h_1 = 10-9 = 1cm$$

40.

$$\text{Mean} = \frac{40+50+60+70+80+90+95}{7}$$

Mean = 69.28

Here A = 65, n = 7.

x_i	$x_i - A$ $= x_i - 65$	$d_i = \frac{x_i - A}{c}$ $d_i = \frac{x_i - 65}{5}$	d_i^2
40	-25	-5	25
50	-15	-3	9
60	-5	-1	1
70	5	1	1
80	+15	3	9
90	+25	5	25
95	+30	6	36
		$\Sigma d_i = 6$	$\Sigma d_i^2 = 100$

$$S.D(\sigma) = \sqrt{\frac{\Sigma d_i^2}{n} - \left(\frac{\Sigma d_i}{n}\right)^2} \times c$$
$$= \sqrt{\frac{100}{7} - \left(\frac{6}{7}\right)^2} \times 5$$
$$= \sqrt{\frac{700-36}{49}} \times 5$$
$$= \sqrt{\frac{664}{49}} \times 5$$
$$= \sqrt{13.55} \times 5$$
$$= 3.68 \times 5$$
$$\sigma = 18.4.$$

41. **Solution :**

Two dice are rolled

sample sapce S = {(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)}

n (S) = 36

(i) Let A be the event of getting a doublet

A = {(1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)}

n (A) = 6

$$p(A) = \frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

(ii) Let B be the event of getting a product is a prime number

B = {(1, 2) (1, 3) (1, 5) (2, 1) (3, 1) (5, 1)}

n (B) = 6

$$p(B) = \frac{n(B)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

(iii) Let C be the event of getting a sum is prime number.

C = {(1, 1) (1, 2) (1, 4) (1, 6)
(2, 1) (2, 3) (2, 5) (3, 2)
(3, 4) (4, 1) (4, 3) (5, 2)
(5, 6) (6, 1) (6, 5)}

n (C) = 15

(iv) Let D be the event of getting a sum is 1.

∴ D is an impossible event D = { }

∴ P (D) = 0

42. Given that $(x_1, y_1) = A(x, 0)$

$(x_2, y_2) = B(0, y)$

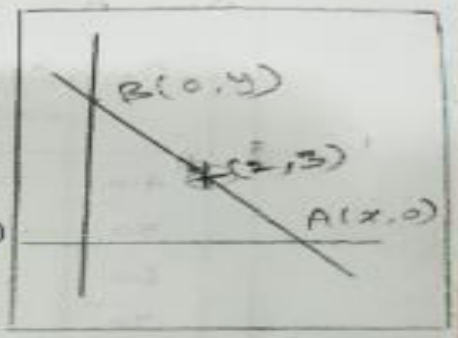
Mid point of AB $= (2, 3)$

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = (2, 3)$

$\Rightarrow \left(\frac{x+0}{2}, \frac{0+y}{2}\right) = (2, 3)$

$\Rightarrow \left(\frac{x}{2}, \frac{y}{2}\right) = 2, 3$

$\therefore (x, y) = (4, 6)$



Now, $(x_1, y_1) = A(4, 0)$

$(x_2, y_2) = B(0, 6)$

To find: Equation of the straight line AB.

(Using Two-point form)

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$$\Rightarrow \frac{y-0}{6-0} = \frac{x-4}{0-4}$$

$$\Rightarrow \frac{y}{6} = \frac{x-4}{-4}$$

$$\Rightarrow -4y = 6x - 24$$

$$\Rightarrow 0 = 6x + 4y - 24$$

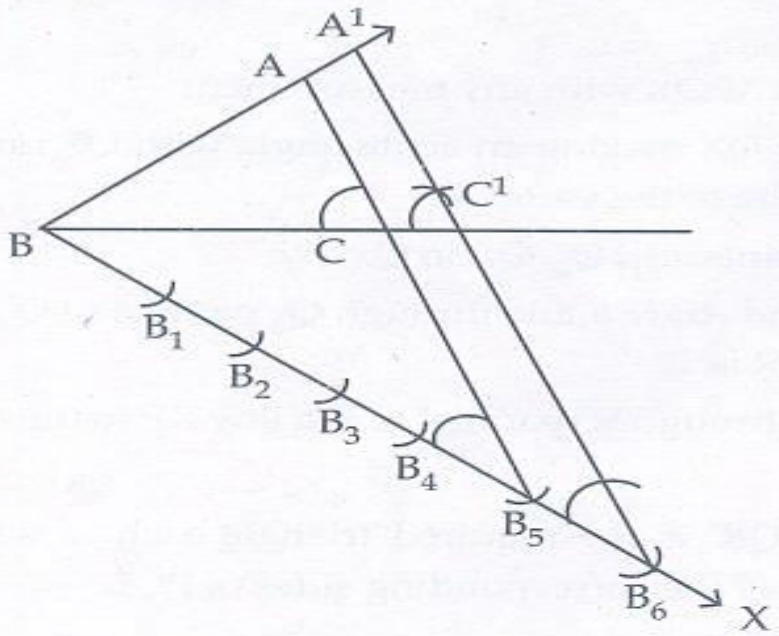
$$\Rightarrow 6x + 4y - 24 = 0$$

$\div 2 \Rightarrow 3x + 2y - 12 = 0$.

Which is the required equation of straight line AB.

43. (a)

Solution :



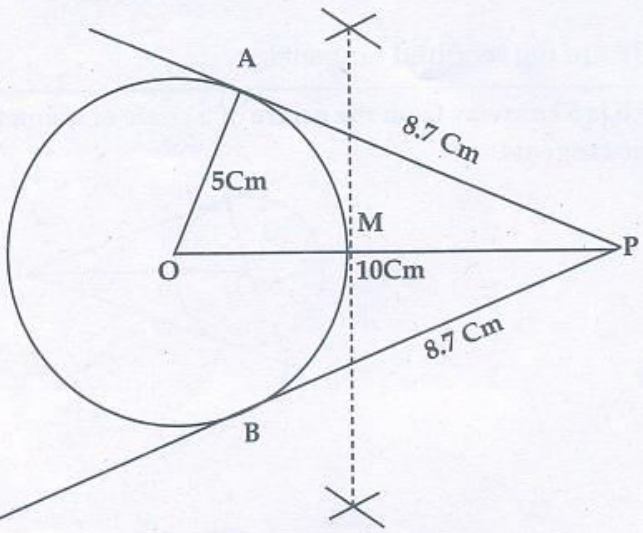
Construction :

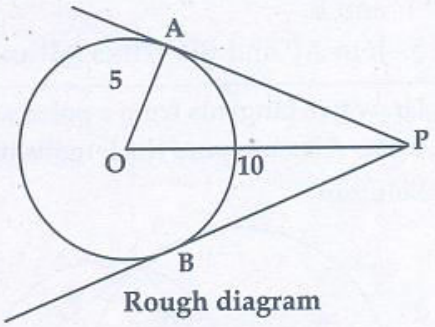
1. Draw a ΔABC
2. Draw a ray BX
3. Locate 6 points B_1, B_2, B_3, B_4, B_5 and B_6 on BX
4. Join B_5C and draw a line passing through B_6 parallel to B_5C intersect at C'.
5. Draw a line through parallel AC intersect the extended line segment AB at A'.

   Then $\Delta A'BC'$ is the required triangle.

(or)

(b) Solution





Rough diagram

Construction :

1. With centre at O, draw a circle of radius 5 cm
2. Draw a line OP = PO cm
3. Draw a perpendicular bisector of OP. Which cuts OP at M.
4. With M as centre and MO as radius, draw a circle which cuts previous circle at A and B.
5. Join AP and BP. These are the required tangents. The length of the tangents PA = PB = 8.7 cm.

44. (a) **Step 1**

Prepare the table of values for the equation $y = x^2 - 8x + 16$

x	−1	0	1	2	3	4	5	6	7	8
y	25	16	9	4	1	0	1	4	9	16

Step 2

Plot the points for the above ordered pairs (x, y) on the graph using suitable scale.

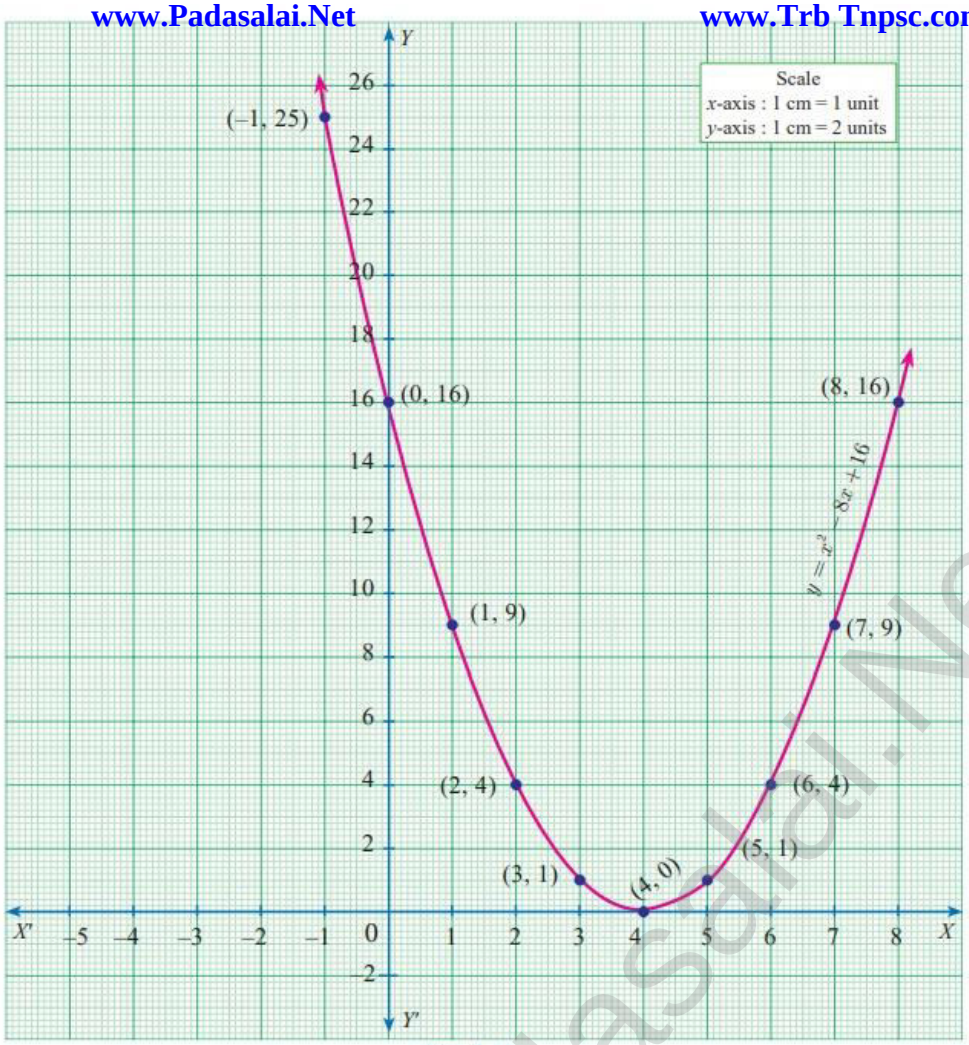


Fig. 3.13

Step 3

Draw the parabola and mark the coordinates of the parabola which intersect with the *X* axis.

Step 4

The roots of the equation are the *x* coordinates of the intersecting points of the parabola with the *X* axis (4,0) which is 4.

Since there is only one point of intersection with *X* axis, the quadratic equation $x^2 - 8x + 16 = 0$ has real and equal roots.

(or)

(b) **Solution :**

$y = 2x^2 - 3x - 5$

x	– 4	– 3	– 2	–1	0	1	2	3	4
y	39	22	9	0	–5	– 6	– 3	4	15

Now $y = 2x^2 - 3x - 5$

$0 = 2x^2 - 4x - 6$ (–)

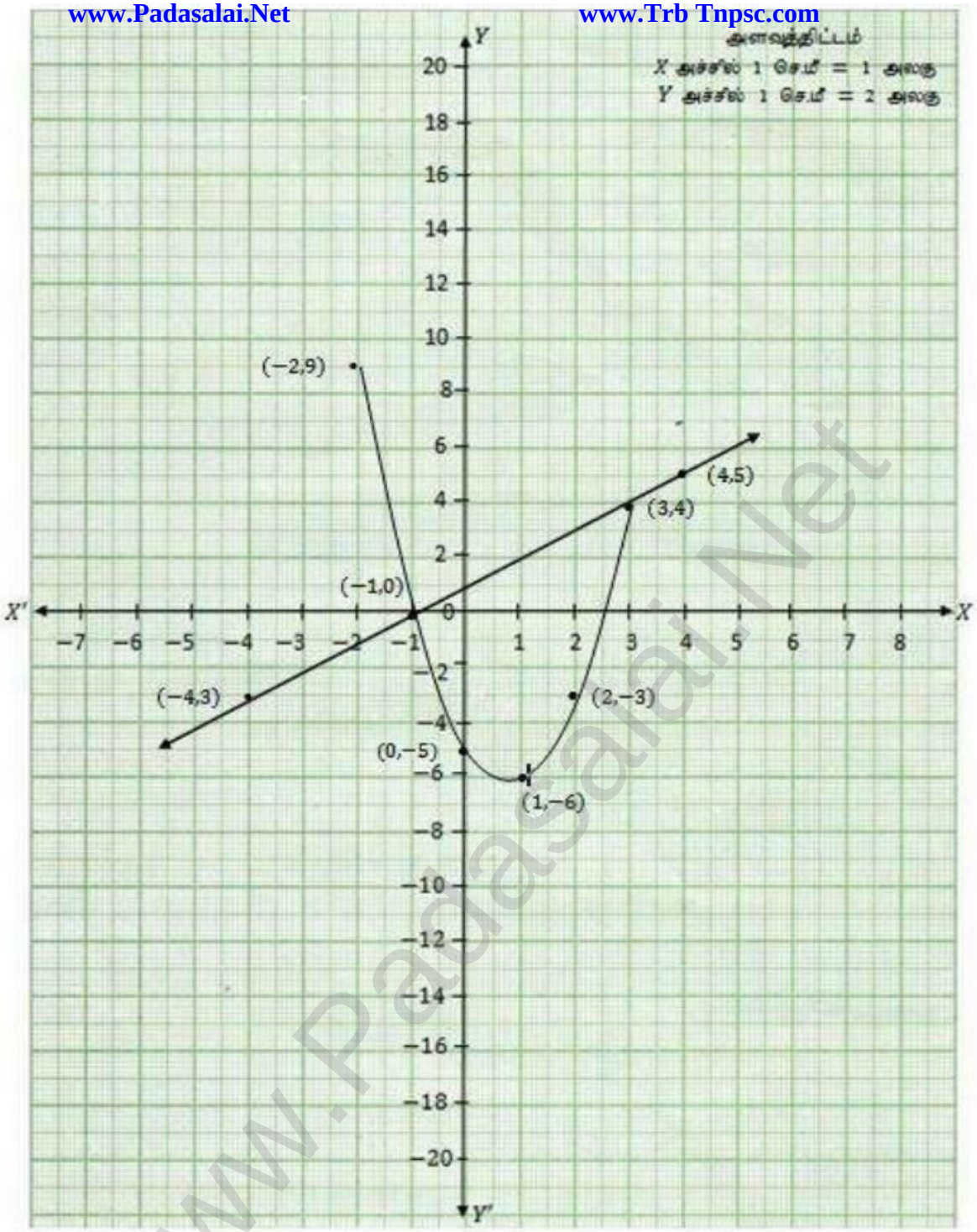
$y = x + 1$

$y = x + 1$

x	– 2	0	2
y	–1	1	3

The straight line y = x + 1 intersects the x axis at 2 different points

There fore, the solution for $2x^2 - 4x - 6 = 0$ is –1 and 3



- E.VIKRAM (M.Sc., B.Ed(Mathematics))
Now I am Working in Sri Rajalakshmi Tuition Centre.,
Arni -632301.,Tiruvannamalai district.