10^{TH} MODEL PUBLIC EXAMINATION QUESTION PAPER – (2024 – 2025)

KEY ANSWER - MARKING SCHEME

GENERAL INSTRUCTIONS:

1. If a student has given any answer which is different from one given in this marking scheme, but arrives with correct answer, should be given full credit with appropriate distribution.
2. In section I, award 1 mark for the correct option code and the corresponding answer. If one of them (Option or Answer) is wrong then award **ZERO** mark only.
3. In **PART II, PART III & PART IV** if the solution is correct then award full mark directly. The stage mark is essential only if the part of the solution is incorrect.
4. 4. If a particular stage is wrong and if the student writes the appropriate formula, then suitable mark which is attached with that stage should be awarded for the formula. Mark should not be deducted for not writing the formula, if the student arrives at the correct answer.

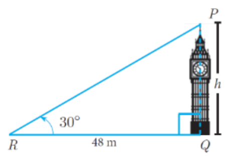
Maximum Marks: 100

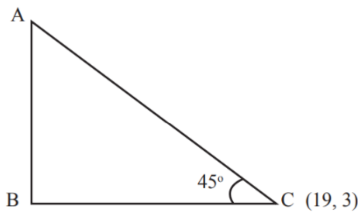
PART – I

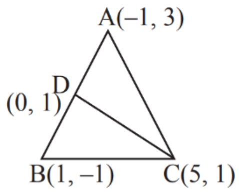
Answer all the questions **14x1=14**

Q. No	Option code	Key Answers	Marks Allotted
1.	(c)	many - one function	1
2.	(c)	3	1
3.	(a)	1	1
4.	(b)	14280	1
5.	(b)	The slope is 0.5 and the y intercept is 2.6	1
6.	(d)	row matrix	1
7.	(a)	$(x-5)\ (x-3)$	1
8.	(a)	9	1
9.	(c)	$x+y=3;\ 3x+y=7$	1
10.	(d)	$\frac{1}{25}$	1
11.	(b)	$\frac{7}{11}$	1
12.	(b)	2	1
13.	(d)	$P(A) > 1$	1
14.	(a)	$\frac{n(n+1)}{2}$	1

Created by: Mr. Sudhan R DMO., BE.,

PART – II			
Answer any 10 questions. Question No. 28 is compulsory.			**14x1=14**
Q. No	**Answers**	**Step Marks**	**Total Marks**
15.	No. of completed rows = 25. Left over flower pots = 7 pots.	1 1	2
16.	$g(f(x)) = g(a^2 - 1) = (a^2 - 1) - 2 = a^2 - 3$ $a = \pm 2$	1 1	2
17.	$3 + k$, $18 - k$, $5k + 1$ are in AP $t_2 - t_1 = t_3 - t_2$ (common difference is same) $18 - k - (3 + k) = 5k + 1 - (18 - k)$ $18 - k - 3 - k = 5k + 1 - 18 + k$ $15 - 2k = 6k - 17$ $32 = 8k$ $k = \frac{32}{8} = 4.$ The value of $k = 4$	1 1	2
18.	$r = \frac{-1/2}{1/4} = \frac{-1}{2} \times \frac{4}{1} = -2$ $a = \frac{1}{4}$ $t_n = ar^{n-1}$ $t_{10} = \frac{1}{4}(-2)^{10-1}$ $t_{10} = \frac{1}{2^2} \times (-2)^9$ $t_{10} = -2^7$	1 1	2
19.	$x = 3$, $y = 12$, $z = 3$		2
20.	Let PQ be the height of the tower. Take $PQ = h$ and QR is the distance between the tower and the point R. In the right angled ΔPQR, $\angle PRQ = 30°$ $\tan\theta = \frac{PQ}{QR}$ $\tan 30° = \frac{h}{48} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{48} \Rightarrow h = 16\sqrt{3}$ Therefore, the height of the tower is $16\sqrt{3}$ m 	1 1	2

21.	Slope of line joining (sinθ, −cosθ) (−sinθ, cosθ) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\cos\theta + \cos\theta}{-\sin\theta - \sin\theta}$ $m = \frac{2\cos\theta}{-2\sin\theta}$ $m = -\cot\theta$	1 1	2
22.	 Slope of AC $= m = \tan 45° = 1$ ∴ Equation of AC whose slope 1 and passing through C (19, 3) is $y - y_1 = m\ (x - x)$ $y - 3 = 1\ (x - 19)$ $x - y - 16 = 0.$	1 1	2
23.	$m = 1 \Rightarrow \tan\theta = 1$ since $\theta = 45°$		2
24.	LHS $= \frac{\cot A - \cos A}{\cot A + \cos A}$ $= \frac{\frac{\cos A}{\sin A} - \cos A}{\frac{\cos A}{\sin A} + \cos A}$ $= \frac{\cos A\left[\frac{1}{\sin A} - 1\right]}{\cos A\left[\frac{1}{\sin A} + 1\right]}$ $= \frac{\text{cosec}A - 1}{\text{cosec}A + 1}$ LHS = RHS	1 1	2
25.	Ratio of the volumes of two cones $= \frac{1}{3}\pi r^2 h_1 : \frac{1}{3}\pi r^2 h_2$ $=$ h1 : h2 $=$ 3600 : 5040 $=$ 360 : 504 $=$ 40 : 56 $=$ 5 : 7	1 1	2

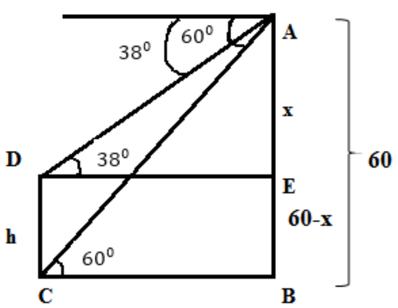
26.	$t_n = a+(n-1)d$ The 19th term is $t_{19} = -11 + 18(-4) \Rightarrow -11 - 72$ $t_{19} = -83$	1 1	2
27.	$\tan\theta = \frac{\text{opposite side}}{\text{Adjacent side}} = \frac{4}{5}$ $\tan\theta = 0.8$ $\tan\theta = 38.7°$ ($\therefore \tan 38.7° = 0.8011$) $\angle BAC = 38.7°$	1 1	2
28.	 Midpoint of AB $= \left(\frac{-1+1}{2}, \frac{3-1}{2}\right) = (0, 1)$ Length of the median through the vertex C $= \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2} = \sqrt{(5-0)^2 + (1-1)^2}$ $= \sqrt{5^2} = 5$ units.	1 1	2

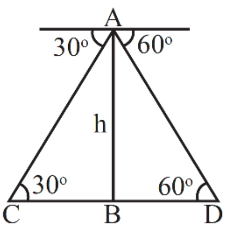
PART – III

Answer any 10 questions. Question No. 42 is compulsory.			10x5=50
Q. No	**Answers**	**Step Marks**	**Total Marks**
29.	$f : \mathbb{N} \to \mathbb{N}$ be defined by $f(x) = 3x + 2$ i) image of 1, 2, 3 when x = 1, f (1) = 3 (1) + 2 = 5 when x = 2, f (2) = 3 (2) + 2 = 8 when x = 3, f (3) = 3 (3) + 2 = 11 The image of 1, 2, 3 are 5, 8, 11 respectively.	2	5

	ii) pre image of 29, 53. $f(x) = 29$ $3x + 2 = 29$ $3x = 27$ $x = 9$ $f(x) = 53$ $3x + 2 = 53$ $3x = 51$ $x = 17$ The pre image of 29, 53 is 9, 17.	1 1	
	iii) Identify the type of function: f is one - one and into function	1	
30.	The size of 15 square colour papers is 10cm, 11cm, 12cm, ... 24cm. The area of square $= a^2$ Using the formula for the sum of squares of integers: $1^2 + 2^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$ The colour paper decorated area $= 10^2 + 11^2 + 12^2 + \cdots + 24^2$ $= (1^2 + 2^2 + \cdots + 24^2) - (1^2 + 2^2 + 3^2 + \cdots + 9^2)$ $= \frac{24(24+1)(24\times2+1)}{6} - \frac{9(9+1)(2\times9+1)}{6}$ $= 4(25)(49) - 3(5)(19)$ $= 4900 - 285 = 4615\ cm^2$	1 1 2 1	5
31.	$f \circ g(x) = f(g(x)) = f(x^2) = x^2 - 4$ Then $(f \circ g) \circ h(x) = f \circ g(h(x))$ $= f \circ g(3x - 5)$ $= (3x - 5)^2 - 4$ $= 9x^2 - 30x + 25 - 4$ $= 9x^2 - 30x + 21$ ....(1) $(g \circ h)x = g(h(x))$ $= g(3x - 5) = (3x - 5)^2$ $= 9x^2 - 30x + 25$ $f \circ (g \circ h)(x) = f(9x^2 - 30x + 25)$	1 1 1	5

	$= 9x^2 - 30x + 25 - 4$ $= 9x^2 - 30x + 21$ ....(2) From (1) and (2), $(f \circ g) \circ h = f \circ (g \circ h)$	 1 1	
32.	Given geometric series $3 + 6 + 12 + \cdots + 1536$ $a = 3,\ r = 2$ $t_n = 1536$ $ar^{n-1} = 1536$ $3(2)^{n-1} = 1536$ $[\because t_n = ar^{n-1}]$ $3(2)^{n-1} = 3(2)^9$ $2^{n-1} = 2^9$ $n = 10$ $S_n = \dfrac{a(r^n - 1)}{r - 1}$ $S_{10} = \dfrac{3(2^{10} - 1)}{10 - 1}$ $= 3(1023) \Rightarrow 3069$	1 1 1 2	5
33.	$x\begin{pmatrix} 2x & 2 \\ 3 & x \end{pmatrix} + 2\begin{pmatrix} 8 & 5x \\ 4 & 4x \end{pmatrix} = 2\begin{pmatrix} x^2 + 8 & 24 \\ 10 & 6x \end{pmatrix}$ $\begin{pmatrix} 2x^2 + 16 & 12x \\ 3x + 8 & x^2 + 8x \end{pmatrix} = \begin{pmatrix} 2x^2 + 16 & 48 \\ 20 & 12x \end{pmatrix}$ $\begin{pmatrix} 2x^2 & 2x \\ 3x & x^2 \end{pmatrix} + \begin{pmatrix} 16 & 10x \\ 8 & 8x \end{pmatrix} = \begin{pmatrix} 2x^2 + 16 & 48 \\ 20 & 12x \end{pmatrix}$ $12x = 48 \Rightarrow x = 4$ $3x + 8 = 20 \Rightarrow 3x = 12$ $\Rightarrow x = 4$ $\therefore x = 4$ $x^2 + 8x = 12x$ $\Rightarrow x^2 - 4x = 0$ $\Rightarrow x(x - 4) = 0,\ x = 0,\ x = 4$	2 1 1 1	5
34.	Compare $x^2 + 2x - 2 = 0$ with the standard form $ax^2 + bx + c^2 = 0$ $a = 1,\ b = 2,\ c = -2$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	1 1	5

	substituting the values of a, b and c in the formula we get, $$x = \frac{-2 \pm \sqrt{(2)^2 - 4(1)(-2)}}{2(1)} = \frac{-2 \pm \sqrt{12}}{2} = -1 \pm \sqrt{3}$$ Therefore, $x = -1 + \sqrt{3}, -1 - \sqrt{3}$	2 1	
35.	Δ AQC is a right triangle at C, $AQ^2 = AC^2 + QC^2$ ...(1) Δ BPC is a right triangle at C, $BP^2 = BC^2 + CP^2$ ...(2) Δ ABC is a right triangle at C, $AB^2 = AC^2 + BC^2$ ...(3) From (1) and (2), $AQ^2 + BP^2 = AC^2 + QC^2 + BC^2 + CP^2$ $4(AC^2 + BP^2) = 4AC^2 + 4QD^2 + 4BC^2 + 4CP^2$ $= 4AC^2 + (2QD)^2 + 4BC^2 + (2CP)^2$ $= 4AC^2 + BC^2 + 4BC^2 + AC^2$ (Since P and Q are mid points) $= 5(AC^2 + BC^2)$ (From equation (3)) $4(AQ^2 + BP^2) = 5AB^2$	2 1 1 1	5
36.	$A = \{x \in W / x < 2\} \Rightarrow A = \{0, 1\}$ $B = \{x \in N / 1 < x \leq 4\} \Rightarrow B = \{2, 3, 4\}$ $C = \{3, 5\}$ To Prove $A \times (B \cup C) = (A \times B) \cup (A \times C)$ $B \cup C = \{2, 3, 4, 5\}$ $A \times (B \cup C) = \{(0,2), (0,3), (0,4), (0,5), (1,2), (1,3), (1,4), (1,5)\}$...(1) $A \times B = \{(0, 2), (0, 3), (0, 4), (1, 2), (1, 3), (1, 4)\}$ $A \times C = \{(0, 3), (0, 5), (1, 3), (1, 5)\}$ $\therefore (A \times B) \cup (A \times C) = \{(0,2), (0,3), (0,4), (0,5), (1,2),$ $(1,3), (1,4), (1,5)\}$ .... (2) $\therefore$ (1) = (2) Hence Proved.	1 1 1 2	5
37.	AB = Tower = 60*m* CD = lamp post = *h* AE = x CD = BE = $60 - x = h$ In right angle ΔAEC $$\tan 38^\circ = \frac{AE}{DE} = 0.7813$$ $$DE = \frac{x}{0.7813}$$ ....(1) In right angle Δ ABC  	1	

	$\theta = 60^\circ$ $\tan 60^\circ = \frac{AB}{BC} = \sqrt{3}$ $\frac{60}{BC} = \sqrt{3}$ $BC = \frac{60}{\sqrt{3}}$ $BC = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ $BC = \frac{60\sqrt{3}}{3}$ $BC = 20\sqrt{3}$ $BC = DE$ $\therefore DE = 20\sqrt{3}$ ....(2) From (1) & (2) $BC = \frac{x}{0.7813} = 20\sqrt{3}$ $x = 20\sqrt{3} \times 0.7813$ $x = 20 \times 1.732 \times 0.7813$ $x = 27.064m$ Height of the lamp post $\boldsymbol{h} = 60 - x$ $= 60 - 27.064$ $h = 32.93m$	1 1 1 1	5
38.	C, D – Positions of the two ships Height of the Light House AB = h m  In ΔABC $\tan\theta = \frac{\textit{opposite side}}{\textit{Adjacent side}}$ $\tan 30^\circ = \frac{h}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$ $x = h\sqrt{3}$ [Where BC = x] In ΔABD $\tan 30^\circ = \frac{h}{x}$ [Where BD = y] $\sqrt{3} = \frac{h}{y} \Rightarrow y = \frac{h}{\sqrt{3}}$ Distance between two ships = $(x + y) = h\sqrt{3} + \frac{h}{\sqrt{3}} \Rightarrow d = \frac{4h}{\sqrt{3}} m$	1 1 1 2	5

39.

Number of guavas (x_i), N = 7

Number of oranges (y_i), N = 7

x_i	x_i^2	y_i	y_i^2
3	9	1	1
5	25	3	9
6	36	7	49
4	16	9	81
3	9	2	4
5	25	6	36
4	16	2	4
$\sum x_i = 30$	$\sum x_i^2 = 136$	$\sum y_i = 30$	$\sum y_i^2 = 184$

1/2

Mean ($\overline{x}$):

$$\overline{x} = \frac{\sum x_i}{N} = \frac{30}{7} = 4.29$$

1/2

Standard deviation (σ_1):

$$\sigma_1 = \sqrt{\frac{\sum x_i^2}{N} - \left(\frac{\sum x_i}{N}\right)^2}$$

$$\sigma_1 = \sqrt{\frac{136}{7} - \frac{30^2}{7}} = \sqrt{(19.43) - (18.40)} \approx 1.01$$

1/2

5

Coefficient of variation for guavas:

$$C.V_1 = \frac{\sigma_1}{\overline{x}} \times 100\% = \frac{1.01}{4.29} \times 100\% = 23.54\%$$

1

Mean ($\overline{y}$):

$$\overline{y} = \frac{\sum y_i}{N} = \frac{30}{7} = 4.29$$

1/2

Standard deviation (σ_2):

$$\sigma_2 = \sqrt{\frac{\sum y_i^2}{N} - \left(\frac{\sum y_i}{N}\right)^2}$$

$$\sigma_2 = \sqrt{\frac{184}{7} - \frac{30^2}{7}} = \sqrt{(26.29) - (18.40)} \approx 2.81$$

1/2

Coefficient of variation for oranges:

$$C.V_2 = \frac{\sigma_2}{\overline{y}} \times 100\% = \frac{2.81}{4.29} \times 100\% = 65.50\%$$

1

	C . V_1 = 23.54%, C . V_2 = 65.50%. Since, C.V1 < C.V2, we can conclude that the consumption of guava is more consistent than orange.	1/2	
40.	Let r_1 be the radius of the lower end of the frustum and r_2 be the radius of the upper end of the frustum. Let h and l be the height and slant height of the frustum respectively. Given that, $r_1 = 1$ cm, $r_2 = 2.5$ cm, $h = 6$ cm and then the slant height of the frustum is given by $l = \sqrt{h^2 + (r_1 - r_2)^2}$ ....(1) Now put all the values of r_1, r_2, h in the equation (1), we get $l = \sqrt{36 + (2.5 - 1)^2}$ $l = \sqrt{36 + (1.5)^2}$ $l = \sqrt{36 + 2.25}$ $l = \sqrt{38.25}$ $l = 6.18$ Hence the slant height of the frustum is 6 cm. External surface area of shuttlecock = Curved surface area of the frustum + Surface area of the hemisphere External surface area of shuttlecock = $\pi(r_1 + r_2)l + 2\pi r_1^2$..............(2) Now put all the values r_1, r_2, l in the equation (2), we get External surface area of shuttlecock $= \{\pi(1 + 2.5) \times 6.18 + 2 \times \pi \times (1)^2\}$.........(3) Also put the value of $\pi = 3.14$ in the equation (3), we get External surface area of shuttlecock $= \{3.14 \times 3.5 \times 6.18 + 2 \times 3.14\}$ $= \{67.92 + 6.28\}$ $= 74.26$ Hence the external surface area of the shuttlecock is 74.26 cm^2.	2 1 2	5

41. (5 marks)

Let the assumed mean, $A = 11,\ c = 1$

C.I	Mid value(x_i)	f_i	$d_i = x_i - A$	d^2	$f_i.d_i$	$f_i.d_i^2$
8.5 – 9.5	9	6	’ 2	4	’ 12	24
9.5 – 10.5	10	8	’ 1	1	’ 8	8
10.5 – 11.5	11	17	0	0	0	0
11.5 – 12.5	12	10	1	1	10	10
12.5 – 13.5	13	9	2	4	18	36
		N = 50			$\Sigma f_i.d_i = 8$	$\Sigma f_i.d_i^2 = 78$

2

Standard deviation $\sigma = c \times \sqrt{\frac{\Sigma f_i d_i^2}{N} - \left(\frac{\Sigma f_i d_i}{N}\right)^2}$ 1

$$= \sqrt{\frac{78}{50} - \left(\frac{8}{50}\right)^2}$$

$$= \sqrt{\frac{78}{50} - \frac{64}{50 \times 50}}$$

$$= \sqrt{\frac{3900 - 64}{50 \times 50}}$$

$$= \frac{\sqrt{3836}}{50}$$

$$= \frac{61.935}{50}$$

$$= 1.238 \approx 1.24$$ 2

42. (5 marks)

The series is neither Arithmetic nor Geometric series.

So, it can be split into two series and then find the sum.

$$5 + 55 + 555 + n\ terms = 5[1 + 11 + 111 + ... + n\ terms]$$ 1

$$= \frac{5}{9}[9 + 99 + 999 + ... + n\ terms]$$ 1

$$= \frac{5}{9}[(10 - 1) + (100 - 1) + (1000 - 1) + ... + n\ terms]$$

$$= \frac{5}{9}[(10 + 100 + 1000 + ... + n\ terms) - n]$$ 1

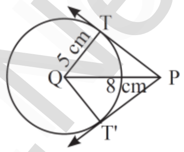
$$S_n = \frac{a(r^n - 1)}{r - 1}$$ 1

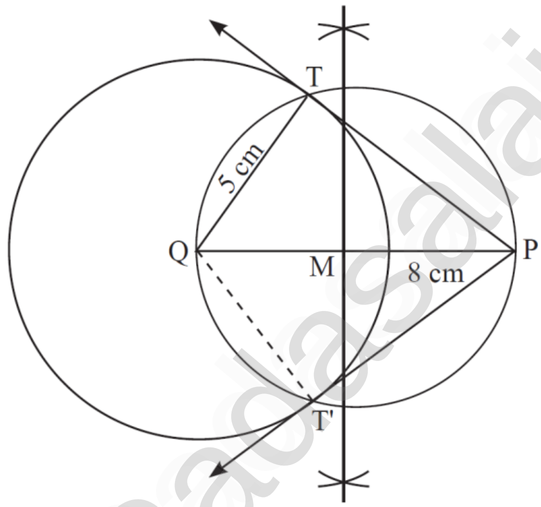
$$= \frac{5}{9} \times \frac{10(10 - 1)}{(10 - 1)} - n \Rightarrow \frac{50(10 - 1)}{81} - \frac{5n}{9}$$ 1

PART – IV

Answer all questions.				2x8=16
Q. No		**Answers**	**Step Marks**	**Total Marks**
43.	(a)	Rough diagram	1	8
		Drawing the circle	1	
		Drawing the chord PQ	1	
		Constructing tangents at P and Q	3	
		Calculation of TP	2	

Rough Diagram





Radius = 5 cm; Distance = 8 cm

Construction:

- With O as centre draw a circle with radius 5 cm.
- Draw a line QP which cuts QP at M.
- Draw a perpendicular bisector of OP which cuts OP at M.
- With M as centre and MQ as radius draw a circle which cuts previous circle at T and T'.
- Join PT and PT'. PT and PT' are the required tangents. Thus, the length of the tangents is PT = PT'
- Verification:

  $OP^2 = OT^2 + TP^2$

  $TP^2 = OP^2 - OT^2 = 82 - 52$

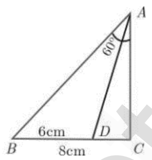
  $TP^2 = 64 - 25 = 39$

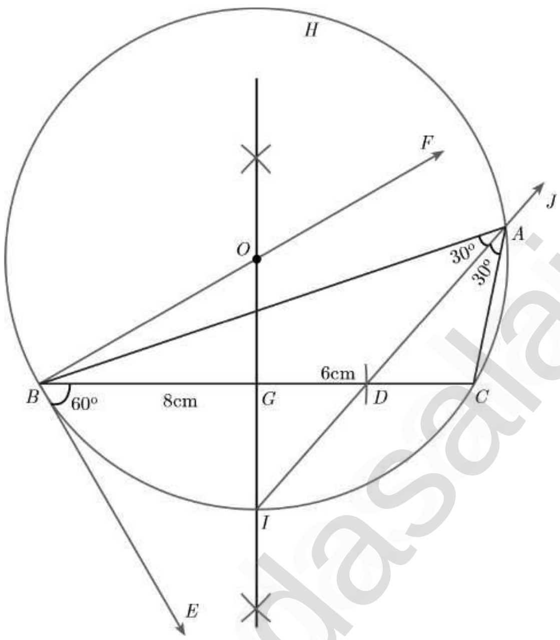
  TP = 6.2 cm (approximately)

(OR)

43.	(b)	Rough diagram	1	8
		Drawing the base BC	1	
		Constructing ∠A = 60° at point A	2	
		Constructing tangents at P and Q	2	
		Finalizing the triangle ABC	2	

Rough Diagram





Construction:

- Draw a line segment BC = 8 cm.
- At B draw BE, such that ∠CBE = 60°.
- At B draw BF, such that ∠EBF = 90°.
- Draw the perpendicular bisector to BC which intersects BF at O and BC at G.
- With O as centre and OB as radius draw a circle.
- From B, mark and arc at 6 cm on BC at D.
- The perpendicular bisector intersects the circle at I joint ID.
- ID produced meets the circle at A. Now join AB and AC. Then ABC is the required triangle.

		x axis, y axis	1	8

44. (a)

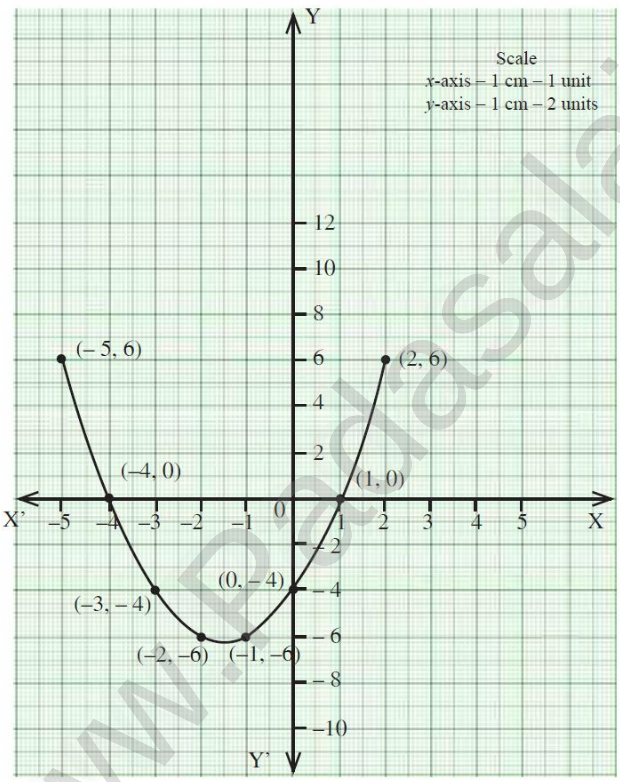
Scale — **1**

$y = x^2 + 3x - 4$ (any 5 points) — **2**

x	–5	–4	–3	–2	–1	0	1	2	3
x^2	25	16	9	4	1	0	1	4	9
$3x$	–15	–12	–9	–6	–3	0	3	6	9
' 4	–4	–4	–4	–4	–4	–4	–4	–4	–4
y	6	0	' 4	' 6	' 6	' 4	0	6	14

Points: (–5, 6), (–4, 0), (–3, –4), (–2, –6), (–1, –6), (0, –4), (1, 0), (2, 6), (3, 14)

$$y = x^2 + 3x - 4$$
$$0 = x^2 + 3x - 4$$
$$y = 0$$



3

The curve meets x-axis at (– 4, 0), (1, 0) and the x co-ordinates of the points x = – 4, x = 1 will be the solution of $x^2 + 3x - 4 = 0$.

∴Solution = {–4, 1} — **1**

(OR)

42.	(b)	Speed of the water $= x$ km/h		
		Speed of the boat $= 18$ km/hour		
		Speed of the boat in the direction of the water $= 18 + x$		
		Speed of the boat in the opposite direction of the water $= 18 - x$		
		Time taken by the boat to cross 24 km in the along the direction of the water $= \dfrac{distance}{speed} = \dfrac{24}{18+x}$	1	
		Time taken by the boat to cross 24 km in the opposite the direction of the water $= \dfrac{24}{18-x}$	1	
		$\dfrac{24}{18-x} - \dfrac{24}{18+\text{x}} = 1$	1	
		$24\left(\dfrac{1}{18-x} - \dfrac{1}{18+x}\right) = 1$		8
		$24\left(\dfrac{(18+x)-(18-x)}{(18-x)(18+x)}\right) = 1$	1	
		$24\left(\dfrac{2x}{324-x^2}\right) = 1$		
		$48x = 324 - x^2$		
		$x^2 + 48x - 324 = 0$		
		$(x+54)(x-6) = 0$	2	
		$x + 54 = 0$ (or) $x - 6 = 0$	1	
		$x = -54$ which is not possible (or) $x = 6$		
		$\therefore$ Speed of the water $= 6$ km/hour	1	

- o 0 o -