No. of Printed Pages: 17

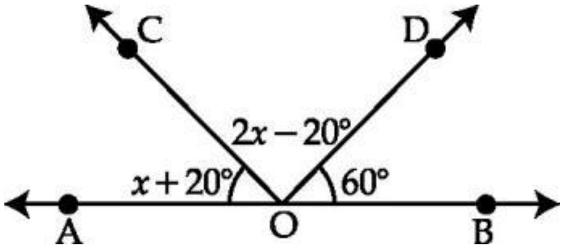
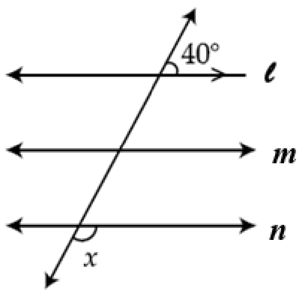
Class- IX
Mid Term Examination, 2023-24
Subject- Mathematics
Set : A1/ A2 Solutions

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

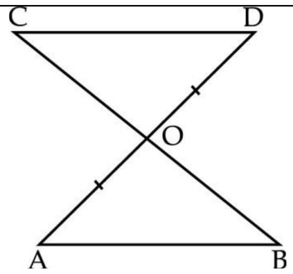
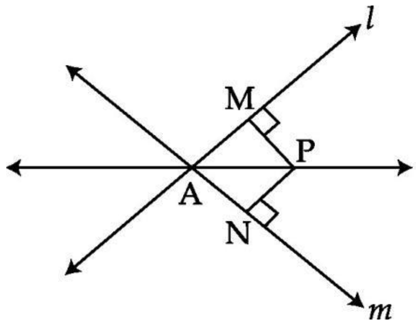
1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 questions carrying 2 marks each.
4. Section C has 6 questions carrying 3 marks each.
5. Section D has 4 questions carrying 5 marks each.
6. Section E has 3 Case Based integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 questions of 2 marks, 2 questions of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required.

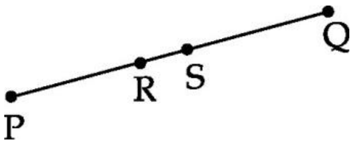
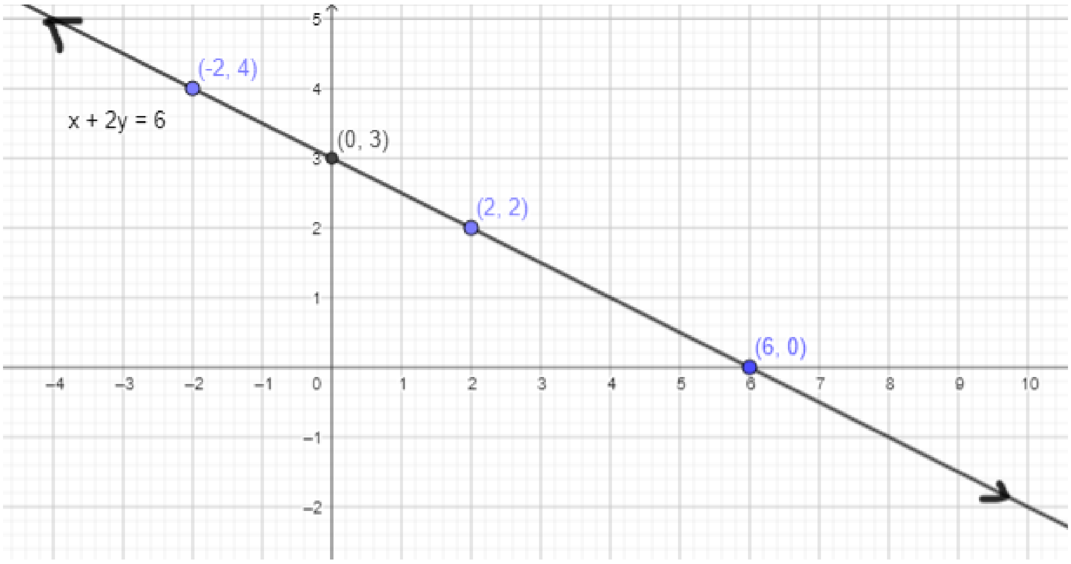
A1	A2	Expected Answers	Marks
		SECTION A **Section A consists of 20 questions of 1 mark each.**	
1	**18**	$\sqrt{12} \times \sqrt{8}$ is equal to (A) $2\sqrt{6}$ (B) $3\sqrt{6}$ (C) $4\sqrt{6}$ (D) $6\sqrt{6}$ Sol. (C)	1
2	**1**	The equation $x = 7$, in two variables, can be written as (A) $1.x + 1.y = 7$ (B) $1.x + 0.y = 7$ (C) $0.x + 1.y = 7$ (D) $0.x + 0.y = 7$ Sol. (B)	1
3	**2**	Which of the following is irrational? (A) 0.1414 (B) 0.141414… (C) 0.1434343… (D) 0.14014001400014... Sol. (D)	1
4	**3**	Abscissa of a point is positive in (A) I and II quadrants (B) I and IV quadrants (C) I quadrant only (D) II quadrant only Sol. (B)	1

5	**4**	An angle is twice its supplement. The angle measures (A) 60° (B) 80° (C) 120° (D) 40° Sol. (C)	1
6	**5**	The point of the form (a, a) always lies on : (A) x-axis (B) y-axis (C) On the line $y = x$ (D) On the line $x + y = 0$ Sol. (C)	1
7	**6**	Coordinates of a point are $(-2, 3)$. Its distance from x-axis is : (A) 2 units (B) -3 units (C) -2 units (D) 3 units Sol. (D)	1
8	**7**	In the given figure, AOB is a line. The value of x is  (A) 60° (B) 80° (C) 120° (D) 40° Sol. (D)	1
9	**8**	Point (–3, −5) lies in the (A) I quadrant (B) II quadrant (C) III quadrant (D) IV quadrant Sol. (C)	1
10	**9**	In the given figure, $l \| m \| n$. The value of x is  (A) 40° (B) 80° (C) 140° (D) 120° Sol. (C)	1
11	**10**	Two sides of a triangle are 13 cm and 14 cm and its semi-perimeter is 18 cm. Then third side of the triangle is : (A) 12 cm (B) 11 cm (C) 10 cm (D) 9 cm Sol. (D)	1

12	**11**	It is given that $\Delta ABC \cong \Delta FDE$ and AB = 5 cm, $\angle B = 40°$ and $\angle A = 80°$. Then which of the following is true? (A) DF = 5 cm, $\angle F = 60°$ (B) DF = 5 cm, $\angle E = 60°$ (C) DE = 5 cm, $\angle E = 60°$ (D) DE = 5 cm, $\angle D = 40°$ Sol. (B)	1
13	**12**	$x = 5,\ y = -2$ is a solution of the linear equation (A) $x + 2y = 9$ (B) $5x + 2y = 7$ (C) $x + y = 3$ (D) $x + y = 7$ Sol. (C)	1
14	**13**	If the area of an equilateral triangle is $16\sqrt{3}$ cm^2, then the side of the triangle is (A) 4 cm (B) 8 cm (C) 2 cm (D) $4\sqrt{3}$ cm Sol. (B)	1
15	**14**	For drawing a frequency polygon of a continuous frequency distribution, we plot the points whose ordinates are the frequency of the respective classes and abscissae are respectively : (A) upper limits of the classes (B) lower limits of the classes (C) class marks of the classes (D) upper limits of preceding classes Sol. (C)	1
16	**15**	In triangles ABC and PRQ, AB = PR and $\angle A = \angle P$. The two triangles are congruent by SAS axiom if : (A) BC = QR (B) AC = PQ (C) AC = QR (D) BC = PR Sol. (B)	1
17	**16**	In ΔPQR, $\angle R = \angle P$ and QR = 4 cm and PR = 5 cm. Then the length of PQ is (A) 4 cm (B) 5 cm (C) 2 cm (D) 2.5 cm Sol. (A)	1
18	**17**	The class mark of the class 90-120 is : (A) 90 (B) 105 (C) 115 (D) 120 Sol. (B)	1
		Direction for questions 19 & 20: In question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.	
19	**20**	**Statement A (Assertion):** $\frac{\sqrt{12}}{\sqrt{3}}$ is not a rational number. **Statement R(Reason) :** If we divide two irrationals, the result may be rational or irrational. (A) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)	1

		(B) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A) (C) Assertion (A) is true but reason (R) is false. (D) Assertion (A) is false but reason (R) is true. **Sol. (D)**	
20	**19**	**Statement A (Assertion):** If AB = PQ and PQ = XY, then AB = XY. ***Statement R(Reason) :*** Things which are equal to the same thing are equal to one another. (A) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (B) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A) (C) Assertion (A) is true but reason (R) is false. (D) Assertion (A) is false but reason (R) is true. **Sol. (A)**	1
		SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	**21**	A1- Find the value of k so that $x = 2, y = 1$ is a solution of $2x + ky = 5$. Find one more solution of the resulting equation. Sol. $2(2) + k(1) = 5$ $\Rightarrow k = 1$ So the eq becomes $2x + y = 5$ Another solution can be $(0, 5)$, $\left(\frac{5}{2}, 0\right)$, (1, 3), (3, -1),.. A2- Find the value of k so that $x = 2, y = -1$ is a solution of $2x + ky = 3$. Find one more solution of the resulting equation. Sol. $2(2) + k(-1) = 3$ $\Rightarrow k = 1$ So the eq becomes $2x + y = 3$ Another solution can be $(0, 3)$, $\left(\frac{3}{2}, 0\right)$, (1, 1), ($-1$, 5),..	1 1 1 1
22	**24**	In the given figure AB || CD and O is the midpoint of AD. Show that O is also midpoint of BC.	

		 Sol. In Δ AOB and Δ DOC, AO = DO (Given) ∠ AOB = ∠ DOC (Vertically Opp. Angles) ∠ ABO = ∠ DCO (Alt. Int. Angles) So, Δ AOB ≅ ΔDOC (AAS rule) So, OB = OC (CPCT) **OR** P is a point equidistant from two lines *l* and *m* intersecting at point A (see figure). Show that the line AP bisects the angle between them.  Sol. In Δ PAM and Δ PAN, PM = PN (Given) ∠ PMA = ∠ PNA = 90° (Given) PA = PA (Common) So, Δ PAM ≅ Δ PAN (RHS rule) So, ∠ PAM = ∠ PAN (CPCT)	1 ½ ½ 1 ½ ½
23	**23**	Find the coordinates of the point (i) whose ordinate is 4 and which lies on negative side of y-axis. (ii) whose abscissa is 5 and which lies positive side of x-axis. Sol. (i) $(0, -4)$ (ii) $(5, 0)$	1+1
24	**22**	Express $0.4\overline{7}$ in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$. Sol. Let $x = 0.4\overline{7}$ $10x = 4.\overline{7}$ $100x = 47.\overline{7}$ $\therefore 90x = 43$ $\therefore x = \frac{43}{90}$ **OR**	½ ½ ½ ½

		Find the value of $\sqrt[4]{(81)^{-2}}$. Sol. $(81)^{-\frac{2}{4}} = 9^{2\times\frac{-1}{2}} = \frac{1}{9}$	1+1
25	**25**	In the figure given below, if PS = RQ then prove that PR = SQ. State Euclid's axiom used.  **Sol.** In fig. we have PS = RQ $\Rightarrow PS - RS = RQ - RS$ ⇒ PR = SQ (Equals subtracted from equals, the remainders are equal)	 1 1
		SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	**26**	A1- Draw the graph of the equation $x + 2y = 6$. At what points, the graph of the equation cuts the x-axis and the y-axis?  The line intersects the x-axis and the y-axis at (6, 0) and (0, 3) repectively. A2- Draw the graph of the equation $2x + y = 6$. At what points, the graph of the equation cuts the x-axis and the y-axis?	 2 1

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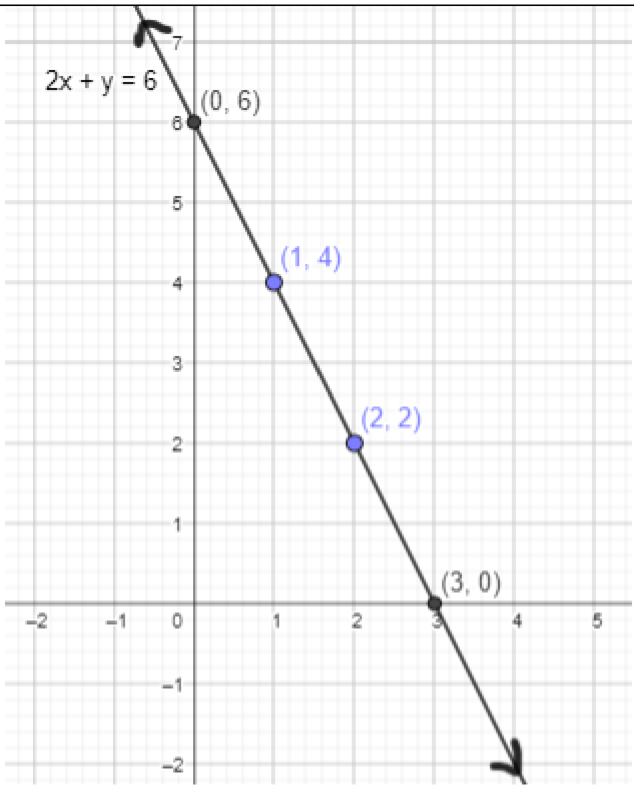
<td>

The line intersects the x-axis and the y-axis at (3, 0) and (0, 6) repectively.</td>
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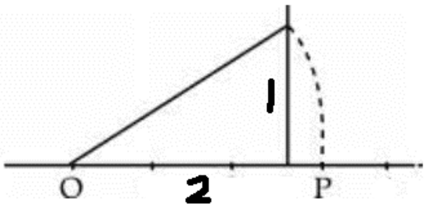
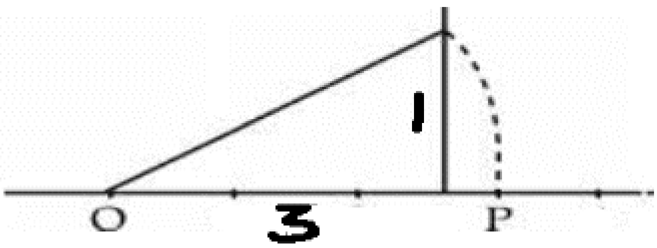
<td>27</td>
<td>A1- Locate $\sqrt{5}$ on the number line geometrically.
Sol. $\sqrt{5} = \sqrt{2^2 + 1^2}$


P represents $\sqrt{5}$ on the number line
A2 – Locate $\sqrt{10}$ on the number line geometrically.
Sol. $\sqrt{10} = \sqrt{3^2 + 1^2}$


P represents $\sqrt{10}$ on the number line</td>
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<td>28</td>
<td>30</td>
<td>The monthly rainfall for 25 cities was recorded and is shown in the histogram below.</td>
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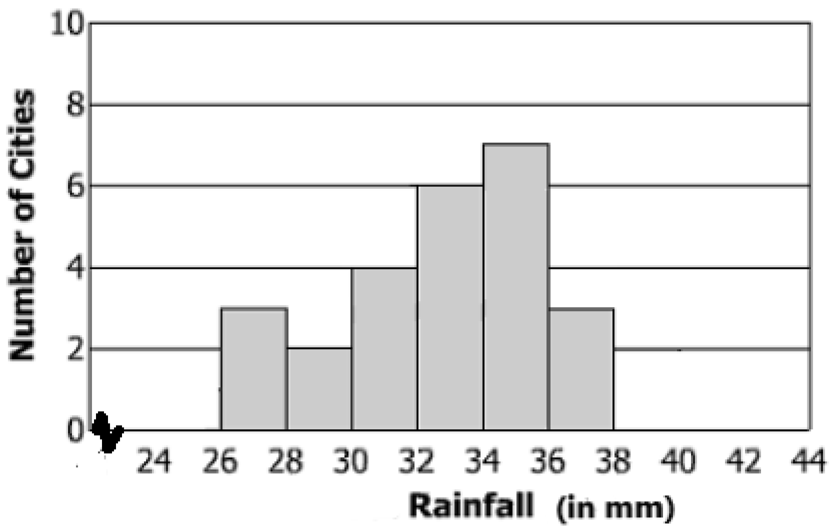


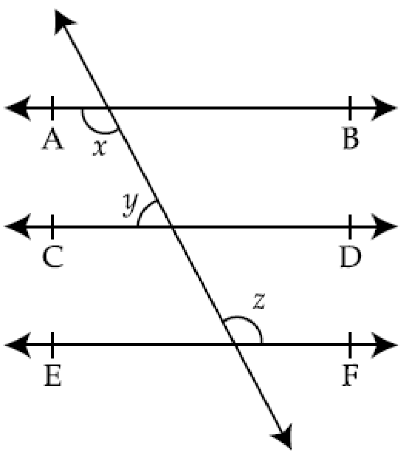
(i) How many cities had rainfall 28 mm – 32 mm?

(ii) How many cities had rainfall more than 32 mm?

(iii) How many cities had rainfall less than 28 mm?

Sol. (i) 6 (ii) 16 (iii) 3 — 3×1

29	**31**	The perimeter of a triangle is 120 cm and its sides are in the ratio 5 : 12 : 13. Find the area of the triangle.	
		Sol. $s = \frac{120}{2} = 60$ cm	½
		Now, $5x + 12x + 13x = 120$ $30x = 120$ $x = 4\ cm$ $5x = 20cm, 12x = 48cm, 13x = 52cm.$	1
		Area of $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ sq. cm $= \sqrt{60\times40\times12\times8}$ $= 480\text{ cm}^2$	1 ½
		OR	
		The sides of a triangle are 35 cm, 54 cm and 61 cm, respectively. Find the length of its longest altitude. Sol.	

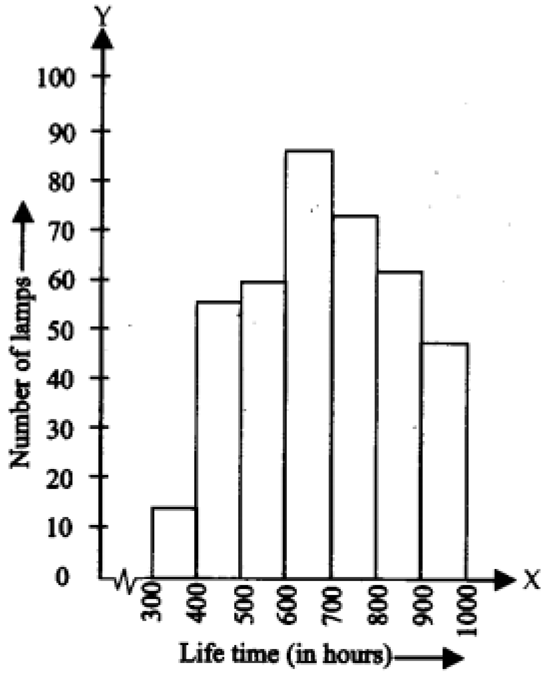
		semi-perimeter of a triangle, $s = \frac{a+b+c}{2} = \frac{35+54+61}{2} = \frac{150}{2} = 75$ cm Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ $= \sqrt{75(75-35)(75-54)(75-61)}$ $= \sqrt{75 \times 40 \times 21 \times 14}$ $= \sqrt{25 \times 3 \times 4 \times 2 \times 5 \times 7 \times 3 \times 7 \times 2}$ $= 5 \times 2 \times 2 \times 3 \times 7\sqrt{5} = 420\sqrt{5}$ cm^2 Also, Area of $\Delta ABC = \frac{1}{2} \times AB \times$ Altitude $\Rightarrow \frac{1}{2} \times 35 \times CD = 420\sqrt{5}$ $\Rightarrow CD = \frac{420 \times 2\sqrt{5}}{35}$ $\therefore CD = 24\sqrt{5}$ Hence, the length of altitude is $24\sqrt{5}$ cm.	½ 1 ½ 1
30	**29**	Write in the simplest form : $12\sqrt{18} + 6\sqrt{20} - 6\sqrt{147} + 3\sqrt{50}$ Sol. $12\sqrt{9 \times 2} + 6\sqrt{4 \times 5} - 6\sqrt{49 \times 3} + 3\sqrt{25 \times 2}$ $= 36\sqrt{2} + 12\sqrt{5} - 42\sqrt{3} + 15\sqrt{2}$ $= 51\sqrt{2} - 42\sqrt{3} + 12\sqrt{5}$ **OR** If $a = 2 + \sqrt{3}$, then find the value of $a + \frac{1}{a}$. Sol. $\frac{1}{a} = \frac{1}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}} = \frac{2-\sqrt{3}}{(2)^2-(\sqrt{3})^2} = 2 - \sqrt{3}$ $a + \frac{1}{a} = 2 + \sqrt{3} + 2 - \sqrt{3} = 4$	1 1 1 2 1
31	**28**	In the given figure, if AB || CD, CD || EF and $y : z = 3 : 7$, find x.  	

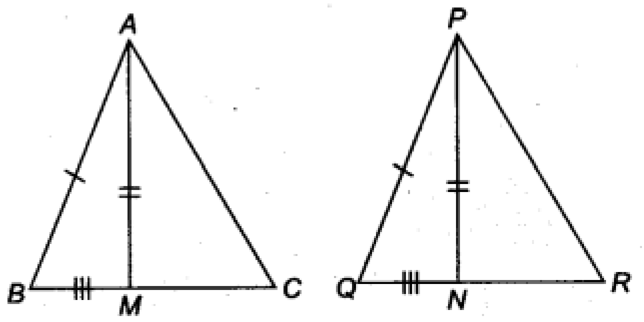
		Sol. AB || CD, and CD || EF [Given]	
		∴ AB || EF [Lines parallel to same line]	½
		$\therefore x = z$ [Alternate interior angles] ….(1)	½
		Again, AB || CD	
		$\Rightarrow x + y = 180°$ [Co-interior angles]	½
		$\Rightarrow z + y = 180°$ … (2) [By (1)]	
		So, $7m + 3m = 180°$ [Since $y : z = 3 : 7$]	
		$\Rightarrow 10m = 180°$	
		$\Rightarrow m = 18°$	1
		From (1) and (3), we have	
		$x = 7m = 126°$	1/2
		SECTION D **Section D consists of 4 questions of 5 marks each.**	
32	**35**	The following table gives the life times of 400 neon lamps:	

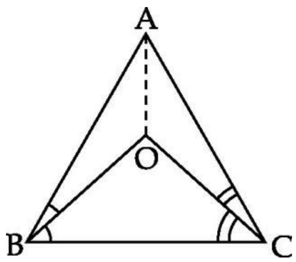
Life time (in hours)	**Number of lamps**
300 – 400	14
400 – 500	56
500 – 600	60
600 – 700	86
700 – 800	74
800 – 900	62
900 – 1000	48

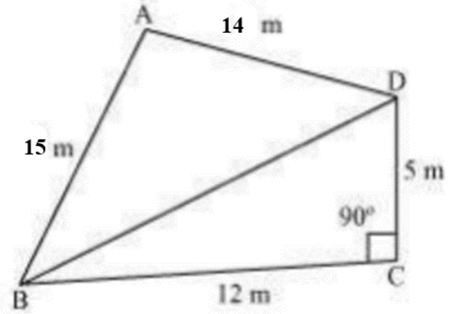
(i) Represent the given information with the help of a histogram.
(ii) How many lamps have a life time of more than 800 hours?

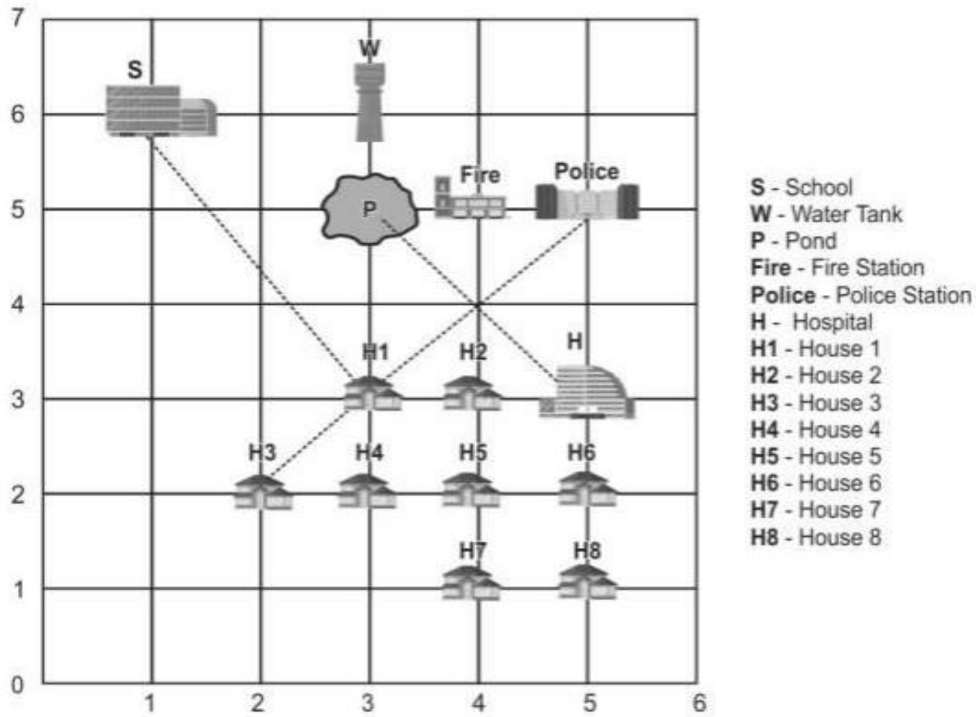
Sol.

		 (ii) No. of lamps having life time of more than 800 hours = 68+42 = 110	4 1
33	**34**	(i) Prove that if two lines intersect each other, then the vertically opposite angles are equal. (ii) Lines PQ and RS intersect each other at point O. If ∠ POR : ∠ ROQ = 5 : 7, find all the angles. Sol. (i) Given, To prove, Figure – 1 ½ Proof – 1 ½ (ii) ∠ POR + ∠ ROQ = 180° (Linear Pair Axiom) So, $5x + 7x = 180°$ So, $x = 15°$ Now, ∠ POS = ∠ ROQ = 105° (Vertically opposite angles) and ∠ SOQ = ∠ POR = 75° (Vertically opposite angles)	1 ½ ½
34	**33**	Evaluate: $\frac{3}{(216)^{-2/3}} + \frac{1}{(256)^{-3/4}} + \frac{2}{(243)^{-1/5}}$ Sol. $\frac{3}{(6^3)^{-2/3}} + \frac{1}{(4^4)^{-3/4}} + \frac{2}{(3^5)^{-1/5}}$ $= 3 \times 36 + 64 + 2 \times 3$ $= 108 + 64 + 6$ $= 178$ **OR**	1 ½ 1 ½ 1 1

		Find the values of a and b if : $\dfrac{3+2\sqrt{2}}{3-2\sqrt{2}} = a + b\sqrt{2}$ Sol. $\frac{3+2\sqrt{2}}{3-2\sqrt{2}} = \frac{3+2\sqrt{2}}{3-2\sqrt{2}} \times \frac{3+2\sqrt{2}}{3+2\sqrt{2}}$ $= \dfrac{(3)^2 + \left(2\sqrt{2}\right)^2 + 2(3)\left(2\sqrt{2}\right)}{(3)^2 - \left(2\sqrt{2}\right)^2}$ $= \dfrac{9+8+12\sqrt{2}}{9-8}$ So, $a + b\sqrt{2} = 17 + 12\sqrt{2}$ Thus, $a = 17, b = 12$	1 2 1 1
35	**32**	Two sides AB and BC and median AM of one triangle ABC are respectively equal to sides PQ and QR and median PN of Δ PQR. Show that: (i) Δ ABM ≅ Δ PQN (ii) Δ ABC ≅ Δ PQR  Sol. BC = QR [Given] ⇒ ½ BC = ½ QR ⇒ BM = QN …(1) (i) In ΔABM and ΔPQN, we have AB = PQ [Given] AM = PN [Given] BM = QN [From (1)] ∴ ΔABM ≅ ΔPQN [By SSS congruency] (ii) Since ΔABM ≅ ΔPQN ⇒ ∠B = ∠Q …(2) [By C.P.C.T.] Now, in ΔABC and ΔPQR, we have ∠B = ∠Q [From (2)] AB = PQ [Given]	½ 2 ½

		BC = QR [Given] ∴ ΔABC ≅ ΔPQR [By SAS congruency] **OR** In an isosceles triangle ABC, with AB = AC, the bisectors of ∠ B and ∠ C intersect each other at O. Join A to O. Show that : (i) OB = OC (ii) AO bisects ∠ A Sol.  Figure – ½ Proof : (i) AB = AC So, $\angle ABC = \angle ACB$ $\frac{1}{2}\angle ABC = \frac{1}{2}\angle ACB$ $\angle OBC = \angle OCB$ So $OB = OC$ (ii) In ΔAOB and ΔAOC OB = OC (Proved) AB = AC (Given) AO = AO (Common) Thus, $\Delta AOB \cong \Delta AOC$ (SSS Congruence) ∠OAB = ∠OAC (CPCT)	2 ½ ½ 1 2 ½
		SECTION E **Case study based questions are compulsory.**	
36	**36**	**Case Study 1** Students of a school staged a rally for cleanliness campaign. A small park of the neighbourhood was divided into two triangles ABD and BDC. One group of students cleaned the area ABD while the other group cleaned the area BDC. AB = 15 m, BC = 12 m, CD = 5 m, DA = 14 m and ∠C = 90º (see figure).	

		 On the basis of the above information answer the following questions: (i) Find the length BD. (ii) Find the area of triangle ABD. **OR** Find the area of triangle BDC. (iii) Find the cost of fencing the park with barbed wire at the rate of Rs 20 per metre. **Sol.** (i) $BD^2 = BC^2 + CD^2$ $BD = \sqrt{5^2 + 12^2} = 13m$ (ii) $s = \frac{13+14+15}{2} = 21$ m Area of ABD = $\sqrt{21 \times 8 \times 7 \times 6}$ $= \sqrt{3 \times 7 \times 4 \times 2 \times 7 \times 2 \times 3}$ $= 3 \times 7 \times 4 = 84$ sq m **OR** Area of BDC = $\frac{1}{2} \times 5 \times 12 = 30$ sq m (iii) Perimeter of park = 46 m Cost of fencing = Rs 920	1 2 1
37	**37**	**Case Study 2** Coordinate Geometry and Property Surveying helps in Urban Planning to establish boundaries, helps in location and construction of layout surveys for highways, railways, and other works, providing ground control points for mapping. Shown below is a town plan on a coordinate grid, where 1 unit = 1 km. Consider the co-ordinates of each building to be the point of intersection of the respective grid lines.	



(Note: Consider the horizontal axis as the x-axis and the vertical axis as the y-axis.)

Study the given information and answer the questions that follow:

(i) Write the coordinates of the houses whose ordinate is 1.

(ii) Ramesh wants to build a house H9 such that H1, H, H8 and H9 form a square. What will be the coordinates of his house H9?

[OR]

Ravi starts from his house H8 and reaches Hospital H. He then visits his grandmother at H1. What is the total distance travelled by him?

(iii) What will be the mirror image of Police Station with respect to y-axis?

Sol. (i) H7 (4, 1) and H8 (5, 1) 1

(ii) Distance between H and H1 = 2 km

So, coordinates of H9 = (3, 1) 2

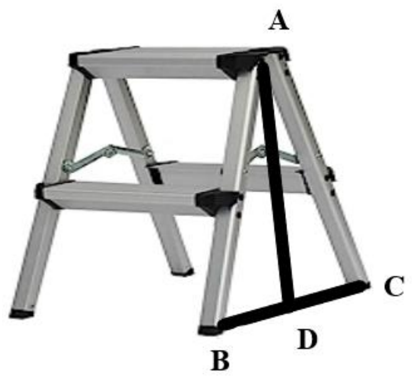
OR

Distance between H8 and H = 2 km

Distance between H and H1 = 2 km

So, total distance travelled = 4 km

(iv) Mirror image of Police Station with respect to y-axis = $(-5, 5)$ 1

38	**38**	**Case Study 3** A ladder manufacturing company manufactures foldable step ladders of aluminium as shown in the figure. The lengths of two legs AB and AC are both equal to 110 cm and the angle between the two legs is 30°.  On the basis of the above information answer the following questions: (i) Find the measure of ∠ABC. (ii) AD bisects side BC of the isosceles triangle ABC. Show that AD is the perpendicular to BC. **OR** ABC is an isosceles triangle in which altitudes BE and CF are drawn to equal sides AC and AB respectively. Show that these altitudes are equal. (iii) ABC is a right angled triangle in which ∠ A = 90° and AB = AC. Find ∠ B. Sol. (i) AB = AC So, $\angle B = \angle C$ Now, $30^0 + 2\angle B = 180^0$ $\angle B = 75°$ (ii) In ΔABD and ΔACD, AB = AC (Given) AD = AD (Common) BD = CD (Given) So, Δ ABD ≅ Δ ACD (SSS rule) and ∠ ADB = ∠ADC (CPCT) Also, ∠ ADB + ∠ ADC = 180° (Linear pair) So, 2∠ADC = 180° or, ∠ ADC = 90° **OR**	1 1 ½ ½

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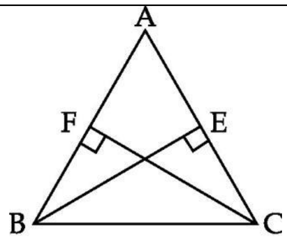
<tr><td></td><td></td><td>
Fig – ½
In Δ ABE and Δ ACF,
AB = AC (Given)
∠ A = ∠ A (Common)
∠AEB = ∠AFC (Each 90°)
So, Δ ABE ≅ Δ ACF (AAS rule)
Therefore, BE = CF (CPCT)
(iii) AB = AC (Given)
∠B = ∠C
$90° + 2\angle B = 180°$
∠B = 45°</td><td>1 ½

1</td></tr>
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