

S. No	Question
Section A	
1.	Marking Guidelines: • Award 1 mark for selecting option C. • Award 0 mark for selecting options A, B, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
2.	Correct Option: A. The sum of zeroes is 6 and the product is 5. Marking Guidelines: • Award 1 mark for selecting option A. • Award 0 mark for selecting options B, C, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
3.	Correct Option: B. Compute $D = b^2 - 4ac$, interpret its sign, and justify the conclusion. Marking Guidelines: • Award 1 mark for selecting option B. • Award 0 mark for selecting options A, C, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
4.	Correct Option: A. It helps determine whether factorisation over real numbers is possible. Marking Guidelines: • Award 1 mark for selecting option A. • Award 0 mark for selecting options B, C, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
5.	Correct Option: C. The sequence is an AP with common difference 3. Marking Guidelines: • Award 1 mark for selecting option C. • Award 0 mark for selecting options A, B, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark
6.	Correct Option: B. Distance formula and properties of a 45° triangle Marking Guidelines: • Award 1 mark for selecting option B. • Award 0 mark for selecting options A, C, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.

7.	Correct Option: C. Recognise that the condition is a ratio 1: 2, not equal lengths, and apply the Section Formula after discussion. Marking Guidelines: • Award 1 mark for selecting option C. • Award 0 mark for selecting options A, B, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
8.	Correct Option: B. $\tan P - \cot R$ Marking Guidelines: • Award 1 mark for selecting option B. • Award 0 mark for selecting options A, C, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
9.	Correct Option: C. Compare both approaches and confirm they give $\frac{1}{2}$. Marking Guidelines: • Award 1 mark for selecting option C. • Award 0 mark for selecting options A, B, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
10.	Correct Option: C. Discuss the property together, verify both relationships logically, and agree on the correct conclusion. Marking Guidelines: • Award 1 mark for selecting option C. • Award 0 mark for selecting options A, B, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
11.	Correct Option: C. Use $r^2 = 5^2 + 5^2$ to determine the radius before finding the remaining area. Marking Guidelines: • Award 1 mark for selecting option C. • Award 0 mark for selecting options A, B, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
12.	Correct Option: A. Compare the positions of minimum, maximum, and median in both diagrams and select the one consistent with the definition of median. Marking Guidelines: • Award 1 mark for selecting option A.

	• Award 0 mark for selecting options B, C, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
13.	orrect Option: B. Compare the ratio of marked ducks to total ducks before and after the addition. Marking Guidelines: • Award 1 mark for selecting option B. • Award 0 mark for selecting options A, C, or D. • No partial marking. • If more than one option is marked → 0 mark. • If no option is marked → 0 mark.
Section B	
14.	Expected Answer: Example: $\sqrt{2} \times \sqrt{2} = 2$ Since $\sqrt{2}$ is irrational and 2 is rational, the product of two irrational numbers can be rational. Conclusion: The statement is false. Mark Distribution: • 1 Mark – Correct counterexample (e.g., $\sqrt{2} \times \sqrt{2} = 2$). • 1 Mark – Correct conclusion stating that the statement is false (product of two irrational numbers may be rational). Marking Guidelines: • If only a correct example is given without conclusion → 1 mark. • If only conclusion is written without valid example → 1 mark. • If example is incorrect → 0 mark. • No partial marking beyond the above distribution.
15.	Expected Solution: Forming equations: $\begin{aligned}x + y &= 60 \\x &= 2y + 10\end{aligned}$ Substituting in first equation: $\begin{aligned}2y + 10 + y &= 60 \\3y + 10 &= 60 \\3y &= 50 \\y &= \frac{50}{3} \\x &= 60 - \frac{50}{3} = \frac{130}{3}\end{aligned}$

	Thus, $\text{Plastic items} = \frac{130}{3},$ $\text{Paper items} = \frac{50}{3}.$ Mark Distribution: • 1 Mark – Correct formation of both linear equations. • 1 Mark – Correct elimination/substitution process with final values of x and y. Marking Guidelines: • If equations are correct but solution incomplete $\rightarrow$ 1 mark. • If minor arithmetic error but correct method $\rightarrow$ 1 mark. • If equations incorrectly formed $\rightarrow$ 0 mark.
16.	Expected Answer: Since the corresponding sides of the two triangles are proportional, 1. The two triangles are similar (by SSS similarity criterion). 2. Corresponding angles of the triangles are equal. <i>(Alternatively: The ratio of their areas is the square of the ratio of corresponding sides.)</i> Mark Distribution: • 1 Mark – Correctly stating that the triangles are similar (SSS similarity). • 1 Mark – Any one valid conclusion, such as: ◦ Corresponding angles are equal, or ◦ Ratio of areas equals square of ratio of corresponding sides, or ◦ Corresponding sides are proportional. Marking Guidelines: • If only similarity is stated without any additional conclusion $\rightarrow$ 1 mark. • If incorrect property stated $\rightarrow$ deduct accordingly. • No extra marks beyond 2.
17.	Time in hours: • $12 \text{ min} = \frac{12}{60} = \frac{1}{5} \text{ h}$ • $3 \text{ min} = \frac{3}{60} = \frac{1}{20} \text{ h}$ • $4 \text{ min} = \frac{4}{60} = \frac{1}{15} \text{ h}$ Distances: Preeti: • East: $30 \times \frac{1}{5} = 6 \text{ km}$ • South: $60 \times \frac{1}{20} = 3 \text{ km}$ $\rightarrow$ Position of Preeti: $(6, -3)$ Arun: • West: $30 \times \frac{1}{15} = 2 \text{ km}$ • North: $45 \times \frac{1}{15} = 3 \text{ km}$

	→ Position of Arun: $(-2,3)$ Method 1: Coordinate Geometry (Distance Formula) Distance between $(6, -3)$ and $(-2,3)$: $d = \sqrt{(6 - (-2))^2 + (-3 - 3)^2}$ $d = \sqrt{8^2 + (-6)^2}$ $d = \sqrt{64 + 36}$ $d = \sqrt{100} = 10 \text{ km}$ Method 2: Geometric Reasoning (Right Triangle) Horizontal separation: $6 - (-2) = 8\text{km}$ Vertical separation: $-3 - 3 = -6\text{km} \rightarrow \text{magnitude } 6 \text{ km}$ Using Pythagoras Theorem: $d = \sqrt{8^2 + 6^2}$ $d = \sqrt{64 + 36}$ $d = \sqrt{100} = 10 \text{ km}$ Final Answer: The straight-line distance between their offices is 10 km. Marking Scheme (2 Marks) Mark Distribution: • 1 Mark – Correct positions of Preeti and Arun OR correct horizontal and vertical separation. • 1 Mark – Correct application of distance formula/Pythagoras with final answer 10 km. Marking Guidelines: • Minor arithmetic error but correct method → 1 mark. • If only one method shown correctly → full marks (since result is verified). • Incorrect unit conversion → deduct accordingly.
18.	Yes, a conflict exists in Step 2. In Step 1: $= \frac{\cos^2 A + (1 - \sin A)^2}{(1 - \sin A)\cos A}$ Expanding $(1 - \sin A)^2$: $(1 - \sin A)^2 = 1 - 2\sin A + \sin^2 A$ Salma incorrectly replaced $(1 - \sin A)^2 = \cos^2 A$

This is wrong because:

$$\cos^2 A = 1 - \sin^2 A$$

But

$$(1 - \sin A)^2 \neq 1 - \sin^2 A$$

Hence, Step 2 is incorrect.

Correct Simplification

Take LCM:

$$= \frac{\cos^2 A + (1 - \sin A)^2}{(1 - \sin A)\cos A}$$

Now expand correctly:

$$= \frac{\cos^2 A + 1 - 2\sin A + \sin^2 A}{(1 - \sin A)\cos A}$$

Using identity:

$$\sin^2 A + \cos^2 A = 1$$

So numerator becomes:

$$\begin{aligned} 1 + 1 - 2\sin A &= 2 - 2\sin A \\ &= 2(1 - \sin A) \end{aligned}$$

Thus,

$$= \frac{2(1 - \sin A)}{(1 - \sin A)\cos A}$$

Cancel $(1 - \sin A)$:

$$\begin{aligned} &= \frac{2}{\cos A} \\ &= 2\sec A \end{aligned}$$

Final Answer:

$$\boxed{2\sec A}$$

Marking Scheme (2 Marks)

Mark Distribution:

- 1 Mark – Correctly identifying the mistake in Step 2 (wrong expansion of $(1 - \sin A)^2$).
- 1 Mark – Correct simplification leading to final answer $2\sec A$.

Marking Guidelines:

- If error identified but correction incomplete → 1 mark.
- If correct final answer without explanation → 1 mark.
- If both explanation and correction correct → 2 marks.

19.	Step 1: Real depth relation From right triangle in water: $\tan 30^\circ = \frac{\text{horizontal shift}}{\text{real depth}}$ $\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{1}{1.7}$ $\text{Horizontal distance} = \frac{34}{1.7} = 20 \text{ cm}$ Step 2: Apparent depth From triangle in air: $\tan 45^\circ = \frac{\text{same horizontal distance}}{\text{apparent depth}}$ $1 = \frac{20}{\text{apparent depth}}$ $\text{Apparent depth} = 20 \text{ cm}$ Step 3: Apparent Shift $\text{Shift} = 34 - 20 = 14 \text{ cm}$ Final Answer: The object appears 14 cm above its real position. Concept Explanation When light passes from water (denser medium) to air (rarer medium), it bends away from the normal. This makes the object appear closer to the surface, reducing its apparent depth. Marking Scheme (2 Marks) Mark Distribution: • 1 Mark – Correct use of trigonometric reasoning to determine apparent depth. • 1 Mark – Correct calculation of shift = 14 cm.
20.	Quick Calculations Step 1: Frustum Top radius $r = 5\text{in}$ Bottom radius $R = 8\text{in}$ Height $h = 4\text{in}$ Slant height: $l = \sqrt{(R - r)^2 + h^2} = \sqrt{(8 - 5)^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ CSA of frustum: $\pi(R + r)l = \pi(8 + 5)(5) = 65\pi$

	Using $\pi = 3.14$: $= 204.1 \text{ sq in}$ Step 2: Cylinder Radius = 8 in Height = 5 in CSA: $2\pi rh = 2\pi(8)(5) = 80\pi = 251.2 \text{ sq in}$ Step 3: Total Curved Surface Area $204.1 + 251.2 = 455.3 \text{ sq in}$ Step 4: Number of Sheets $\frac{455.3}{44} = 10.35$ Minimum sheets required = 11 sheets Final Answer: 11 sheet S Marking Scheme (2 Marks) Mark Distribution: • 1 Mark – Correct calculation of total curved surface area. • 1 Mark – Correct division and rounding up to 11 sheets.
21.	Step 1: Class Marks 0–20 $\rightarrow$ 10 20–40 $\rightarrow$ 30 40–60 $\rightarrow$ 50 60–80 $\rightarrow$ 70 Step 2: Apply Mean Formula $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$ $35 = \frac{7(10) + x(30) + 10(50) + 4(70)}{7 + x + 10 + 4}$ $35 = \frac{70 + 30x + 500 + 280}{21 + x}$ $35 = \frac{850 + 30x}{21 + x}$ Step 3: Solve

	$5x = 115$ $x = 23$ Final Answer $\boxed{x = 23}$ Marking Scheme (2 Marks) Mark Distribution: • 1 Mark – Correct application of grouped mean formula. • 1 Mark – Correct solving to obtain $x = 23$.
Section C	
22.	Expected Proof (By Contradiction) 1. Assume that $\sqrt{6}$ is rational. 2. Then it can be written in lowest form as $\sqrt{6} = \frac{p}{q}, q \neq 0$ where p and q are integers with no common factor. 3. Squaring both sides: $6 = \frac{p^2}{q^2}$ 4. Therefore, $p^2 = 6q^2$ 5. Thus p^2 is divisible by 2 and 3, so p is divisible by 2 and 3. Hence p is divisible by 6. 6. Let $p = 6k$. Substituting: $(6k)^2 = 6q^2$ 7. $36k^2 = 6q^2 \Rightarrow q^2 = 6k^2$ So q is also divisible by 6. 8. This contradicts the assumption that p and q have no common factor. Therefore, the assumption is wrong and $\boxed{\sqrt{6} \text{ is irrational.}}$ Marking Scheme (3 Marks) Mark Distribution: • 1 Mark – Correct assumption $\sqrt{6} = \frac{p}{q}$ in lowest form and squaring. • 1 Mark – Showing p divisible by 6 and deriving $p = 6k$. • 1 Mark – Showing q also divisible by 6 and stating contradiction $\rightarrow$ correct conclusion.

23.	For a quadratic polynomial: $ax^2 + bx + c$ Sum of zeroes = $-\frac{b}{a}$ Product of zeroes = $\frac{c}{a}$ Step 1: Compute Actual Sum and Product Given zeroes: 2 and 5 $\text{Sum} = 2 + 5 = 7$ $\text{Product} = 2 \times 5 = 10$ Step 2: Verify Student A's Polynomial For $x^2 - 7x + 10$: $\text{Sum} = -\frac{-7}{1} = 7$ $\text{Product} = \frac{10}{1} = 10$ Matches given values ✓ Step 3: Verify Student B's Polynomial For $x^2 + 7x + 10$: $\text{Sum} = -\frac{7}{1} = -7$ Does not match required sum ✗ Conclusion The disagreement arises from misunderstanding the relationship between coefficients and zeroes, specifically the negative sign in $\text{Sum of zeroes} = -\frac{b}{a}$ Therefore, the correct polynomial is: $x^2 - 7x + 10$ Marking Scheme (3 Marks) Mark Distribution: • 1 Mark – Correct statement of sum and product formula. • 1 Mark – Verification of Student A's polynomial. • 1 Mark – Identification of error in Student B's polynomial and correct conclusion.
24.	Step 1: Form the Quadratic Equation Let the number be x.

	$x^2 + 6x - 16 = 0$ Step 2: Apply Brahmagupta's Quadratic Formula For $ax^2 + bx + c = 0$, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Here, $a = 1, b = 6, c = -16$ $ \begin{aligned} x &= \frac{-6 \pm \sqrt{6^2 - 4(1)(-16)}}{2} \\ &= \frac{-6 \pm \sqrt{36 + 64}}{2} \\ &= \frac{-6 \pm \sqrt{100}}{2} \\ &= \frac{-6 \pm 10}{2} \end{aligned} $ Step 3: Roots $ \begin{aligned} x &= \frac{-6 + 10}{2} = 2 \\ x &= \frac{-6 - 10}{2} = -8 \end{aligned} $ Final Answer $\boxed{x = 2, -8}$ Marking Scheme (3 Marks) Mark Distribution: • 1 Mark – Correct formation of quadratic equation $x^2 + 6x - 16 = 0$. • 1 Mark – Correct substitution in quadratic formula and discriminant calculation. • 1 Mark – Correct evaluation of roots 2 and -8.
25.	Insect's Path (Space Diagonal) First find base diagonal PR: $PR = \sqrt{5^2 + 4^2} = \sqrt{25 + 16} = \sqrt{41}$ Now apply 3D Pythagoras: $ \begin{aligned} PS &= \sqrt{PR^2 + 3^2} = \sqrt{41 + 9} = \sqrt{50} \\ PS &= 5\sqrt{2} \\ &\approx 5 \times 1.414 = 7.07 \text{ m} \end{aligned} $

	Ant's Path (Along Surfaces) $PR = \sqrt{41} \approx 6.4 \text{ m}$ $RS = 3 \text{ m}$ Total distance: $6.4 + 3 = 9.4 \text{ m}$ Comparison Insect's path: $\approx 7.07 \text{ m}$ Ant's path: $\approx 9.4 \text{ m}$ $7.07 < 9.4$ Conclusion The insect's path is shorter. The student's claim is justified, but the conclusion is valid only after mathematical calculation—not merely because it “looks more direct.” Comparing both geometric approaches ensures a fair and reasoned conclusion. Marking Scheme (3 Marks) Mark Distribution: • 1 Mark – Correct calculation of insect's distance (space diagonal). • 1 Mark – Correct calculation of ant's path along surfaces. • 1 Mark – Proper comparison with justified conclusion.
26.	Step 1: Base Diagonal In the base rectangle, $\text{Base diagonal} = \sqrt{l^2 + b^2}$ (Using Pythagoras Theorem) Step 2: Space Diagonal Using Pythagoras again in 3D, $\text{Space diagonal} = \sqrt{l^2 + b^2 + h^2}$ Step 3: Find $\cos \theta$ In the right triangle formed by: • Base diagonal • Height h • Space diagonal $\cos \theta = \frac{\text{Adjacent side}}{\text{Hypotenuse}}$

Adjacent side = Base diagonal
Hypotenuse = Space diagonal

$$\cos \theta = \frac{\sqrt{l^2 + b^2}}{\sqrt{l^2 + b^2 + h^2}}$$

$$\cos \theta = \frac{\sqrt{l^2 + b^2}}{\sqrt{l^2 + b^2 + h^2}}$$

When the Cuboid is a Cube
If $l = b = h = a$,

$$\begin{aligned}\cos \theta &= \frac{\sqrt{a^2 + a^2}}{\sqrt{a^2 + a^2 + a^2}} \\ &= \frac{\sqrt{2a^2}}{\sqrt{3a^2}} = \frac{a\sqrt{2}}{a\sqrt{3}}\end{aligned}$$

$$\cos \theta = \sqrt{\frac{2}{3}}$$

Marking Scheme (3 Marks)

Mark Distribution:

- 1 Mark – Correct calculation of base and space diagonals using Pythagoras.
- 1 Mark – Correct expression for $\cos \theta$.
- 1 Mark – Correct substitution for cube and final answer $\sqrt{\frac{2}{3}}$.

27.

Step 1: Radius–Tangent Property

Radius drawn to the point of contact is perpendicular to the tangent.

$$OQ \perp PQ$$

$$OR \perp PR$$

Thus, $\angle OQP = 90^\circ$ and $\angle ORP = 90^\circ$.

Step 2: Consider Triangles $\triangle OQP$ and $\triangle ORP$

In both triangles:

- $OQ = OR$ (Radii of the same circle)
- $OP = OP$ (Common side)
- $\angle OQP = \angle ORP = 90^\circ$

Step 3: Apply RHS Congruence

$$\triangle OQP \cong \triangle ORP$$

(By RHS Congruence)

Step 4: Corresponding Parts

$$PQ = PR$$

	(CPCT) Conclusion $\boxed{PQ = PR}$ Hence, tangents drawn from an external point to a circle are equal in length. Marking Scheme (3 Marks) Mark Distribution: • 1 Mark – Stating $OQ \perp PQ$, $OR \perp PR$ and $OQ = OR$. • 1 Mark – Applying RHS congruence to triangles OQP and ORP. • 1 Mark – Concluding $PQ = PR$ using CPCT.
28.	Step 1: Use Tangent–Chord Theorem Angle between tangent PA and chord AC equals the angle in the opposite arc. $\angle ABC = 30^\circ$ Step 2: Use Angle Sum of Triangle ABC $\begin{aligned}\angle ABC + \angle ACB + \angle BAC &= 180^\circ \\ 30^\circ + 70^\circ + \angle BAC &= 180^\circ \\ \angle BAC &= 80^\circ\end{aligned}$ Step 3: Use Property of Circle (Angle at Centre) Angle at centre is twice the angle at circumference: $\begin{aligned}\angle BOC &= 2 \times \angle BAC \\ \angle BOC &= 2 \times 80^\circ = 160^\circ\end{aligned}$ Step 4: Triangle BOC is Isosceles Since $OB = OC$ (radii), Base angles are equal: $\begin{aligned}\angle OBC &= \angle OCB \\ \angle OBC &= \frac{180^\circ - 160^\circ}{2} \\ \angle OBC &= 10^\circ\end{aligned}$ Final Answer $\boxed{\angle OBC = 10^\circ}$ Marking Scheme (3 Marks) Mark Distribution: • 1 Mark – Correct use of tangent–chord theorem and finding $\angle ABC$.

	• 1 Mark – Correct finding of $\angle BAC$ and $\angle BOC$. • 1 Mark – Correct use of isosceles triangle property and final answer 10°.
29.	Given • Two equal circles with centres A and B • They intersect at C and D • $CD = 400\text{m}$ • $\angle CAD = 90^\circ$ and $\angle CBD = 90^\circ$ • $\pi = 3.14$ ☒ Step 1: Use the Right Angle Property Correctly In circle with centre A: $\angle CAD = 90^\circ$ This is an angle at the centre (since A is centre). For a circle: $\text{Length of chord} = 2r \sin \left(\frac{\theta}{2} \right)$ Here, $\begin{aligned}\theta &= 90^\circ \\ CD &= 2r \sin 45^\circ \\ 400 &= 2r \times \frac{\sqrt{2}}{2} \\ 400 &= r\sqrt{2} \\ r &= \frac{400}{\sqrt{2}} \\ r &= 200\sqrt{2} \\ r &\approx 200 \times 1.414 \\ r &\approx 282.8\text{ m}\end{aligned}$ Step 2: Structure of Overlapping Region The overlapping region consists of two identical circular segments. Each segment area = $\text{Sector area} - \text{Area of triangle}$ Step 3: Sector Area (90°) $\begin{aligned}&\frac{90}{360} \times \pi r^2 \\&= \frac{1}{4} \times 3.14 \times (282.8)^2 \\&= \frac{1}{4} \times 3.14 \times 80000 \\&= \frac{1}{4} \times 251200 \\&= 62800\end{aligned}$

Step 4: Area of Triangle ACD

$$\begin{aligned}\frac{1}{2}r^2\sin 90^\circ \\&= \frac{1}{2} \times 80000 \\&= 40000\end{aligned}$$

Step 5: One Segment Area

$$62800 - 40000 = 22800$$

Step 6: Total Overlapping Area

Two segments:

$$2 \times 22800 = 45600$$

Final Answers

$$r = 200\sqrt{2} \approx 282.8 \text{ m}$$

$$\text{Overlapping Area} = 45600 \text{ m}^2$$

Marking Scheme (3 Marks)

- 1 Mark – Correct radius calculation using chord formula
- 1 Mark – Correct sector and triangle area calculation
- 1 Mark – Correct overlapping area 45600 m^2

30.

Determine Probability of Each Room Opening

Count total equal sectors and number of grey sectors from the figure.

Room 1

- Total sectors = 6
- Grey sectors = 3

$$P_1 = \frac{3}{6} = \frac{1}{2}$$

Room 2

- Total sectors = 8
- Grey sectors = 1

$$P_2 = \frac{1}{8}$$

Room 3

- Total sectors = 6
- Grey sectors = 2

$$P_3 = \frac{2}{6} = \frac{1}{3}$$

	Step 2: Compare Probabilities $\frac{1}{2}, \frac{1}{8}, \frac{1}{3}$ Convert to decimals: $0.5, 0.125, 0.333$ Smallest probability: $\frac{1}{8}$ Step 3: Final Decision Room 2 Room 2 has the least probability of landing on grey, so it is least likely to open. Conclusion Zaira keeps her treasure in Room 2, because it has the smallest probability of opening. Marking Scheme (3 Marks) • 1 Mark – Correct probabilities of all three rooms. • 1 Mark – Correct comparison of probabilities. • 1 Mark – Correct identification of Room 2 with reasoning.
Section D	
31.	Part (i): Form Linear Equations and Find x and y Step 1: Understand the Charging Pattern If a car is parked for more than 2 hours: $\text{Total charge} = x + (\text{extra hours}) \cdot y$ Extra hours = (Total hours – 2) Step 2: Form Equations Murli: Parked 6 hours Extra hours = $6 - 2 = 4$ $x + 4y = 110 \text{ (Equation 1)}$ Aparna: Parked 13 hours Extra hours = $13 - 2 = 11$ $x + 11y = 250 \text{ (Equation 2)}$

	Step 3: Solve Using Elimination $\begin{aligned}x + 11y &= 250 \\x + 4y &= 110\end{aligned}$ Subtract: $\begin{aligned}(x + 11y) - (x + 4y) &= 250 - 110 \\7y &= 140 \\y &= 20\end{aligned}$ Substitute in Equation 1: $\begin{aligned}x + 4(20) &= 110 \\x + 80 &= 110 \\x &= 30\end{aligned}$ Fixed charge = ₹30 Subsequent hourly charge = ₹20 Part (ii): Amount Paid by Amish Amish parked from 8 AM to 3 PM Total hours = 7 hours Extra hours = $7 - 2 = 5$ $\begin{aligned}\text{Total charge} &= x + 5y \\&= 30 + 5(20) \\&= 30 + 100 \\&= 130\end{aligned}$ Final Answer Fixed charge = ₹30 Subsequent hourly charge = ₹20 Amish must pay ₹130 Marking Scheme (5 Marks) 1 Mark Correct formation of equation for Murli 1 Mark Correct formation of equation for Aparna 1 Mark Correct elimination method 1 Mark Correct values of x and y 1 Mark Correct calculation for Amish
32.	Part (i) Given: $\begin{aligned}a &= 40 \\a_{15} &= 180\end{aligned}$ Using:

$$a_n = a + (n - 1)d$$

$$180 = 40 + 14d$$

$$140 = 14d$$

$$d = 10$$

AP:

40,50,60, ...

Sum of first 15 terms:

$$S_n = \frac{n}{2} [2a + (n - 1)d]$$

$$S_{15} = \frac{15}{2} [80 + 140]$$

$$= \frac{15}{2} (220)$$

$$= 1650$$

Part (ii)

New total:

$$1650 + 450 = 2100$$

Let new common difference = d'

$$2100 = \frac{15}{2} [80 + 14d']$$

Multiply by 2:

$$4200 = 15(80 + 14d')$$

$$4200 = 1200 + 210d'$$

$$3000 = 210d'$$

$$d' = \frac{3000}{210}$$

$$d' = \frac{100}{7}$$

$$d' \approx 14.29$$

Final Answers

Common difference = 10

Total after 15 modules = 1650

New common difference = $100/7 \approx 14.29$

Marking Scheme (4 Marks)

1 Mark

Correct use of nth term formula and finding $d = 10$

1 Mark

Correct calculation of sum $S_{15} = 1650$

1 Mark

Correct formation of equation for new sum

	1 Mark Correct new common difference $d' = 100/7$
33.	Step 1: Let the Measurements Let: $YZ = 4a$ Since A, B, C divide YZ equally: $YA = a, YB = 2a, YC = 3a$ Let: $XY = h$ Step 2: Apply Pythagoras Theorem Since triangle is right-angled at Y, $XA^2 = XY^2 + YA^2 = h^2 + a^2$ $XB^2 = h^2 + (2a)^2 = h^2 + 4a^2$ $XC^2 = h^2 + (3a)^2 = h^2 + 9a^2$ $XZ^2 = h^2 + (4a)^2 = h^2 + 16a^2$ Step 3: Substitute in Given Expression $3XA^2 + XB^2 + XC^2 - XZ^2$ Substitute values: $3(h^2 + a^2) + (h^2 + 4a^2) + (h^2 + 9a^2) - (h^2 + 16a^2)$ Step 4: Simplify Expand: $3h^2 + 3a^2 + h^2 + 4a^2 + h^2 + 9a^2 - h^2 - 16a^2$ Group like terms: For h^2: $3h^2 + h^2 + h^2 - h^2 = 4h^2$ For a^2: $3a^2 + 4a^2 + 9a^2 - 16a^2 = 0$ Thus, $= 4h^2$ Final Result $3XA^2 + XB^2 + XC^2 - XZ^2 = 4XY^2$ Hence Proved.
	Marking Scheme (4 Marks)

	1 Mark Correct assumption: $YZ = 4a$, equal divisions 1 Mark Correct application of Pythagoras for all four lengths 1 Mark Correct substitution in expression 1 Mark Correct simplification and final proof
34.	Step 1: Angle Relationships Angle of depression = Angle of elevation (alternate interior angles). Therefore: • Angle of elevation of Gagan from Jyoti = 30° • Angle of depression of Gagan from Karan = 60° Step 2: Let Radius = r Lowest cabin height = 0 m Highest cabin height = $2r$ Gagan's height = 12 m Let horizontal distance from wheel's centre line to Gagan's vertical projection be d. Step 3: Use Triangle with Jyoti Height difference = 12 m $\tan 30^\circ = \frac{12}{d}$ $\frac{1}{\sqrt{3}} = \frac{12}{d}$ $d = 12\sqrt{3}$ Step 4: Use Triangle with Karan Height difference between Karan and Gagan: $= 2r - 12$ $\tan 60^\circ = \frac{2r - 12}{d}$ $\sqrt{3} = \frac{2r - 12}{12\sqrt{3}}$ Multiply: $\sqrt{3} \times 12\sqrt{3} = 2r - 12$ $12 \times 3 = 2r - 12$ $36 = 2r - 12$ $2r = 48$ $r = 24$ Step 5: Diameter Diameter = $2r = 48 \text{ m}$

	Final Answers Angle of elevation of Gagan from Jyoti = 30° Angle of depression of Gagan from Karan = 60° Diameter of the giant wheel = 48 m Marking Scheme (4 Marks) 1 Mark Correct identification of angle relationship 1 Mark Correct use of $\tan 30^\circ$ 1 Mark Correct equation using $\tan 60^\circ$ 1 Mark Correct radius and diameter (48 m)
35.	Step 1: Find Base Radius Without Overlap When a semicircle is folded into a cone: Slant height of cone = radius of semicircle $l = 5 \text{ cm}$ Arc length of semicircle becomes circumference of cone base. Arc length of semicircle: $= \pi r$ $= \pi \times 5 = 5\pi$ This equals circumference of base: $2\pi R$ $5\pi = 2\pi R$ $R = \frac{5}{2} = 2.5 \text{ cm}$ Step 2: Account for 80% Overlap New base radius: $R' = 0.8 \times 2.5$ $R' = 2 \text{ cm}$ Step 3: Slant Height Slant height remains equal to radius of semicircle: $l = 5 \text{ cm}$ Step 4: Find Height of Cone Using Pythagoras: $l^2 = h^2 + R'^2$ $5^2 = h^2 + 2^2$ $25 = h^2 + 4$ $h^2 = 21$ $h = \sqrt{21}$ $h \approx 4.58 \text{ cm}$

Step 5: Volume of Cone

$$\begin{aligned}
 V &= \frac{1}{3} \pi R'^2 h \\
 &= \frac{1}{3} \times \frac{22}{7} \times 4 \times \sqrt{21} \\
 &= \frac{88}{21} \sqrt{21} \\
 &\approx 19.2 \text{ cm}^3
 \end{aligned}$$

Final Answers

Base radius after overlap = 2 cm

Slant height = 5 cm

Height ≈ 4.58 cm

Volume $\approx 19.2 \text{ cm}^3$

Marking Scheme (4 Marks)

1 Mark

Correct base radius without overlap

1 Mark

Correct adjusted base radius (80%)

1 Mark

Correct height using Pythagoras

1 Mark

Correct volume calculation

36.

1. Mean Viewing Time for Channel 1

Step 1: Class Marks

Class	Midpoint (xi)
0–2	1
2–4	3
4–6	5
6–8	7
8–10	9
10–12	11

Step 2: Compute $f_i x_i$

$$\begin{aligned}
 &(5500 \times 1) + (10000 \times 3) + (6000 \times 5) + (2000 \times 7) + (1000 \times 9) \\
 &\quad + (500 \times 11) \\
 &= 5500 + 30000 + 30000 + 14000 + 9000 + 5500 \\
 &= 94,000
 \end{aligned}$$

Step 3: Mean Formula

$$\begin{aligned}
 \bar{x} &= \frac{\sum f_i x_i}{\sum f_i} \\
 &= \frac{94000}{25000} \\
 &= 3.76 \text{ hours}
 \end{aligned}$$

Mean Viewing Time for Channel 1 = 3.76 hours

2. Less-than Type Ogive for Channel 2

Step 1: Cumulative Frequencies

Upper Limit	Cumulative Frequency
2	9000
4	15000
6	21500
8	23000
10	24700
12	25000

Step 2: Plot Points

Plot:

(2,9000)

(4,15000)

(6,21500)

(8,23000)

(10,24700)

(12,25000)

Join smoothly to obtain ogive.

3. Interpretation

- Channel 1 average viewing time = 3.76 hours
- Ogive of Channel 2 shows that:
 - 15,000 viewers watch less than 4 hours
 - 21,500 viewers watch less than 6 hours

The curve rises sharply in lower intervals, indicating:

Large number of viewers watch Channel 2 for shorter durations.

Channel 1 has slightly more balanced mid-range viewing (2–6 hours).

Conclusion on Viewer Engagement

- Channel 1 shows moderate average engagement (3.76 hours).
- Channel 2 has a larger concentration of short-duration viewers.
- Cumulative frequency graph helps visualize viewer retention pattern.

Measures of central tendency (mean) show typical viewing time.

Ogive shows how viewers accumulate across time intervals.

Together they provide a complete picture of popularity and engagement.

Marking Scheme (4 Marks)

1 Mark

Correct midpoints and calculation of mean

1 Mark

Correct cumulative frequency table

1 Mark

Correct plotting method (less-than ogive points)

1 Mark

	Clear interpretation comparing engagement
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