CBSE ADDITIONAL PRACTICE QUESTIONS 2023-2024

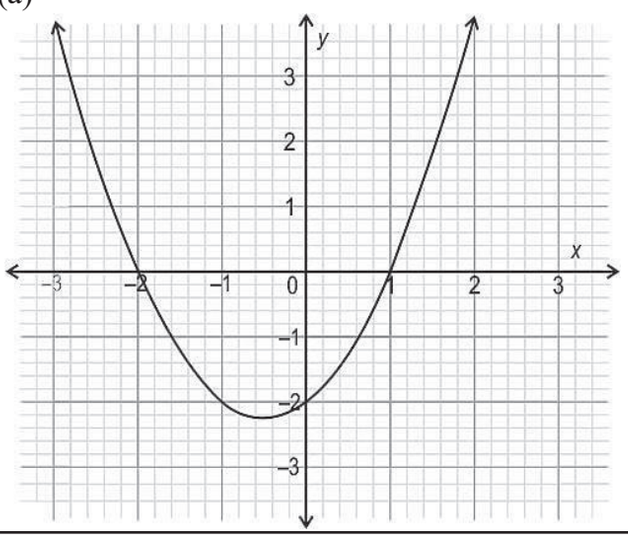
Time Allowed : 3 Hours **Max. Marks : 80**

General Instructions

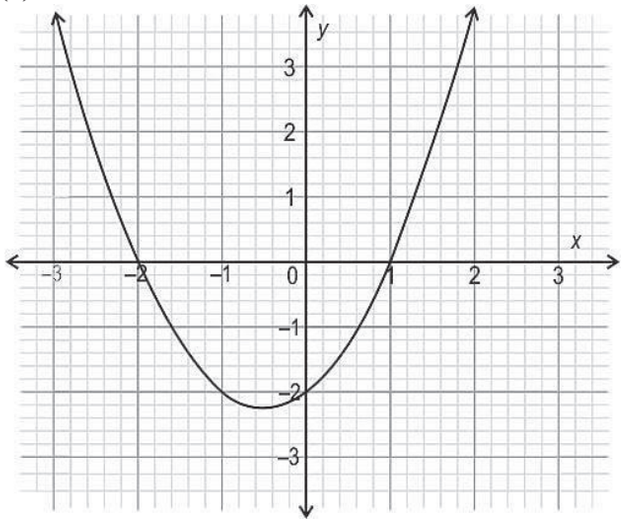
1. This Question paper contains - five sections A, B, C, D and E.
2. **Section A** has 18 MCQs and 02 Assertion-Reason based questions of 1 mark each.
3. **Section B** has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. **Section C** has 6 Short Answer (SA)-type questions of 3 marks each.
5. **Section D** has 4 Long Answer (LA)-type questions of 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 5 marks, 2 Qs of 3 marks and 2 questions of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.

SECTION-A

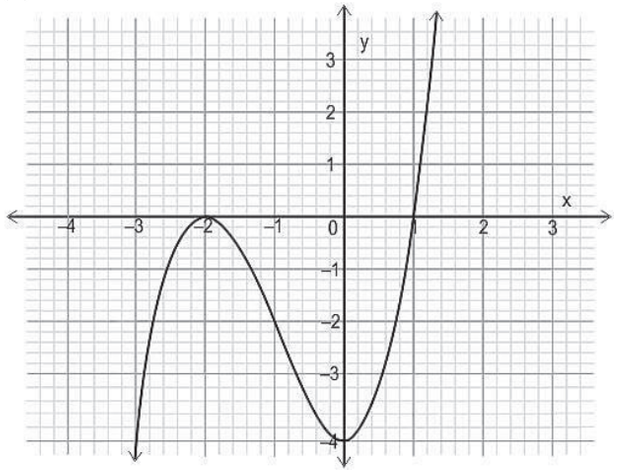
(This section comprises of Multiple-choice questions (MCQ) of 1 mark each.)

Serial No.	Question	Marks
1	Which of the following could be the graph of the polynomial? $(x - 1)^2(x + 2)$?	1
	(a) 	

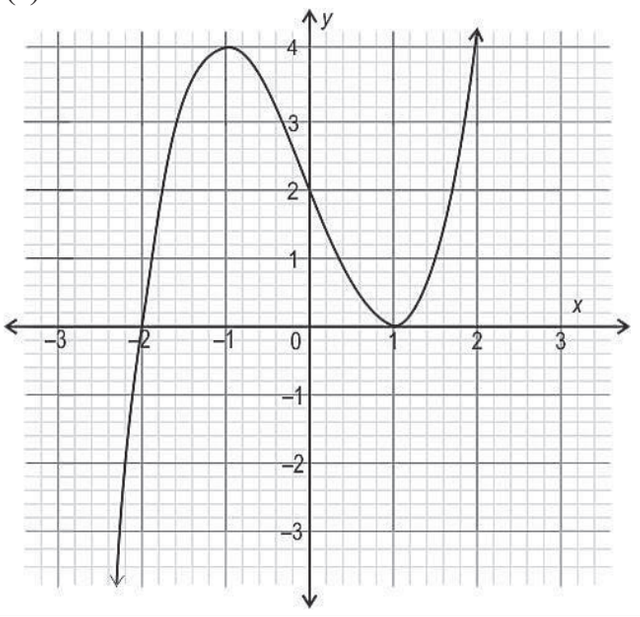
(a)



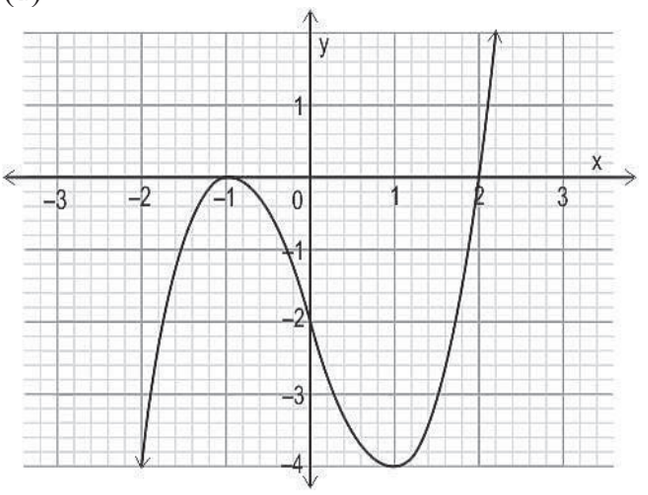
(b)



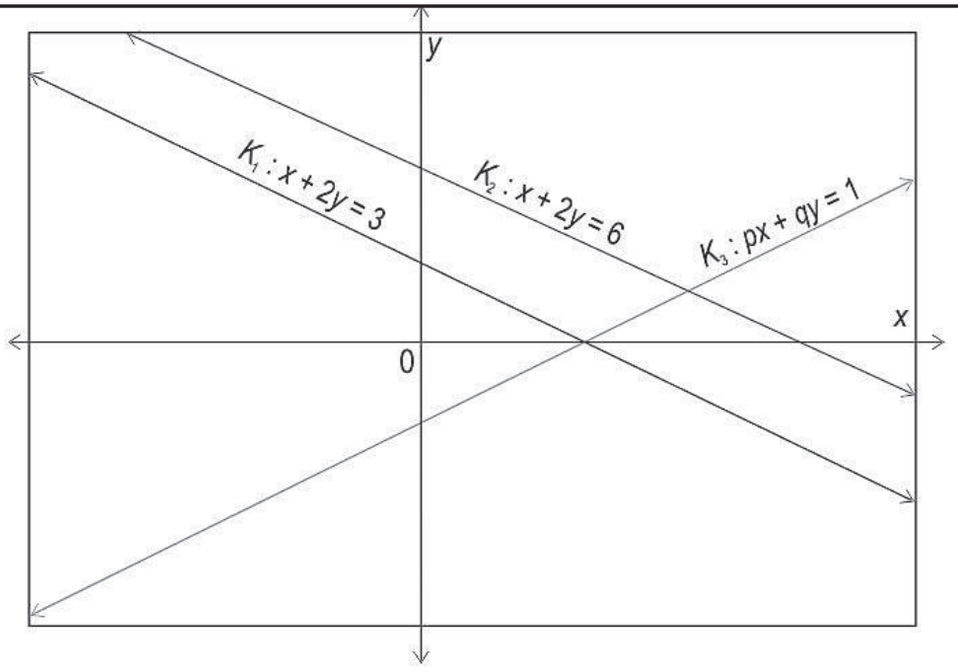
(c)



(d)

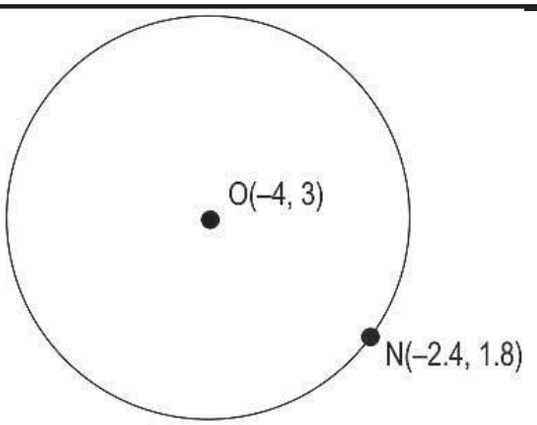
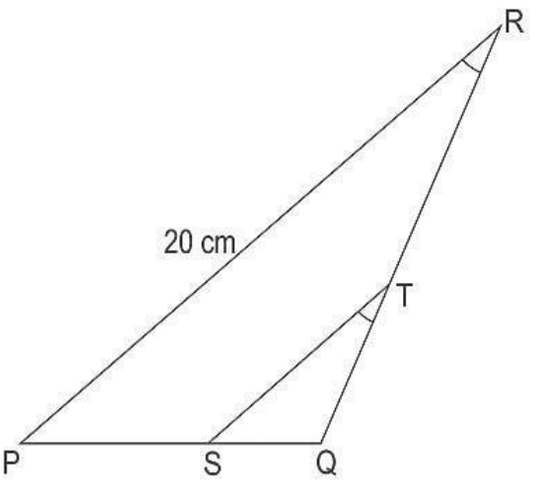


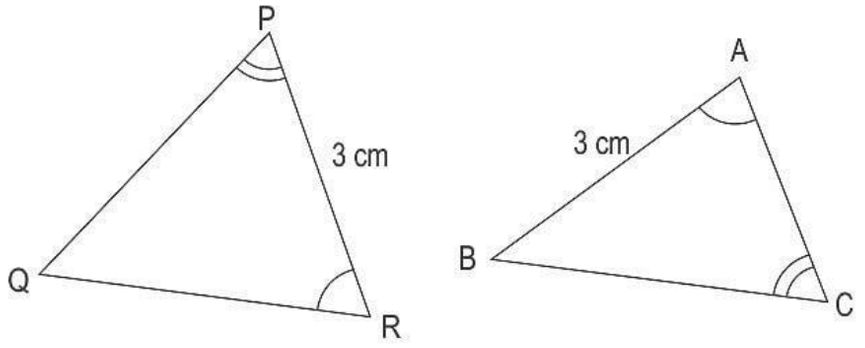
2 The lines k_1, k_2 and k_3 represent three different equations as shown in the graph below. The solution of the equations represented by the lines k_1 and k_3 is $x = 3$ and $y = 0$ while the solution of the equations represented by the lines k_2 and k_3 is $x = 4$ and $y = 1$. 1

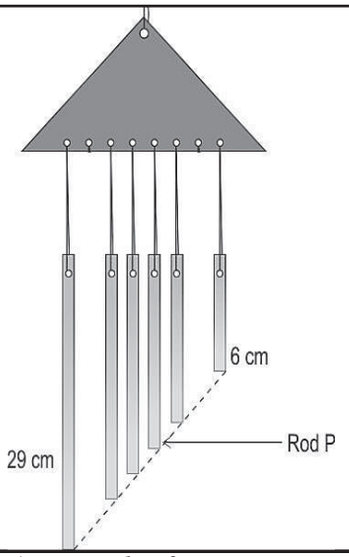


Which of these is the equation of the line k_3?

(a) $x - y = 3$
(b) $x - y = -3$
(c) $x + y = 3$
(d) $x + y = 1$

3	What is/are the roots of $3x^2 = 6x$? (a) only 2 (b) only 3 (c) 0 and 6 (d) 0 and 2	1
4	The coordinates of the centre of the circle, O, and a point on the circle, N, are shown in the figure below.  What is the radius of the circle? (a) $\sqrt{0.4}$ units (b) 2 units (c) 4 units (d) $\sqrt{42.4}$	1
5	ΔPQR is shown below. ST is drawn such that $\angle PRQ = \angle STQ$.  *(Note: The figure is not to scale.)*	1

	If ST divides QR in a ratio of 2:3, then what is the length of ST? (a) $\frac{10}{3}$ cm (b) 8 cm (c) 12 cm (d) $\frac{40}{3}$ cm	
6	Two scalene triangles are given below.	1
	 *(Note: The figures are not to scale.)* Anas and Rishi observed them and said the following: Anas: ΔPQR is similar to ΔCBA Rishi: ΔPQR is congruent to ΔCBA Which of them is/are correct? (a) Only Anas (b) Only Rishi (c) Both Anas and Rishi (d) Neither of them, as two scalene triangles can never be similar or congruent.	
7	Harsha made a wind chime using a frame and metal rods. She punched 8 holes in the frame, each 2 cm apart, and then hung 6 metal rods from the frame, as shown in the figure below. The ends of the metal rods are aligned over a line, shown by the dotted line in the figure.	1



(Note: The figure is not to scale.)

If all of the rods are straight and not swaying, then what is the length of Rod P?

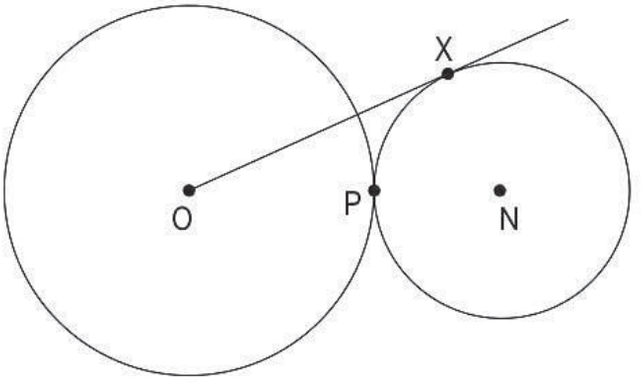
(a) $\frac{69}{7}$ cm

(b) $\frac{53}{5}$ cm

(c) $\frac{76}{5}$ cm

(d) $\frac{111}{7}$ cm

8 Two circles with centres O and N touch each other at point P as shown. O, P and N are collinear. The radius of the circle with centre O is twice that of the circle with centre N. OX is a tangent to the circle with centre N, and OX = 18 cm. 1

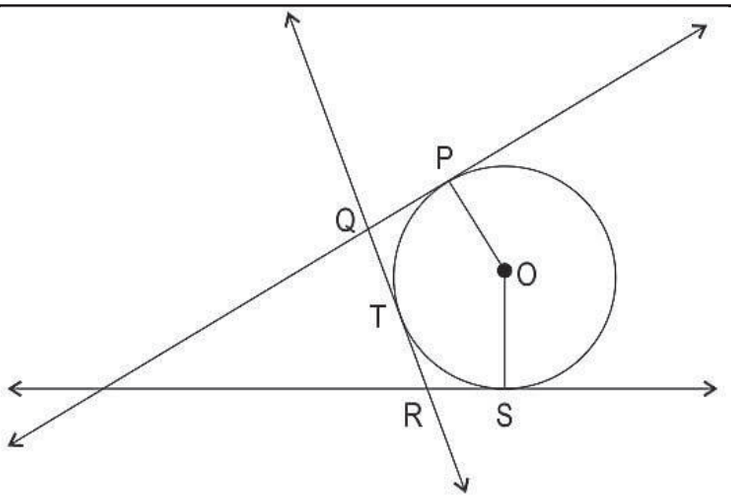


(Note: The figure is not to scale.)

What is the radius of the circle with centre N?

(a) $\frac{18}{\sqrt{2}}$ cm
(b) 9 cm
(c) $\frac{9}{\sqrt{2}}$ cm
(d) $\frac{18}{\sqrt{10}}$ cm

9 Shown below is a circle with centre O having tangents at points P, T and S. 1



(Note: The figure is not to scale.)

If QR = 12 cm and the radius of the circle is 7 cm, what is the perimeter of the polygon PQTRSO?

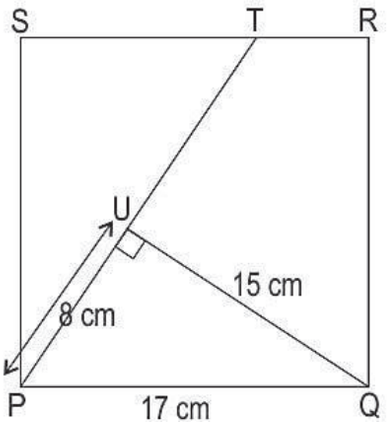
(a) 26 cm
(b) 31 cm
(c) 38 cm
(d) (cannot say with the given information.)

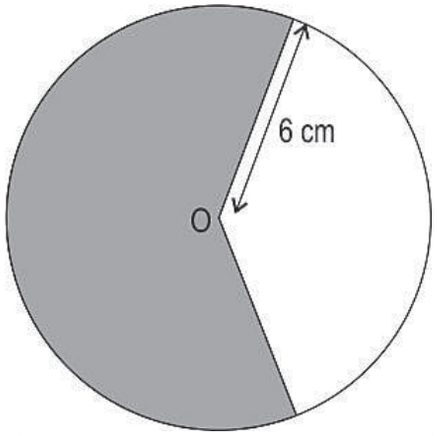
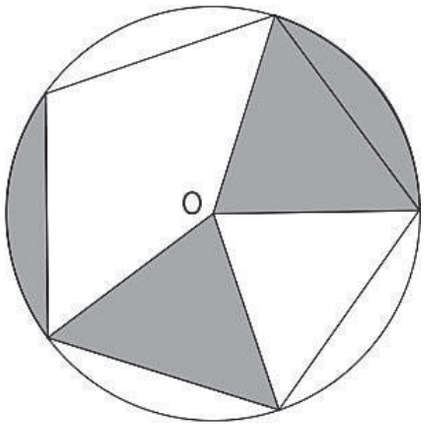
10 Shown below is a table with values of cosecant and secant of different angles. 1

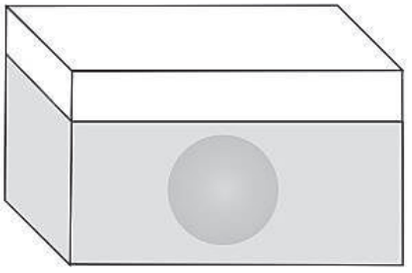
θ	35°	65°
cosec θ	P	1.1
sec (90° - θ)	1.7	Q

What are the values of P and Q respectively?

(a) $\frac{1}{1.7}$ and $\frac{1}{1.1}$
(b) 1.1 and 1.7
(c) 1.7 and 1.1
(d) (cannot be found with the given information)

11	In the figure below, PQRS is a square.	1
	 *(Note: The figure is not to scale.)* What is the value of sin ∠SPT? (a) $\frac{8}{17}$ (b) $\frac{8}{15}$ (c)) $\frac{15}{17}$ (d) (cannot be found with the given information)	
12	Shown below is a solved trigonometric problem. $\frac{\text{cosec}\,\theta + \cot\theta - 1}{\text{cosec}\,\theta - \cot\theta + 1}$ $= \frac{\text{cosec}\,\theta + \cot\theta - (\cot^2\theta - \text{cosec}^2\theta)}{\text{cosec}\,\theta - \cot\theta + 1}$ (step 1) $= \frac{\cot\theta + \text{cosec}\,\theta - (\cot\theta - \text{cosec}\,\theta)(\cot\theta + \text{cosec}\,\theta)}{\text{cosec}\,\theta - \cot\theta + 1}$ (step 2) $= \frac{(\cot\theta + \text{cosec}\,\theta)(1 - \cot\theta + \text{cosec}\,\theta)}{\text{cosec}\,\theta - \cot\theta + 1}$ (step 3) $= \cot\theta + \text{cosec}\,\theta$ (step 4) In which step is there an error in solving? (a) Step 1 (b) Step 2 (c) Step 3 (d) There is no error.	1

13	A circle with radius 6 cm is shown below. The area of the shaded region in the circle is of the area of the circle.  *(Note: The figure is not to scale.)* What is the length of the circle's minor arc? (a) $\frac{16\pi}{3}$ cm (b) $\frac{20\pi}{3}$ cm (c) 16π cm (d) 20π cm	1
14	A regular pentagon is inscribed in a circle with centre O, of radius 5 cm, as shown below.  What is the area of the shaded part of the circle?	1

	(a) 2π cm^2	
	(b) 4π cm^2 (c) 5π cm^2 (d) 10π cm^2	
15	A cuboid of base area P sq units is filled with water upto a height of Q units. A sphere of volume R cu units is dropped into the cuboid such that it is completely submerged. A representation of the submerged sphere is shown below.  Which of these represents the increase in the height of water? (a) 0 units (b) $\frac{R}{P}$ units (c) R units (d) $Q + \frac{R}{P}$ units	1
16	Sweety, Nitesh, and Ashraf visited a hospital for their annual body checkup, which included a blood pressure evaluation. The results of their systolic blood pressure readings are as follows: Sweety: 121 mmHg Nitesh: 147 mmHg Ashraf: 160 mmHg The table below depicts the systolic blood pressure ranges of all the patients who visited the hospital on the same day.	1

Blood pressure (mmHg)	**Number of patients**
115 - 125	10
125 - 135	9
135 - 145	12
145 - 155	19
155 - 165	10

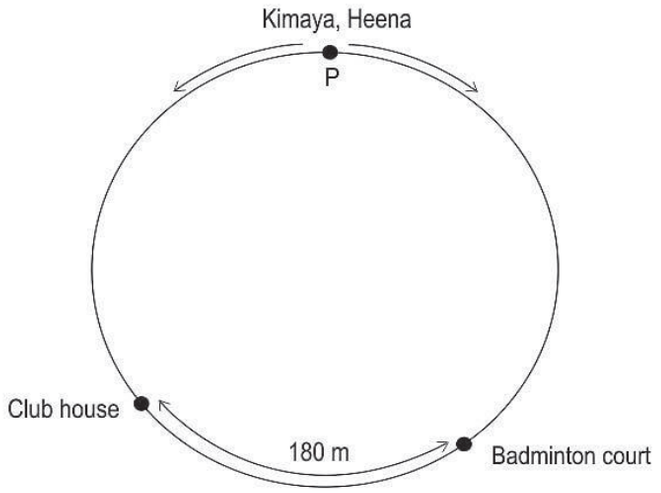
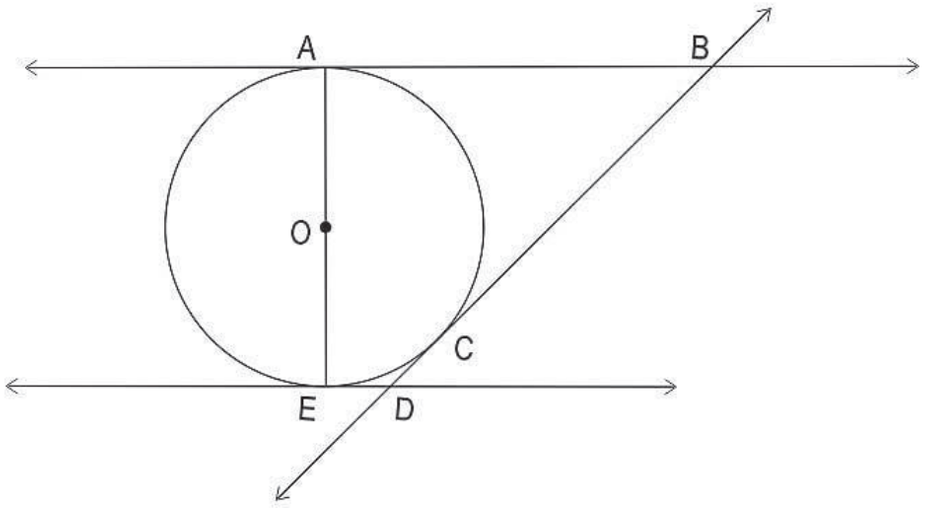
	Who among the three friends have a blood pressure reading that falls in the modal class?	
	(a) Sweety (b) Nitesh (c) Ashraf (d) Both Sweety and Ashraf	
17	The table below depicts the weight of the students of class 6 of Red Bricks Public School. There are 18 students in the class that weigh above the median weight. Weight in kg / Number of Students 25 – 28 / 6 28 – 31 / 8 31 – 34 / 7 34 – 37 / 10 37 – 40 / ? If there are no students with the same weight as median weight, how many students weigh between the range of 37 - 40 kgs? (a) 5 (b) 7 (c) 18 (d) 31	1
18	Ginny flipped a fair coin three times and tails came up each time. Ginny wants to flip the coin again. What is the probability of getting heads in the next coin flip? (a) 0 (b) 0.25 (c) 0.5 (d) 1	1
19	A number q is prime factorised as $3^2 \times 7^2 \times b$, where b is a prime number other than 3 and 7. Based on the above information, two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).	1

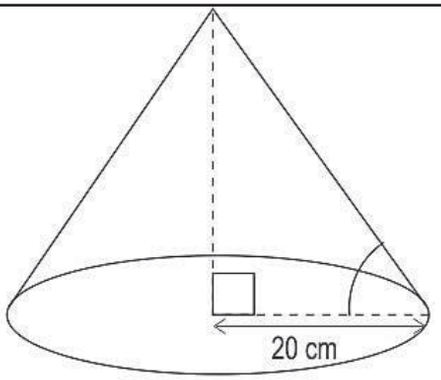
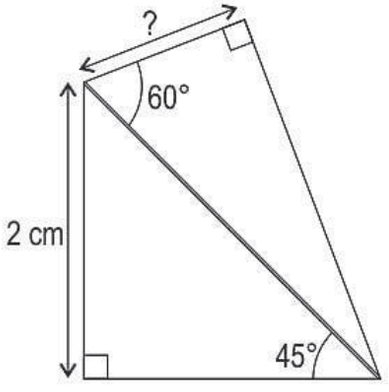
	Assertion (A): q is definitely an odd number. *Reason (R)*: $3^2 \times 7^2$ is an odd number. (a) Both (A) and (R) are true and (R) is the correct explanation for (A). (b) Both (A) and (R) are true but (R) is not the correct explanation for (A). (c) (A) is true but (R) is false. (d) (A) is false but (R) is true.	
20	P (-2, 5) and Q (2, -1) are two points on the coordinate plane. Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R). *Assertion (A)*: The midpoint (0, 2) is the only point equidistant from P and Q. *Reason (R)*: There are many points (x, y) where $(x + 2)^2 + (y - 5)^2 = (x - 2)^2 + (y + 1)^2$ are equidistant from P and Q. (a) Both (A) and (R) are true and (R) is the correct explanation for (A). (b) Both (A) and (R) are true and (R) is not the correct explanation for (A). (c) (A) is true but (R) is false. (d) (A) is false but (R) is true.	1

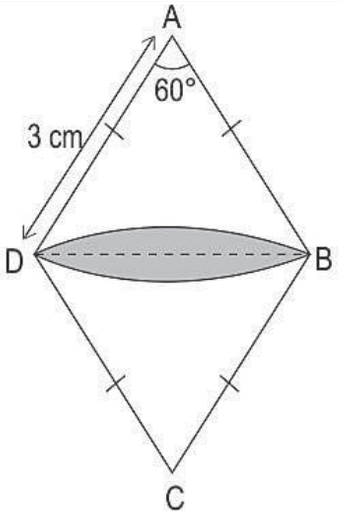
SECTION-B

(This section comprises of very short answer type-questions (VSA) of 2 marks each.)

Serial No.	Question	Marks
21	Check whether the statement below is true or false. "The square root of every composite number is rational." Justify your answer by proving rationality or irrationality as applicable.	2
22	Kimaya and Heena started walking from the point P at the same moment in opposite directions on a 800 m long circular path as shown below. Kimaya walked to the club house at an average speed of 100 m/min and Heena walked to the badminton court at an average speed of 80 m/min. The length of the circular track between the clubhouse and the badminton court is 180 m.	2

	 *(Note: The figure is not to scale.)* If Heena took 1 minute more than Kimaya to reach her destination, find the time taken by Heena to reach the badminton court. Show your work.	
23	Shown below is a circle with centre O and three tangents drawn at points A, E and C. AE is a diameter of the circle. The tangents intersect at points B and D.  Based on the above information, evaluate whether the following statement is true or false. Justify your answer. Atleast one pair of opposite sides of AEDB is parallel.	2
24	Shown below is a right circular cone of volume 13,600 cm^3.	2

	 *(Note: The figure is not to scale.)* Find the angle which the slant height makes with the base radius. Show your work. *(Note: Take π as 3, √2 as 1.4 and √3 as 1.7.)* OR	
	Shown below are two right triangles.  *(Note: The figure is not to scale.)* Find the length of the unknown side marked '?'. Show your work.	2
25	ABCD is a rhombus with side 3 cm. Two arcs are drawn from points A and C respectively such that the radius equals the side of the rhombus. The figure is shown below.	2



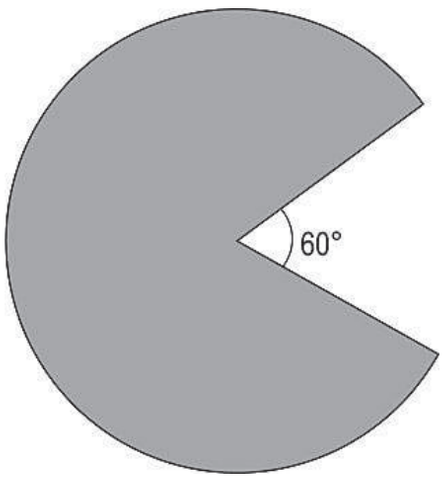
(Note: The figure is not to scale.)

If BD is a line of symmetry for the figure, then find the area of the shaded part of the figure in terms of π. Show your work.

OR

Wasim made a model of Pac-Man, after playing the famous video game of the same name. The area of the model is 120π cm^2. Pac-Man's mouth forms an angle of 60° at the centre of the circle. 2

A picture of the model is shown below.

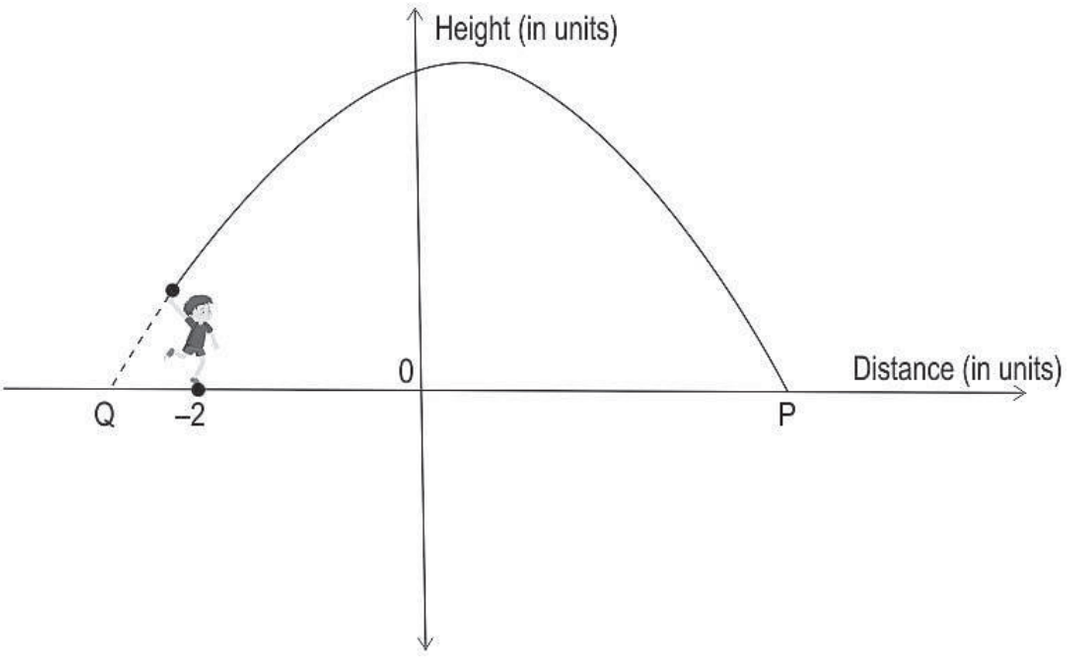


(Note: The figure is not to scale.)

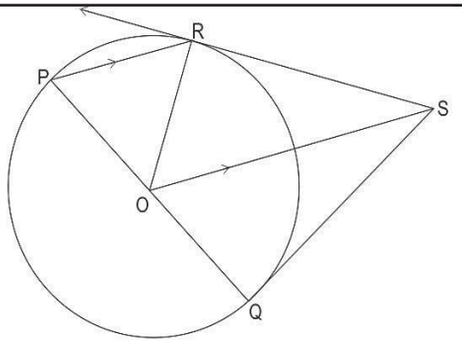
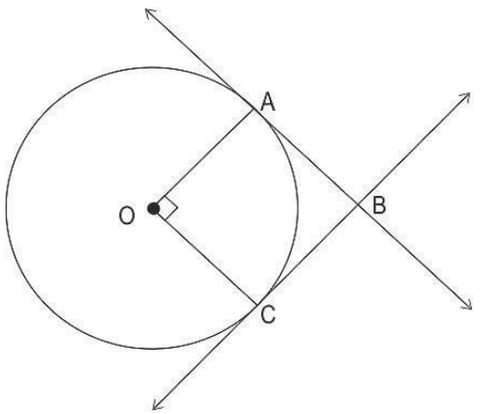
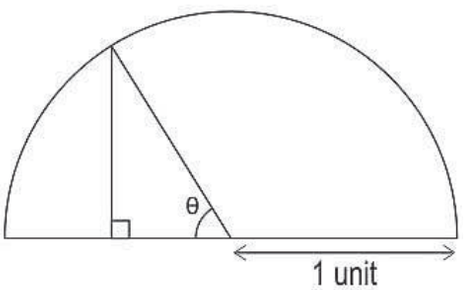
Wasim wants to decorate the model by attaching a coloured ribbon to the entire boundary of the shape. What is the minimum length of the ribbon required in terms of ? Show your work.

SECTION-C

(This section comprises of short answer type-questions (SA) of 3 marks each.)

Serial No.	Question	Marks
26	Prime factorisation of three numbers A, B and C is given below: A = $(2^r \times 3^p \times 5^q)$ B = $(2^p \times 3^r \times 5^p)$ C = $(2^q \times 3^q \times 5^p)$ such that, $p < q < r$ and p, q, & r are natural numbers.. ♦ The largest number that divides A, B and C without leaving a remainder is 30. ♦ The smallest number that leaves a remainder of 2 when divided by each of A, B and C is 5402. Find A, B and C. Show your work.	3
27	Riddhi throws a stone in the air such that it follows a parabolic path before it lands at P on the ground as depicted by the graph below.  *(Note: The figure is not to scale.)*	3

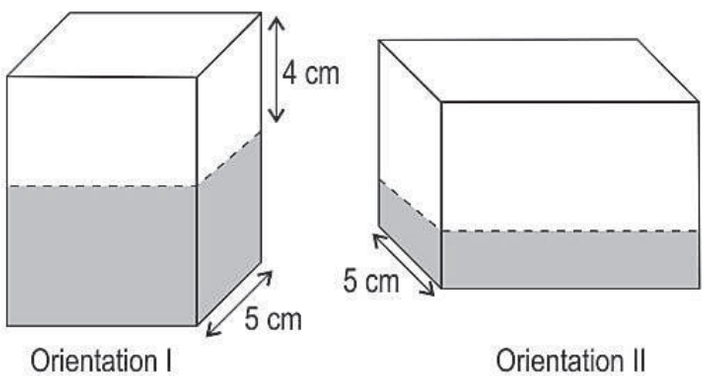
	i) The above graph is represented by a polynomial where the sum of its zeroes is 1 and the sum of the squares of its zeroes is 25. Find the coordinates of P and Q. ii) If one unit on the graph represents 25 metres, how far from Riddhi does the stone land? Show your work.	
28	Given below is a pair of linear equations: $2x - my = 9$ $4x - ny = 9$ Find at least one pair of the possible values of m and n, if exists, for which the above pair of linear equations has: i) a unique solution ii) infinitely many solutions iii) no solution Show your work. OR	3
	(6, 0) and (0, 2) are two of the points of intersections of two lines represented by a pair of linear equations. i) How many points of intersections does the pair of linear equations have in total? Justify your answer. ii) Find the equation that represents one of the lines of the above pair. Show your work.	3
29	In the given figure, PQ is the diameter of the circle with centre O. R is a point on the boundary of the circle, at which a tangent is drawn. A line segment is drawn parallel to PR through O, such that it intersects the tangent at S.	3

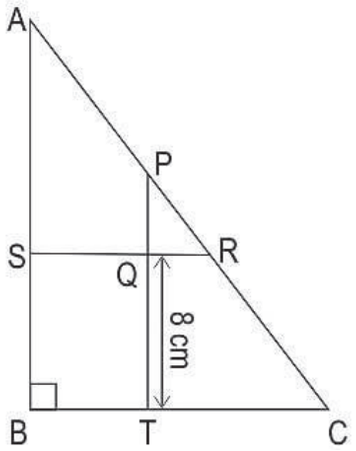
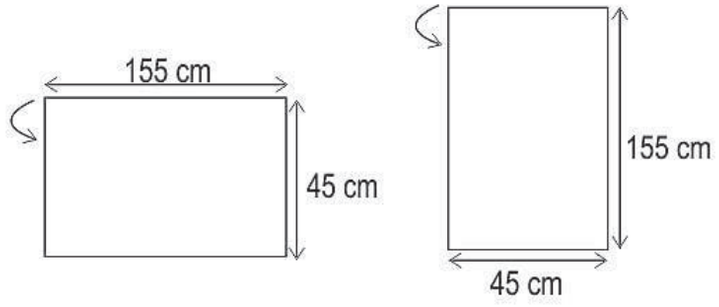
	 Show that SQ is a tangent to the circle. OR	
	Shown below is a circle with centre O. Tangents are drawn at points A and C, such that they intersect at point B.  If OA ⊥ OC, then show that quadrilateral OABC is a square.	3
30	Shown below is a semicircle of radius 1 unit.  *(Note: The figure is not to scale.)* Make necessary constructions and show that: $\tan\frac{\theta}{2} = \frac{\sin\theta}{1+\cos\theta}$	3

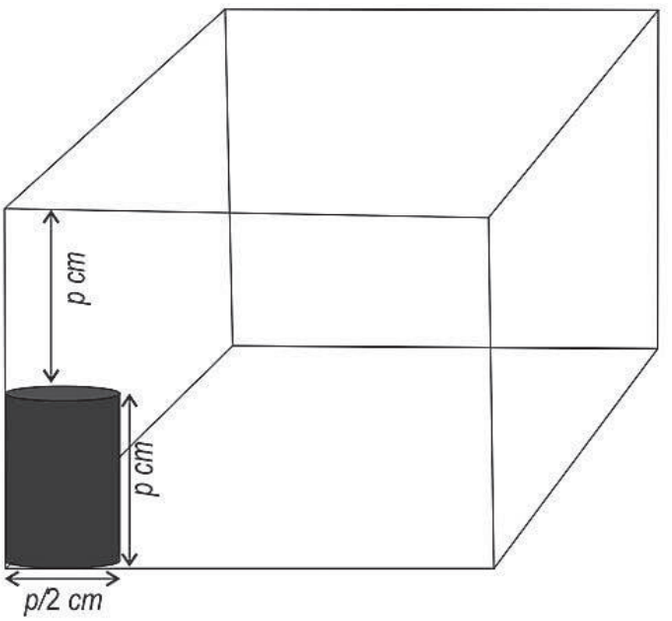
31	Naima is playing a game and has two identical 6-sided dice. The faces of the dice have 3 even numbers and 3 odd numbers. She has to roll the two dice simultaneously and has two options to choose from before rolling the dice. She wins a prize if: Option 1: the sum of the two numbers appearing on the top of the two dice is odd. Option 2: the product of the two numbers appearing on top of the two dice is odd. Which option should Naima choose so that her chances of winning a prize is higher? Show your work.	3

SECTION-D

(This section comprises of long answer type-questions (LA) of 5 marks each.)

Serial No.	Question	Marks
32	Manu and Aiza are competing in a 60 km cycling race. Aiza's average speed is 10 km/hr greater than Manu's average speed and she finished the race in hours less than Manu. Find the time taken by Manu to finish the race. Show your work. OR	5
	Shown below is a cuboid with water in two different orientations. The length, breadth and height of the cuboid are distinct. The cuboid has 480 cm^3 of water.  *(Note: The figures are not to scale.)*	5
	If the height of water in orientation II is half of that in orientation I, then find the heights of water in both orientations. Show your work.	

33	In the following figure, ΔABC is a right-angled triangle, such that: ♦ AC = 25 cm ♦ PT ‖ AB and SR ‖ BC  *(Note: The figure is not to scale.)* Find the area of ΔPQR. Show your work.	5
34	Two rectangular sheets of dimensions 45 cm × 155 cm are folded to make hollow right circular cylindrical pipes, such that there is exactly 1 cm of overlap when sticking the ends of the sheet. Sheet 1 is folded along its length, while Sheet 2 is folded along its width. That is, the top edge of the sheet is joined with its bottom edge in both the sheets, as depicted by the arrow in the figure below. Both pipes are closed on both ends to form cylinders.  **Sheet 1** **Sheet 2** (*Note: The figures are not to scale.)*	5

	i) Find the difference in the curved surface areas of the two cylinders. ii) Find the ratio of the volumes of the two cylinders formed. Show your work. *(Note: Use π as $\frac{22}{7}$. Assume that the sheets have negligible thickness.)* OR	
	Shown below is a cylindrical can placed in a cubical container.  i) How many of these cans can be packed in the container such that no more cans are fitted? ii) If the capacity of one can is 539 ml, find the internal volume of the cubical container. Show your work. *(Note: Take π as $\frac{22}{7}$.)*	5
35	A car assembly unit assembles a limited number of cars daily, depending on the prevailing demand. The following table presents an analysis of the number of cars assembled by the unit over three consecutive months:	5

Cars assembled per day	Number of days
0 - 4	33
4 - 8	18
8 - 12	21
12 - 16	11
16 - 20	7

i) If the demand of the cars is doubled, estimate how many cars on an average should be assembled per day such that the increased demand is met?

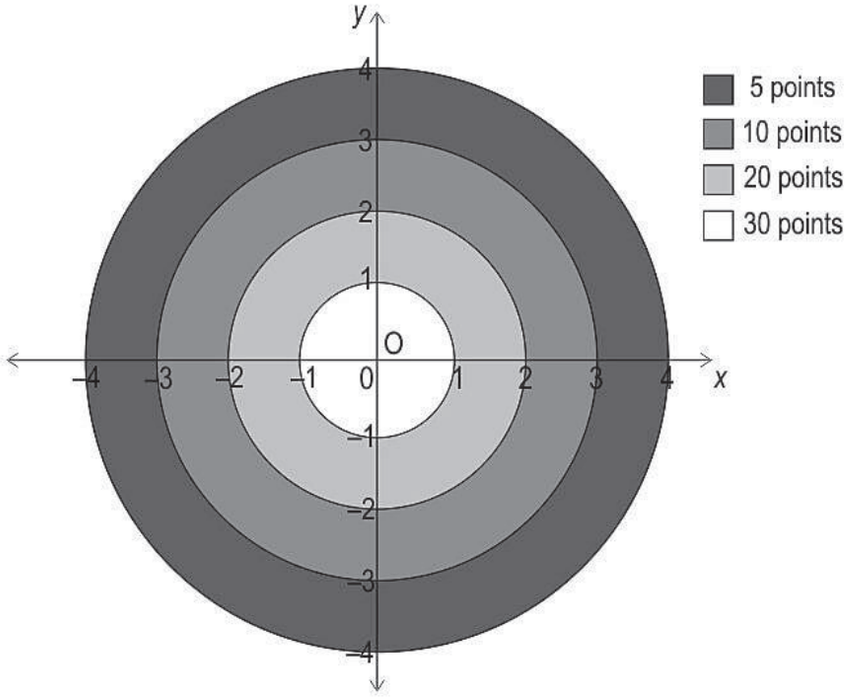
ii) At least on how many days, less than average number of cars were assembled?

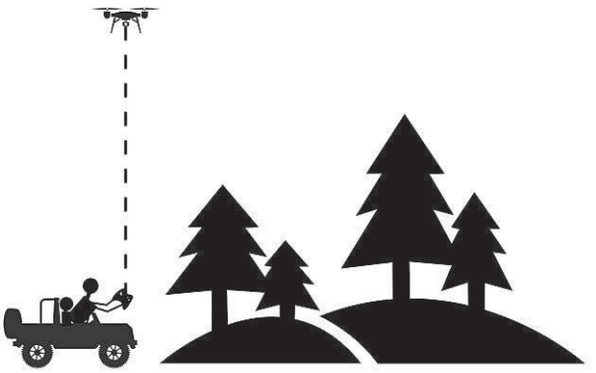
Show your work.

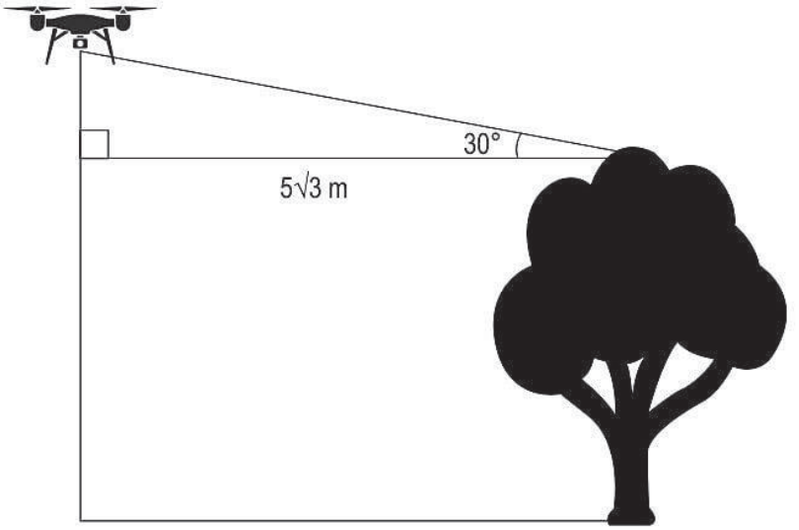
SECTION-E

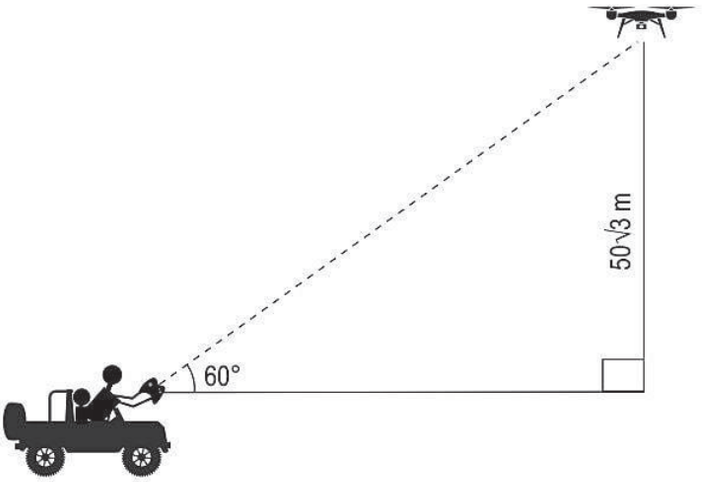
(This section comprises of 3 case-study/passage-based questions of 4 marks each with two sub-questions. First two case study questions have three sub questions of marks 1, 1, 2 respectively. The third case study question has two sub questions of 2 marks each)

Serial No.	Question	Marks
36	**Answer the questions based on the given information.** An interior designer, Sana, hired two painters, Manan and Bhima to make paintings for her buildings. Both painters were asked to make 50 different paintings each. The prices quoted by both the painters are given below: ♦ Manan asked for Rs 6000 for the first painting, and an increment of Rs 200 for each following painting. ♦ Bhima asked for Rs 4000 for the first painting, and an increment of Rs 400 for each following painting.	
	(i) How much money did Manan get for his 25th painting? Show your work.	1
	(ii) How much money did Bhima get in all? Show your work.	1

	(iii) If both Manan and Bhima make paintings at the same pace, find the first painting for which Bhima will get more money than Manan. Show your steps. OR	2
	(iii) Sana's friend, Aarti hired Manan and Bhima to make paintings for her at the same rates as for Sana. Aarti had both painters make the same number of paintings, and paid them the exact same amount in total. How many paintings did Aarti get each painter to make? Show your work.	2
37	**Answer the questions based on the given information.** In the game of archery, a bow is used to shoot arrows at a target board. The player stands far away from the board and aims the arrow so that it hits the board. One such board, which is divided into 4 concentric circular sections, is drawn on a coordinate grid as shown. Each section carries different points as shown in the figure. If an arrow lands on the boundary, the inner section points are awarded.  	

	(i) After shooting two arrows, Rohan scored 25 points. Write one set of coordinates for each arrow that landed on the target.	1
	(ii) If one player's arrow lands on (2, 2.5), how many points will be awarded to the player? Show your work.	1
	(iii) One of Rohan's arrow landed on (1.2, 1.6). He wants his second arrow to land on the line joining the origin and first arrow such that he gets 10 points for it. Find one possible pair of coordinates of the second arrow's landing mark. Show your work. OR	2
	(iii) An arrow landed on the boundary and is worth 20 points. The coordinates of the landing mark were of the form $(m, -m)$. Find all such coordinates. Show your steps.	2
38	**Answer the questions based on the given information.** A drone, is an aircraft without any human pilot and is controlled by a remote-control device. Its various applications include policing, surveillance, photography, precision agriculture, forest fire monitoring, river monitoring and so on. David used an advanced drone with high resolution camera during an expedition in a forest region which could fly upto 100 m height above the ground level. David rode on an open jeep to go deeper into the forest. The initial position of drone with respect to the open jeep on which David was riding is shown below. 	

	David's jeep started moving to enter the forest at an average speed of 10 m/s. He Simultaneously started flying the drone in the same direction as that of the jeep.	
	(i) David reached near one of the tallest trees in the forest. He stopped the drone at a horizontal distance of $5\sqrt{3}$ m from the top of the tree and at a vertical distance of 65 m below its maximum vertical range.  *(Note: The figure is not to scale.)* If the angle of elevation of the drone from the top of the tree was 30°, find the height of the tree. Show your work.	1
	(ii) The drone was flying at a height of $30\sqrt{3}$ metres at a constant speed in the horizontal direction when it spotted a zebra near a pond, right below the drone. The drone travelled for 30 metres from there and it could see the zebra, at the same place, at an angle of depression of θ from it. Draw a diagram to represent this situation and find θ. Show you work.	1
	(iii) After 2 minutes of starting the expedition both the drone and the jeep stopped at the same moment so that the drone can capture some images. The position of the drone and the jeep when they stopped is as shown below.	2

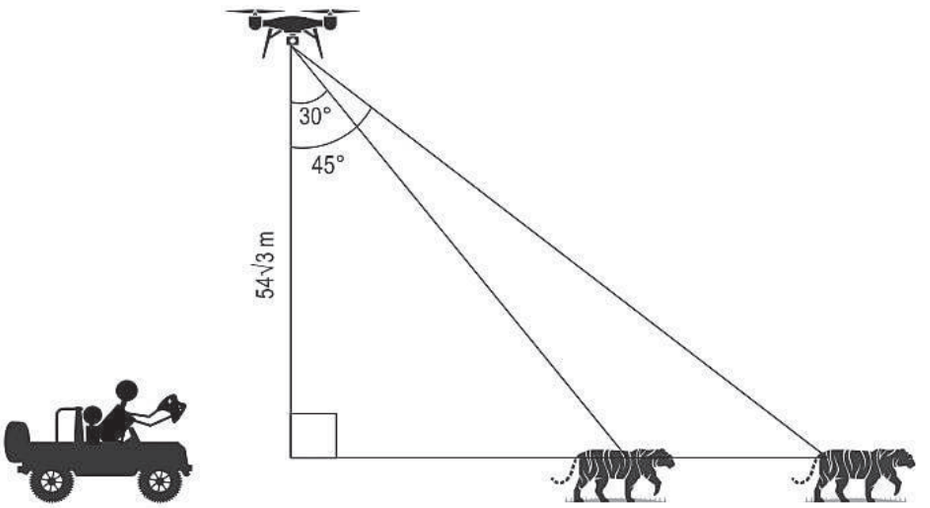


(Note: The figure is not to scale.)

Find the average speed of the drone in m/s rounded off upto 2 decimal places. Show your work.

OR

(iii) At some point during the expedition, David kept the drone stationary for some time to capture the images of a tiger. The angle of depression from the drone to the tiger changed from 30° to 45° in 3 seconds as shown below. 2



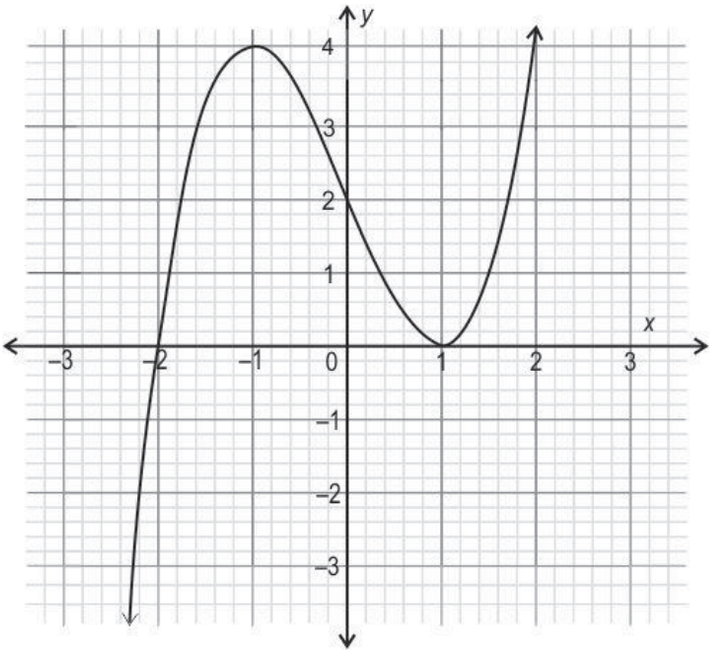
(Note: The figure is not to scale.)

What was the average speed of the tiger during that time? Show your work.

(Note: Take √3 as 1.73.)

SOLUTIONS

SECTION A - Multiple Choice Questions of 1 mark each.

Q. No.	Answer/Solution	Marks
1	(c) 	1
2	(a) $x - y = 3$	1
3	(d) 0 and 2	1
4	(b) 2 units	1
5	(b) 8 cm	1
6	(a) Only Anas	1
7	(d) $\frac{111}{7}$ cm	1
8	(c) $\frac{9}{\sqrt{2}}$ cm	1
9	(c) 38 cm	1
10	(c) 1.7 and 1.1	1

11	(a) $\frac{8}{17}$	1
12	(a) step 1	1
13	(a) $\frac{16\pi}{3}$ cm	1
14	(d) 10π cm^2	1
15	(b) $\frac{R}{P}$ units	1
16	(b) Nitesh	1
17	(a) 5	1
18	(c) 0.5	1
19	(d) (A) is false but (R) is true.	1
20	(d) (A) is false but (R) is true.	1

SECTION B – Very short answer questions of 2 marks each.

Q. No.	Answer/Solution	Marks
21	Takes a number which is not a perfect square but is a composite number. For example, 6. Assumes $\sqrt{6} = \frac{a}{b}$, where $b \neq 0$, a and b are co-primes. Writes $b\sqrt{6} = a$ and squares on both sides to get $6b^2 = a^2$. Writes that as a^2 is divisible by 2 and 3 which are both prime numbers, a is also divisible by both 2 and 3. Hence concludes that a is divisible by 6. Writes $a = 6c$, where c is an integer and squares on both sides to get $a^2 = 36c^2$. Replaces a^2 with $6b^2$ from step 2 to get $6b^2 = 36c^2$ and solves it to get $b^2 = 6c^2$. Writes that as b^2 is divisible by 2 and 3 which are both prime numbers, b is also divisible by both 2 and 3. Hence concludes that b is divisible by 6. Writes that 2 and 3 divide both a and b which contradicts the assumption that a and b are co-prime and hence $\sqrt{6}$ is irrational. Concludes that the given statement is false.	0.5 0.5 0.5 0.5
22	Assumes the time taken by Kimaya and Heena to reach the club house and the badminton court as t_1 and t_2 respectively and frames the equation as: $t_2 - t_1 = 1$ Assumes the distance travelled by Kimaya as x m and by Heena as y m and frames the equation for the total distance travelled by Kimaya and Heena together as:	

	$x + y = 800 - 180 = 620$ Uses the constant speeds of Kimaya and Heena to find the values of x and y as: $x = 100t_1$ and $y = 80t_2$ Replaces the values of x and y in the equation of distance travelled as: $100t_1 + 80t_2 = 620$ Substitutes the value of t_1 in the above equation as: $100(t_2 - 1) + 80t_2 = 620$ Solves the above equation to find the value of t_2 as 4 minutes.	1.0 0.5 0.5
23	Writes that the statement is true. Gives a valid reason. For example, as tangents are drawn at A and E, $\angle OAB = \angle OED = 90°$. Since these are adjacent interior angles, and are supplementary, AB||ED. Hence, atleast one pair of opposite sides of AEDB is parallel.	0.5 1.5
24	Uses the formula for the volume of a cone and solves for height, h, as: $\frac{1}{3} \times 3 \times 20 \times 20 \times h = 13600$ $\Rightarrow h = 34$ cm Finds the angle, θ, which the slant height makes with the base radius as: $\tan\theta = \frac{34}{20}$ $\Rightarrow \tan\theta = 1.7$ $\Rightarrow \tan\theta = \tan 60°$ $\Rightarrow \theta = 60°$ OR Writes $\sin 45° = \frac{2}{hypotenuse}$ and finds the hypotenuse as $2\sqrt{2}$ cm. (Award full marks if it is solved correctly by applying any other properties of triangles.) Writes $\cos 60° = \frac{base}{2\sqrt{2}}$ and finds the unknown side marked with '?' as: $2\sqrt{2} \times \frac{1}{2} = \sqrt{2}$ cm	1.0 1.0 1.0 1.0

25	Finds the area of sector ABD as $\frac{60}{360} \times \pi \times 3^2 = \frac{3\pi}{2} cm^2$ Finds the area of ΔABD as $\frac{\sqrt{3}}{4} \times 9 = \frac{9\sqrt{3}}{4} cm^2$ Finds the required area as: 2 × (area of sector ABD - area of ΔABD) $= 2 \times (\frac{3}{2}\pi - \frac{9\sqrt{3}}{4})$ $= 3\pi - \frac{9\sqrt{3}}{2} cm^2$ OR Assumes the radius of the circle as r cm and writes the equation for the area as: $120\pi = \frac{300}{360} \times \pi \times r^2$ $\Rightarrow r = 12$ cm Finds the length of ribbon required as: $(\frac{300}{360} \times 2 \times \pi \times 12) + 24$ cm $= (20\pi + 24)$ cm	1.0 1.0 1.0 1.0

SECTION C – Short answer questions of 3 marks each.

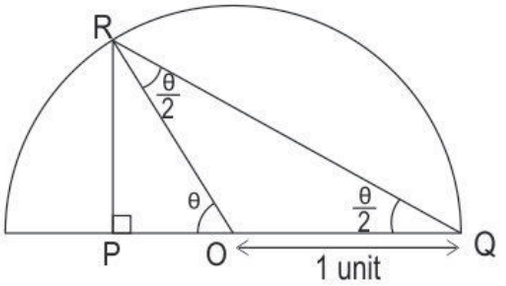
Q No.	Answer/Solution	Marks
26	Finds the HCF and LCM of A, B and C from the prime factorisation as: HCF $= 2^p \times 3^p \times 5^p$ LCM $= 2^r \times 3^r \times 5^q$ From the given information, infers that HCF of A, B and C is 30 and equates it to the HCF obtained in step 1 to get the value of p as: $2^p \times 3^p \times 5^p = 30$ $\Rightarrow (2 \times 3 \times 5)^p = (2 \times 3 \times 5)^1$ $\Rightarrow p = 1$	0.5 0.5

	From the given information, infers that LCM of A, B and C is 5402 - 2 = 5400. Equates it to the LCM obtained in step 1 to get the values of q and r as: $2^r \times 3^r \times 5^q = 5400$ $\Rightarrow (2 \times 3)^r \times (5)^q = (2 \times 3)^3 \times (5)^2$ $\Rightarrow q = 2$ and $r = 3$ Substitutes the values of p, q and r to find the values of A, B and C as: $A = 2^3 \times 3^1 \times 5^2 = 600$ $B = 2^1 \times 3^3 \times 5^1 = 270$ $C = 2^2 \times 3^2 \times 5^1 = 180$	1.0 1.0
27	i) Assumes the polynomial to be $ax^2 + bx + c$ and considers its zeroes to be α and β. Given: $\alpha + \beta = 1$ $\alpha^2 + \beta^2 = 25$ Uses the identity $(\alpha + \beta)^2$ to find $\alpha\beta$ as (-12). From the relation between coefficients and zeroes of a polynomial, finds b and c in terms of a as: $b = (-a)$ and $c = (-12a)$ Frames the expression of polynomial as: $ax^2 - ax - 12a$ Assumes the value of a as 1 and factorises the above polynomial as: $x^2 - x - 12 = (x - 4)(x + 3)$ Finds the zeroes as 4 and (-3). Thus, finds the coordinates of P and Q as (4, 0) and (-3, 0). ii) Writes that the distance between Riddhi and the point where the stones lands (P) is (2 + 4) = 6 units. Finds the distance between Riddhi and point P as (6 × 25) = 150 metres.	1.0 0.5 1.0 0.5

28	i) Writes that for the equations to have unique solution: $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ Hence in the given equations: $\frac{m}{n} \neq \frac{2}{4}$ or $\frac{m}{n} \neq \frac{1}{2}$ Substitutes a set of values for m and n in the given pair of equations which satisfies the above condition and frames a pair of equations. For example: $2x - 2y = 9$ $4x - 6y = 9$ (Award full marks if any other pair of equations satisfying the above conditions is framed.) ii) Writes that for the equations to have infinitely many solutions: $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ Reasons that in the pair of equations provided: $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$ while $\frac{c_1}{c_2} = \frac{9}{9} = 1$ Concludes that as the required condition can never be satisfied, it is not feasible to frame a pair of equations having infinitely many solutions. iii) Writes that for the equations to have no solution: $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ In the given equations: $\frac{c_1}{c_2}$ = which is not equal to $\frac{a_1}{a_2}$ Now, substitutes a pair of values for m and n in the given equations such that:	1.0 1.0

	$\frac{m}{n} = \frac{a_1}{a_2} = \frac{1}{2}$ For example, $2x - 3y = 9$ $4x - 6y = 9$ (Award full marks if any other pair of equations satisfying the above conditions is framed.)	1.0
	OR	
	i) Writes that the pair will have infinitely many solutions. Reasons that as there are more than one points of intersection, the pair is of coincident or overlapping lines.	1.0
	ii) Substitutes the values of the point of intersection (6, 0) in the equation of a line $ax + by = c$ as: $6a + 0 = c$ or $a = \frac{c}{6}$	0.5
	Substitutes the values of the second point of intersection (0, 2) in the equation as: $2b = c$ or $b = \frac{c}{2}$	0.5
	Rewrites the equation of a line by substituting the values of a and b in terms of c as: $\frac{c}{6}x + \frac{c}{2}y = c$ Simplifies the above equation by taking $c = 1$ to find the equation of the line as $x + 3y = 6$.	1.0

29	Finds that ∠OPR = ∠ORP, and ∠ORP = ∠ROS.	0.5
	Finds ∠QOS = ∠ROS = ∠ORP. Gives a valid reason. For example: Using exterior angle property, ∠OPR + ∠ORP = ∠QOS + ∠ROS. => 2∠ROS = ∠QOS + ∠ROS => ∠QOS = ∠ROS	1.0
	Writes that ΔORS ≅ ΔOQS by SAS congruence. The working may look as follows: OS = OS (common side) OR = OQ (radius) ∠ROS = ∠QOS	0.5
	Notes that as RS is a tangent to the circle, ∠ORS = 90°. Concludes that SQ is a tangent to the circle as ∠ORS = ∠OQS = 90°, by CPCT.	1.0
	OR	
	Writes that AB = BC, as they are tangents from an external point to a circle. Notes that OA = OC as they are radii.	0.5
	Writes that ∠BAO = ∠BCO = 90° as AB and BC are tangents.	0.5
	Notes that OA || BC as ∠AOC + ∠OCB = 180° (adjacent interior angles) Notes that OC || AB as ∠AOC + ∠OAB = 180° (adjacent interior angles)	0.5
	Concludes that OABC is a parallelogram.	0.5
	Writes that, as opposite sides in a parallelogram are equal, OA = BC and OC = AB. Also, as opposite angles in a parallelogram are equal, ∠AOC = ∠ABC = 90°	0.5
	(Award full marks if students first proves that OABC is a rectangle using angle sum property and then shows that the adjacent sides are equal.)	
	Concludes that OABC is a square as all of its angles are 90°, and OA = AB = BC = OC.	0.5

30	Draws a rough figure with the necessary constructions. The figure may look as follows:	
	 *(Note: The figure is not to scale.)*	1.0 0.5
	Writes that in ΔRPO, $\sin\theta = \frac{RP}{OR}$ $\Rightarrow RP = \sin\theta$	0.5
	Writes that in ΔRPO, $\cos\theta = \frac{PO}{OR}$ $\Rightarrow PO = \cos\theta$	1.0
	Writes that in ΔRPQ, $\tan\frac{\theta}{2} = \frac{RP}{PQ}$ $\Rightarrow \tan\frac{\theta}{2} = \frac{\sin\theta}{1+\cos\theta}$	
31	Writes that the sum of the two numbers on the dice is one of these: odd + odd = even odd + even = odd even + odd = odd even + even = even	1.0
	Finds the probability of getting an odd number as the sum on rolling the two dice as $\frac{1}{2}$.	0.5
	Writes that the product of the two numbers on the dice is one of these: odd × odd = odd odd × even = even even × odd = even even × even = even	1.0

	Finds the probability of getting an odd number as the product on rolling the two dice as $\frac{1}{4}$.	
	Hence, concludes that Naima should choose option 1.	0.5

SECTION D – Long answer questions of 5 marks each.

Q No.	Answer/Solution	Marks
32	Assumes the time Manu took to finish the race as t hours and writes the equation for his average speed as $\frac{60}{t}$ km/hr.	0.5
	Frames the equation for Aiza using the given information as: $(\frac{60}{t} + 10)(t - \frac{1}{2}) = 60$	1.5
	Simplifies the above equation into standard quadratic equation form as: $2t^2 - t - 6 = 0$	1.5
	Factorises the above equation as $(t - 2)(t + \frac{3}{2}) = 0$	1.0
	Finds the time taken by Manu to finish the race as 2 hours.	0.5
	OR	
	Assumes the vertical length of the cuboid in orientation I as h cm and finds the height of water as $(h - 4)$ cm.	0.5
	Finds the height of water in orientation II as $\frac{1}{2}(h - 4)$ cm.	0.5
	Writes the equation for the volume of water as: $5 \times h \times \frac{1}{2}(h - 4) = 480$	1.0
	Simplifies the above equation as: $h^2 - 4h - 192 = 0$	1.0
	Solves and finds the roots of the above equation as (-12) and 16. (Rejects $h = (-12)$ as height cannot be negative.) Finds the height of water in:	1.0

	orientation I as 16 - 4 = 12 cm orientation II as $\frac{1}{2} \times 12 = 6$ cm (Award full marks if an alternate method is correctly used.)	1.0
33	Finds PR as PC - RC. Finds RC as $\frac{50}{5} = 10$ cm and PC as $\frac{50}{3}$ cm. Hence, finds PR as $\frac{20}{3}$ cm. Writes that $\Delta PQR \sim \Delta PTC$ by basic proportionality theorem, as QR // BC. Writes that $\frac{PR}{CR} = \frac{PQ}{QT}$. Hence, $\frac{20}{10 \times 3} = \frac{PQ}{8}$ $\Rightarrow PQ = \frac{16}{3}$ cm. Uses Pythagoras theorem in ΔPQR to find the length of QR as: $QR = \left(\sqrt{\frac{20}{3}}\right)^2 - \left(\sqrt{\frac{16}{3}}\right)^2 = 4$ cm Finds the area of ΔPQR as $\frac{1}{2} \times 4 \times \frac{16}{3} = \frac{32}{3}$ cm^2. (Award full marks if a different solution method is used correctly to find the answer.)	1.5 0.5 1.0 1.0 1.0

34	i) Writes that, in the sheet 1 cylinder, the height of the cylinder = 155 cm.	
	Hence finds area wasted in overlap = 155 x 1 = 155 cm^2.	0.5
	Writes that, in the sheet 2 cylinder, the height of the cylinder = 45 cm.	
	Hence finds area wasted in overlap = 45 x 1 = 45 cm^2.	0.5
	Writes that, as the sheets used are identical, the difference in curved surface area = difference between area wasted in overlap = 155 - 45 = 110 cm^2.	
	(Award full marks if solved using formula).	1.0
	ii) Notes that the circumference of the circle in the Sheet 1 cylinder is: 45 cm - 1 cm = 44 cm	
	Finds the radius of the sheet 1 cylinder as 7 cm.	
	The working may look as follows:	
	$2\pi r_1 = 44$ cm $\Rightarrow r_1 = 7$ cm	1.0
	Notes that the circumference of the circle in the Sheet 2 cylinder is: 155 cm - 1 cm = 154 cm	
	Finds the radius of the sheet 2 cylinder as $\frac{49}{2}$ cm.	
	The working may look as follows:	
	$2\pi r_2 = 154$ cm $\Rightarrow r_2 = \frac{49}{2}$ cm	1.0
	Finds the ratio of the volumes of the two cylinders as follows:	
	$\frac{V_1}{V_2} = \frac{\pi \times 7 \times 7 \times 155}{\pi \times \frac{49}{2} \times \frac{49}{2} \times 45} = \frac{31 \times 4}{49 \times 9} = \frac{124}{441}$	1.0
	where V_1 is the volume of the cylinder made by sheet 1, and V_2 is the volume of the cylinder made by sheet 2.	

OR

i) Finds the side of the cubical container as $2p$ from the figure. 1.0

Calculates that $2p \div \frac{p}{2} = 4$ cans can be packed in each of the length's and the breadth's directions in the container.

Finds the total number of cans that can fit in the container as: 1.0

$4 \times 4 \times 2 = 32$

ii) Writes the formula for the volume of the can to find the value of p as:

$$539 = \frac{22}{7} \times \frac{p^2}{16} \times p$$

Solves the above equation to find the value of p as 14 cm. 2.0

(Award 0.5 marks if only the formula for volume of a cylinder is written correctly.)

Finds the side of the cube as $2 \times 14 = 28$ cm. 1.0

Finds the internal volume of the cubical container as $(28)^3$ cm^3 or 21952 cm^3.

35 i) Prepares the frequency distribution table as below:

Cars assembled per day	**Number of days (f_i)**	**Class mark (x_i)**	$f_i x_i$
0 - 4	33	2	66
4 - 8	18	6	108
8 - 12	21	10	210
12 - 16	11	14	154
16 - 20	7	18	126
	$\sum f_i = 90$		$\sum f_i x_i =$ 664

Finds the mean of the given data as $\frac{664}{90} = 7.38$ approximately. 2.5

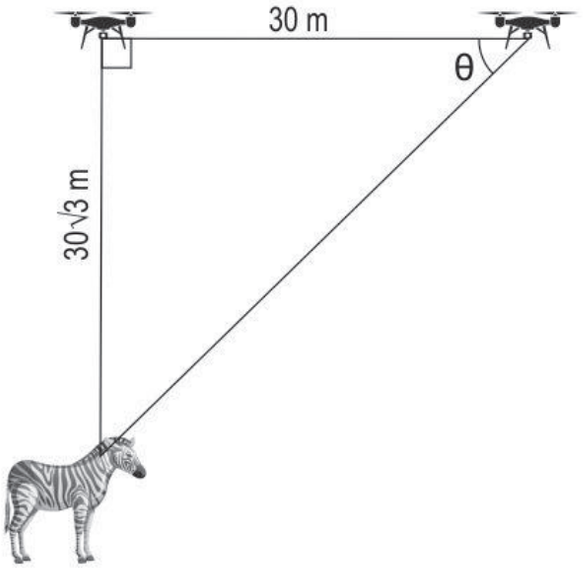
(Award 0.5 marks if only the formula for mean is written correctly.)

	As the demand has doubled, the new average to meet the demand should be: $2 \times 7.38 = 14.76$ approximately. Concludes that nearly 15 cars should be assembled per day on an average to meet the increased demand. ii) From the table concludes that as mean lies in the range of (4 - 8), at least on 33 days less than average number of cars were assembled.	1.0 0.5 1.0

SECTION E – Case-based questions of 4 marks each.

Q No.	Answer/Solution	Marks
36 (i)	Notes that the amounts Manan is paid for each painting forms an AP. Takes $a = 6000$, $d = 200$ and $n = 25$ to find the amount as $6000 + (25 - 1)200 = \text{Rs } 10800$.	1.0
36 (ii)	Finds the total amount earned by Bhima as follows: $S_{50} = \frac{50}{2}[2(4000) + (50 - 1)(400)]$ Solves the above expression to find the total amount as Rs 6,90,000.	0.5 0.5
36 (iii)	Frames equation as follows: $6000 + (n - 1)200 = 4000 + (n - 1)400$ Solves the above equation to find the value of n as 11. Writes that, since they both earn the same amount for the 11th painting, as Bhima's increment is more, Bhima gets more money than Manan for the 12th painting. OR Assumes that the number of paintings required is n. Frames equation as follows:	0.5 1.0 0.5

	S_n(Manan) = S_n(Bhima) $\Rightarrow \frac{n}{2}[2(6000) + (n-1)200] = \frac{n}{2}[2(4000) + (n-1)400]$	1.0
	Solves the equation from step 1 to find n as 21.	1.0
37 (i)	Writes two pairs of possible coordinates such that Rohan scored 20 and 5 points for them. For examples, (1.5, 0) and (3.5, 0).	1.0
37 (ii)	Finds the distance of (2, 2.5) from (0, 0) as: $\sqrt{(4 + 6.25)} = \sqrt{10.25}$ units Hence, concludes that 5 points will be awarded. (Award full marks if students answer correctly based on any other method with appropriate justification.)	1.0
37 (iii)	Finds the distance of (1.2, 1.6) from the origin as: $\sqrt{\{(1.2)^2 + (1.6)^2\}} = 2$ units	0.5
	Assumes that the second arrow lands on the boundary mark and writes that the ratio in which the first arrow divides the origin and the second arrow's landing mark is the ratio of their radii = 2:1.	0.5
	Assumes the coordinates of the second arrow's landing mark as (x, y) and uses section formula to write: $(\frac{2x+0}{3}, \frac{2y+0}{3}) = (1.2, 1.6)$	0.5
	Solves the above equation to find the values of the coordinates of the second arrow's landing mark as (1.8, 2.4).	0.5
	OR	
	Identifies the distance between the origin and the coordinate $(m, -m)$ as 2 units and uses the distance formula to write the equation as: $m^2 + (-m)^2 = 2^2$	0.5
	Simplifies the above equation as $2m^2 = 4$.	0.5
	Solves the above equation to get y as $\sqrt{2}$ and $(-\sqrt{2})$.	0.5
		0.5

	Finds the coordinates as $(\sqrt{2}, -\sqrt{2})$ and $(-\sqrt{2}, \sqrt{2})$.	
38 (i)	Assumes the vertical distance between the top of the tree and the drone to be h and finds h as: $h = 5\sqrt{3} \times \tan 30° = 5\sqrt{3} \times \frac{1}{\sqrt{3}} = 5$ m Finds the height of the tree as 100 - 65 - 5 = 30 m.	0.5 0.5
38 (ii)	Draws a rough diagram to represent the situation. The figure may look as follows:	
	 Finds the value of θ as: $\tan \theta = \frac{30\sqrt{3}}{30} = \sqrt{3}$ Thus finds the value of θ as 60°.	0.5 0.5

38 (iii)	Assumes the horizontal distance between the remote and the drone as x and finds its value as: $x = \frac{50\sqrt{3}}{\tan 60^\circ} = 50\ m$	0.5
	Finds the distance covered by the jeep in 2 mins as: $10 \times 120 = 1200$ m	0.5
	Finds the horizontal distance covered by the drone before it stopped as: $1200 + 50 = 1250$ m Finds the speed of the drone as: $\frac{1250}{120} = 10.42$ m/s	1.0
	OR	
	Assumes the horizontal distance between the drone and the tiger to be x when the angle of depression was 30° and finds the value of x as: $x = 54\sqrt{3} \times \tan 30^\circ = 54\sqrt{3} \times \frac{1}{\sqrt{3}} = 54$ m	0.5
	Assumes the horizontal distance between the drone and the tiger after 3 seconds as y and finds the value of y as: $y = 54\sqrt{3} \times \tan 45^\circ = 54\sqrt{3}$ m	0.5

	Finds the distance covered by the tiger in 3 seconds as: $54\sqrt{3} - 54 = 39.42$ m Finds the average speed of the tiger during that time as: $\frac{39.42}{3} = 13.14$ m/s	0.5 0.5