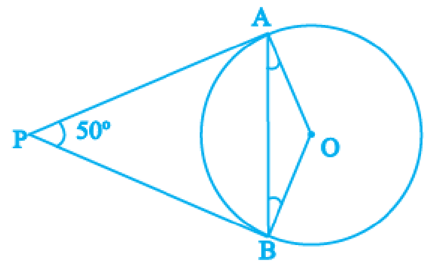
Class - X Session 2022-23
Subject - Mathematics (Basic)
Sample Question Paper

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 Short Answer-I (SA-I) type questions carrying 2 marks each.
4. Section C has 6 Short Answer-II (SA-II) type questions carrying 3 marks each.
5. Section D has 4 Long Answer (LA) type 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 Qs of 2 marks, 2 Qs 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. Take π =22/7 wherever required if not stated.

	Section A	
	Section A consists of 20 questions of 1 mark each.	
SN		**Marks**
1	If two positive integers p and q can be expressed as $p = ab^2$ and $q = a^3b$; a, b being prime numbers, then LCM (p, q) is (a) ab (b) a^2b^2 (c) a^3b^2 (d) a^3b^3	1
2	What is the greatest possible speed at which a man can walk 52 km and 91 km in an exact number of hours? (a) 17 km/hours (b) 7 km/hours (c) 13 km/hours (d) 26 km/hours	1
3	If one zero of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is (a) 10 (b) -10 (c) 5 (d) –5	1
4	Graphically, the pair of equations given by $6x – 3y + 10 = 0$ $2x – y + 9 = 0$ represents two lines which are (a) intersecting at exactly one point. (b) parallel. (c) coincident. (d) intersecting at exactly two points.	1

5	If the quadratic equation $x^2 + 4x + k = 0$ has real and equal roots, then (a) $k < 4$ (b) $k > 4$ (c) $k = 4$ (d) $k \geq 4$	1
6	The perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0) is (a) 5 units (b) 12 units (c) 11 units (d) $(7 + \sqrt{5})$ units	1
7	If in triangles ABC and DEF, $\frac{AB}{DE} = \frac{BC}{FD}$, then they will be similar, when (a) $\angle B = \angle E$ (b) $\angle A = \angle D$ (c) $\angle B = \angle D$ (d) $\angle A = \angle F$	1
8	In which ratio the y-axis divides the line segment joining the points (5, – 6) and (–1, – 4)?. (a) 1 : 5 (b) 5 : 1 (c) 1 : 1 (d) 1 : 2	1
9	In the figure, if PA and PB are tangents to the circle with centre O such that $\angle APB = 50°$, then $\angle OAB$ is equal to  (a) 25° (b) 30° (c) 40° (d) 50°	1
10	If $\sin A = \frac{1}{2}$, then the value of sec A is : (a) $\frac{\sqrt{3}}{2}$ (b) $\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) 1	1
11	$\sqrt{3}\cos^2 A + \sqrt{3}\sin^2 A$ is equal to (a) 1 (b) $\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) 0	1
12	The value of cos1° cos2° cos3° cos4°………………cos90° is (a) 1 (b) 0 (c) – 1 (d) 2	1
13	If the perimeter of a circle is equal to that of a square, then the ratio of their areas is (a) 22 : 7 (b) 14 : 11 (c) 7 : 22 (d) 11: 14	1
14	If the radii of two circles are in the ratio of 4 : 3, then their areas are in the ratio of : (a) 4 : 3 (b) 8 : 3 (c) 16 : 9 (d) 9 : 16	1
15	The total surface area of a solid hemisphere of radius 7 cm is : (a) 447π cm^2 (b) 239π cm^2 (c) 174π cm^2 (d) 147π cm^2	1

16	For the following distribution : Class: 0 - 5, 5 - 10, 10 - 15, 15 - 20, 20 - 25 Frequency: 10, 15, 12, 20, 9 the upper limit of the modal class is (a) 10 (b) 15 (c) 20 (d) 25	1

Class	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25
Frequency	10	15	12	20	9

17 If the mean of the following distribution is 2.6, then the value of y is (1 mark)

Variable (x)	1	2	3	4	5
Frequency	4	5	y	1	2

(a) 3 (b) 8 (c) 13 (d) 24

18 A card is selected at random from a well shuffled deck of 52 cards. The probability of its being a red face card is (1 mark)

(a) $\frac{3}{26}$ (b) $\frac{3}{13}$ (c) $\frac{2}{13}$ (d) $\frac{1}{2}$

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 **Assertion:** If HCF of 510 and 92 is 2, then the LCM of 510 & 92 is 32460 (1 mark)

Reason: as HCF(a,b) x LCM(a,b) = a x b

(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 but 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.

20 **Assertion (A):** The ratio in which the line segment joining (2, -3) and (5, 6) internally divided by x axis is 1:2. (1 mark)

Reason (R): as formula for the internal division is $\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

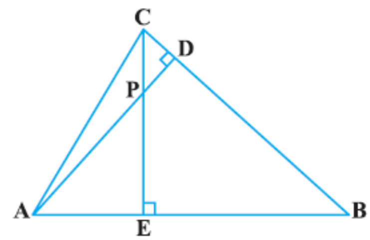
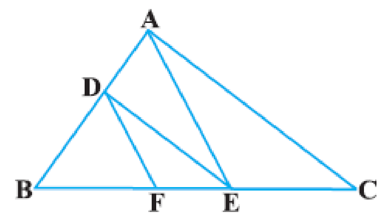
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

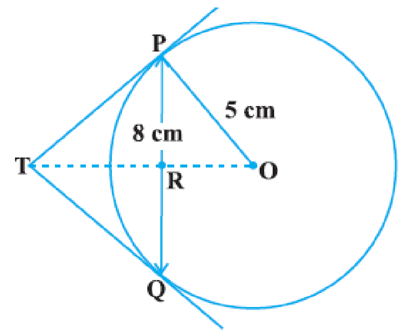
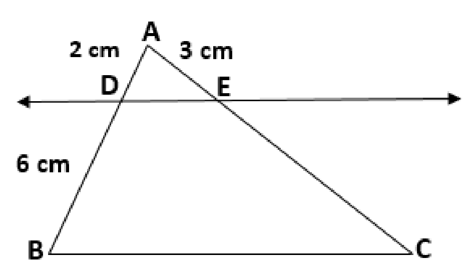
(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

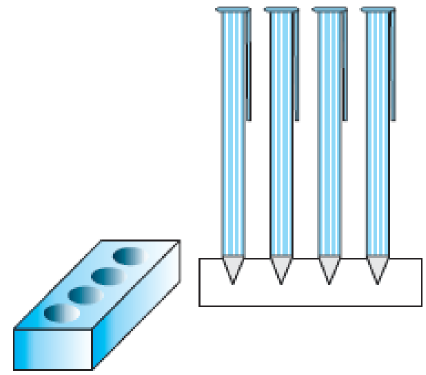
Section B

Section B consists of 5 questions of 2 marks each.

21	For what values of k will the following pair of linear equations have infinitely many solutions? $kx + 3y - (k - 3) = 0$ $12x + ky - k = 0$	2
22	In the figure, altitudes AD and CE of Δ ABC intersect each other at the point P. Show that: (i) $\Delta ABD \sim \Delta CBE$ (ii) $\Delta PDC \sim \Delta BEC$  **[OR]** In the figure, DE || AC and DF || AE. Prove that $\frac{BF}{FE} = \frac{BE}{EC}$ 	2
23	Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.	2
24	If $\cot\theta = \frac{7}{8}$, evaluate $\frac{(1+\sin\theta)\ (1-\sin\theta)}{(1+\cos\theta)\ (1-\cos\theta)}$	2
25	Find the perimeter of a quadrant of a circle of radius 14 cm. **[OR]** Find the diameter of a circle whose area is equal to the sum of the areas of the two circles of radii 24 cm and 7 cm.	2
	Section C	
	Section C consists of 6 questions of 3 marks each.	
26	Prove that $\sqrt{5}$ is an irrational number.	3
27	Find the zeroes of the quadratic polynomial $6x^2 - 3 - 7x$ and verify the relationship between the zeroes and the coefficients.	3
28	A shopkeeper gives books on rent for reading. She takes a fixed charge for the first two days, and an additional charge for each day thereafter. Latika paid Rs 22 for a book kept for six days, while Anand paid Rs 16 for the book kept for four days. Find the fixed charges and the charge for each extra day. **[OR]** Places A and B are 100 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 5	3

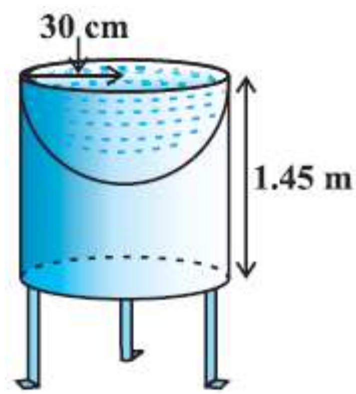
	hours. If they travel towards each other, they meet in 1 hour. What are the speeds of the two cars?	
29	In the figure, PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q intersect at a point T. Find the length TP. 	3
30	Prove that $$\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\ \sec\theta\,\mathrm{cosec}\,\theta$$ **[OR]** If sin θ + cos θ = $\sqrt{3}$, then prove that tan θ + cot θ = 1	3
31	Two dice are thrown at the same time. What is the probability that the sum of the two numbers appearing on the top of the dice is (i) 8? (ii) 13? (iii) less than or equal to 12?	3
	Section D	
	Section D consists of 4 questions of 5 marks each.	
32	An express train takes 1 hour less than a passenger train to travel 132 km between Mysore and Bangalore (without taking into consideration the time they stop at intermediate stations). If the average speed of the express train is 11km/h more than that of the passenger train, find the average speed of the two trains. **[OR]** A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream.	5
33	Prove that If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio. In the figure, find EC if $\frac{AD}{DB}=\frac{AE}{EC}$ Using the above theorem. 	5

34 A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand. **5**



[OR]

Ramesh made a bird-bath for his garden in the shape of a cylinder with a hemispherical depression at one end. The height of the cylinder is 1.45 m and its radius is 30 cm. Find the total surface area of the bird-bath.



35 A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are given only to persons having age 18 years onwards but less than 60 years. **5**

Age (in years)	Number of policy holders
Below 20	2
20-25	4
25-30	18
30-35	21
35-40	33
40-45	11
45-50	3
50-55	6
55-60	2

Section E

Case study based questions are compulsory.

36 **Case Study – 1**

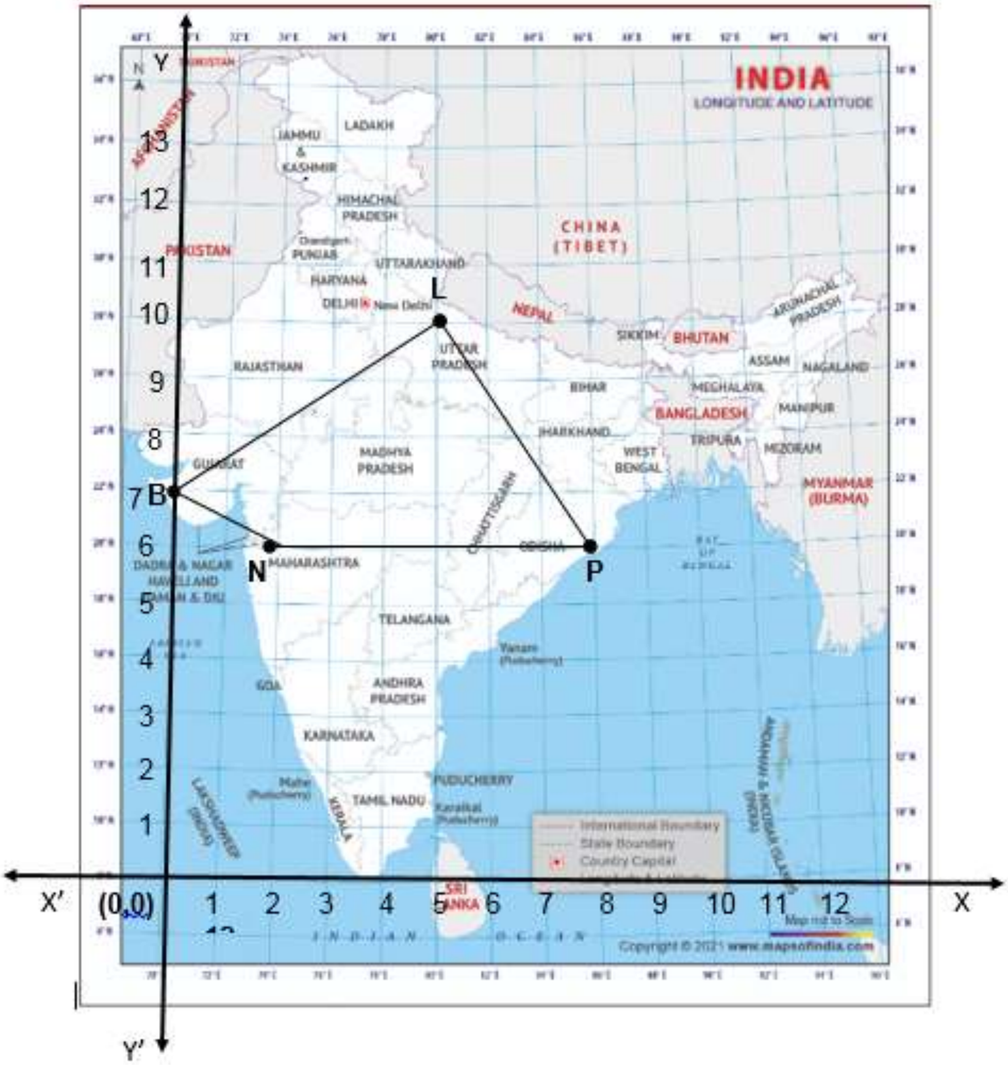
In the month of April to June 2022, the exports of passenger cars from India increased by 26% in the corresponding quarter of 2021–22, as per a report. A car manufacturing company planned to produce 1800 cars in 4^{th} year and 2600 cars in 8th year. Assuming that the production increases uniformly by a fixed number every year.

Based on the above information answer the following questions.

I.	Find the production in the 1^{st} year.	1
II.	Find the production in the 12^{th} year.	1
III.	Find the total production in first 10 years. **[OR]** In which year the total production will reach to 15000 cars?	2

37 **Case Study – 2**

In a GPS, The lines that run east-west are known as lines of latitude, and the lines running north-south are known as lines of longitude. The latitude and the longitude of a place are its coordinates and the distance formula is used to find the distance between two places. The distance between two parallel lines is approximately 150 km. A family from Uttar Pradesh planned a round trip from Lucknow (L) to Puri (P) via Bhuj (B) and Nashik (N) as shown in the given figure below.



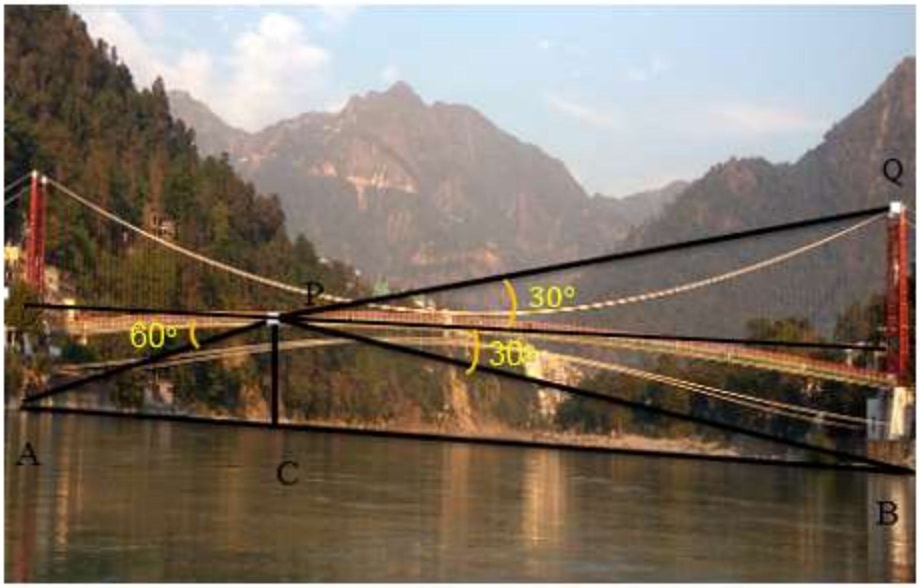
Based on the above information answer the following questions using the coordinate geometry.

I.	Find the distance between Lucknow (L) to Bhuj(B).	1
II.	If Kota (K), internally divide the line segment joining Lucknow (L) to Bhuj (B) into 3 **:** 2 then find the coordinate of Kota (K).	1
III.	Name the type of triangle formed by the places Lucknow (L), Nashik (N) and Puri (P) **[OR]** Find a place (point) on the longitude (y-axis) which is equidistant from the points Lucknow (L) and Puri (P).	2

38 **Case Study – 3**

Lakshaman Jhula is located 5 kilometers north-east of the city of Rishikesh in the Indian state of Uttarakhand. The bridge connects the villages of Tapovan to Jonk. Tapovan is in Tehri Garhwal district, on the west bank of the river, while Jonk is in Pauri Garhwal district, on the east bank. Lakshman Jhula is a pedestrian bridge also used by motorbikes. It is a landmark of Rishikesh.

A group of Class X students visited Rishikesh in Uttarakhand on a trip. They observed from a point (P) on a river bridge that the angles of depression of opposite banks of the river are 60° and 30° respectively. The height of the bridge is about 18 meters from the river.



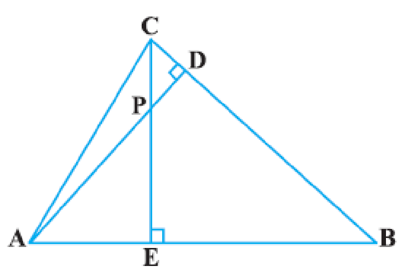
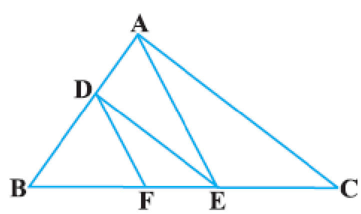
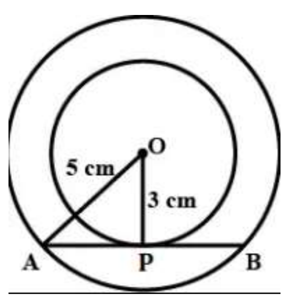
Based on the above information answer the following questions.

I.	Find the distance PA.	1
II.	Find the distance PB	1
III.	Find the width AB of the river. **[OR]** Find the height BQ if the angle of the elevation from P to Q be 30°.	2

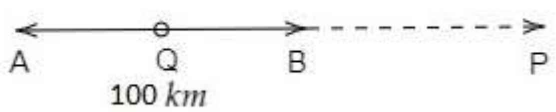
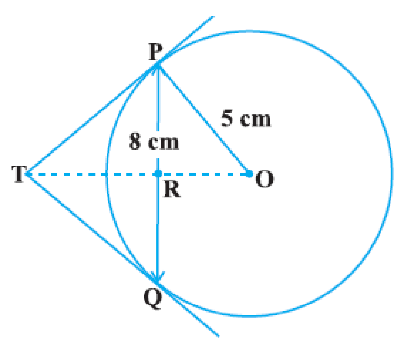
Class- X
Mathematics Basic (241)
Marking Scheme SQP-2022-23

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

	Section A	
1	(c) a^3b^2	1
2	(c) 13 km/hours	1
3	(b) -10	1
4	(b) Parallel.	1
5	(c) k = 4	1
6	(b) 12	1
7	(c) $\angle B = \angle D$	1
8	(b) 5 : 1	1
9	(a) 25°	1
10	(a) $\frac{\sqrt{3}}{2}$	1
11	(c) $\sqrt{3}$	1
12	(b) 0	1
13	(b) 14 : 11	1
14	(c) 16 : 9	1
15	(d) 147π cm^2	1
16	(c) 20	1
17	(b) 8	1
18	(a) $\frac{3}{26}$	1
19	(d) Assertion (A) is false but Reason (R) is true.	1

20	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1
	Section B	
21	For a pair of linear equations to have infinitely many solutions : $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \frac{k}{12} = \frac{3}{k} = \frac{k-3}{k}$ $\frac{k}{12} = \frac{3}{k} \Rightarrow k^2 = 36 \Rightarrow k = \pm 6$ Also, $\frac{3}{k} = \frac{k-3}{k} \Rightarrow k^2 - 6k = 0 \Rightarrow k = 0, 6.$ Therefore, the value of *k*, that satisfies both the conditions, is k = 6.	½ ½ ½ ½
22	 (i) In ΔABD and ΔCBE ∠ADB = ∠CBE = 90º ∠ABD = ∠CBE (Common angle) ⇒ ΔABD ~ ΔCBE (AA criterion) (ii) In ΔPDC and ΔBEC ∠PDC = ∠BEC = 90º ∠PCD = ∠BCE (Common angle) ⇒ ΔPDC ~ ΔBEC (AA criterion) [OR]  In ΔABC, DE $\parallel$ AC BD/AD = BE/EC ....(i) (Using BPT) In ΔABE, DF $\parallel$ AE BD/AD = BF/FE ....(ii) (Using BPT) From (i) and (ii) BD/AD = BE/EC = BF/FE Thus, $\frac{BF}{FE} = \frac{BE}{EC}$	½ ½ ½ ½ ½ ½ ½ ½
23	 Let O be the centre of the concentric circle of radii 5 cm and 3 cm respectively. Let AB be a chord of the larger circle touching the smaller circle at P Then AP = PB and OP⊥AB Applying Pythagoras theorem in ΔOPA, we have $OA^2 = OP^2 + AP^2 \Rightarrow 25 = 9 + AP^2$ $\Rightarrow AP^2 = 16 \Rightarrow AP = 4$ cm ∴ AB = 2AP = 8 cm	½ ½ ½ ½
24	Now, $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)} = \frac{(1-\sin^2\theta)}{(1-\cos^2\theta)}$ $= \frac{\cos^2\theta}{\sin^2\theta} = \left(\frac{\cos\theta}{\sin\theta}\right)^2$ $= \cot^2\theta$ $= \left(\frac{7}{8}\right)^2 = \frac{49}{64}$	½ ½ ½ ½

25	Perimeter of quadrant = 2r + $\frac{1}{4}$ × 2 π r ⇒ Perimeter = 2 × 14 + $\frac{1}{2}$ × $\frac{22}{7}$ × 14 ⇒ Perimeter = 28 + 22 =28+22 = 50 cm [OR] Area of the circle = Area of first circle + Area of second circle ⇒ $\pi R^2 = \pi (r_1)^2 + \pi (r_1)^2$ ⇒ $\pi R^2 = \pi (24)^2 + \pi (7)^2$ ⇒ $\pi R^2 = 576\pi + 49\pi$ ⇒ $\pi R^2 = 625\pi$ ⇒ $R^2 = 625$ ⇒ R = 25 Thus, diameter of the circle = 2R = 50 cm.	½ ½ 1 ½ ½ 1
	Section C	
26	Let us assume to the contrary, that $\sqrt{5}$ is rational. Then we can find a and b ($\neq 0$) such that $\sqrt{5} = \frac{a}{b}$ (assuming that a and b are co-primes). So, a = $\sqrt{5}$ b ⇒ $a^2 = 5b^2$ Here 5 is a prime number that divides a^2 then 5 divides a also (Using the theorem, if a is a prime number and if a divides p^2, then a divides p, where a is a positive integer) Thus 5 is a factor of a Since 5 is a factor of a, we can write a = 5c (where c is a constant). Substituting a = 5c We get $(5c)^2 = 5b^2$ ⇒ $5c^2 = b^2$ This means 5 divides b^2 so 5 divides b also (Using the theorem, if a is a prime number and if a divides p^2, then a divides p, where a is a positive integer). Hence a and b have at least 5 as a common factor. But this contradicts the fact that a and b are coprime. This is the contradiction to our assumption that p and q are co-primes. So, √5 is not a rational number. Therefore, the √5 is irrational.	1 ½ ½ ½ ½
27	$6x^2 - 7x - 3 = 0$ ⇒ $6x^2 - 9x + 2x - 3 = 0$ ⇒ 3x(2x – 3) + 1(2x – 3) = 0 ⇒ (2x – 3)(3x + 1) = 0 ⇒ 2x – 3 = 0 & 3x + 1 = 0 x = 3/2 & x = -1/3 Hence, the zeros of the quadratic polynomials are 3/2 and -1/3. For verification Sum of zeros = $\frac{-\text{coefficient of x}}{\text{coefficient of } x^2}$ ⇒ 3/2 + (-1/3) = – (-7) / 6 ⇒ 7/6 = 7/6 Product of roots = $\frac{\text{constant}}{\text{coefficient of } x^2}$ ⇒ 3/2 x (-1/3) = (-3) / 6 ⇒ -1/2 = -1/2 Therefore, the relationship between zeros and their coefficients is verified.	½ ½ 1 1
28	Let the fixed charge by Rs x and additional charge by Rs y per day Number of days for Latika = 6 = 2 + 4 Hence, Charge x + 4y = 22 x = 22 – 4y ………(1) Number of days for Anand = 4 = 2 + 2 Hence, Charge x + 2y = 16 x = 16 – 2y ……. (2) On comparing equation (1) and (2), we get,	½ ½

	22 – 4y = 16 – 2y ⇒ 2y = 6 ⇒ y = 3 Substituting y = 3 in equation (1), we get, x = 22 – 4 (3) ⇒ x = 22 – 12 ⇒ x = 10 Therefore, fixed charge = Rs 10 and additional charge = Rs 3 per day [OR]  AB = 100 km. We know that, Distance = Speed × Time. AP – BP = 100 ⇒ 5x − 5y = 100 ⇒ x−y=20.....(i) AQ + BQ = 100 ⇒ x + y = 100….(ii) Adding equations (i) and (ii), we get, x − y + x + y = 20 +100 ⇒ 2x = 120 ⇒ x = 60 Substituting x = 60 in equation (ii), we get, 60 + y = 100 ⇒ y = 40 Therefore, the speed of the first car is 60 km/hr and the speed of the second car is 40 km/hr.	1 1 ½ ½ 1 1
29	 Since OT is perpendicular bisector of PQ. Therefore, PR=RQ=4 cm Now, OR = $\sqrt{OP^2 - PR^2} = \sqrt{5^2 - 4^2}$ =3cm Now, ∠TPR + ∠RPO = 90° (∵TPO=90°) & ∠TPR + ∠PTR = 90° (∵TRP=90°) So, ∠RPO = ∠PTR So, $\Delta TRP \sim \Delta PRO$ [By A-A Rule of similar triangles] So, $\frac{TP}{PO} = \frac{RP}{RG}$ $\Rightarrow \frac{TP}{5} = \frac{4}{3} \Rightarrow TP = \frac{20}{3}$ cm	½ ½ ½ ½ ½ ½
30	$LHS = \frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = \frac{\tan\theta}{1-\frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1-\tan\theta}$ $= \frac{\tan^2\theta}{\tan\theta-1} + \frac{1}{\tan\theta\,(1-\tan\theta)}$ $= \frac{\tan^3\theta-1}{\tan\theta\,(\tan\theta-1)}$ $= \frac{(\tan\theta-1)(\tan^3\theta+\tan\theta+1)}{\tan\theta\,(\tan\theta-1)}$ $= \frac{(\tan^3\theta+\tan\theta+1)}{\tan\theta}$ $= \tan\theta + 1 + \sec = 1 + \tan\theta + \sec\theta$ $= 1 + \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$ $= 1 + \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\,\cos\theta}$	½ ½ ½ ½ ½

	$= 1 + \frac{1}{\sin\theta\ \cos\theta} = 1 + \sec\theta \operatorname{cosec}\theta$ [OR] sin θ + cos θ = $\sqrt{3} \Rightarrow (\sin\theta + \cos\theta)^2 = 3$ $\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$ $\Rightarrow 1 + 2\sin\theta\cos\theta = 3 \Rightarrow 1\ \sin\theta\cos\theta = 1$ Now tanθ + cotθ = $\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\text{isn}\ \theta}$ $= \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$ $= \frac{1}{\sin\theta\cos\theta} = \frac{1}{1} = 1$	½ ½ ½ ½ ½ ½ ½
31	(i) P(8) = $\frac{5}{36}$ (ii) P(13) = $\frac{0}{36} = 0$ (iii) P(less than or equal to 12) = 1	1 1 1
	Section D	
32	Let the average speed of passenger train = *x* km/h. and the average speed of express train = (*x* + 11) km/h As per given data, time taken by the express train to cover 132 km is 1 hour less than the passenger train to cover the same distance. Therefore, $\frac{132}{x} - \frac{132}{x+11} = 1$ $\Rightarrow \frac{132\ (x+11-x)}{x\ (x+11)} = 1 \Rightarrow \frac{132\ x\ 11}{x\ (x+11)} = 1$ ⇒ 132 × 11 = *x*(*x* + 11) ⇒ $x^2 + 11x - 1452 = 0$ ⇒ $x^2 + 44x - 33x - 1452 = 0$ ⇒ *x* (*x* + 44) -33(*x* + 44) = 0 ⇒ (*x* + 44)(*x* – 33) = 0 ⇒ *x* = – 44, 33 As the speed cannot be negative, the speed of the passenger train will be 33 km/h and the speed of the express train will be 33 + 11 = 44 km/h. [OR] Let the speed of the stream be x km/hr So, the speed of the boat in upstream = (18 - x) km/hr & the speed of the boat in downstream = (18 + x) km/hr ATQ, $\frac{\text{distance}}{\text{upstream speed}} - \frac{\text{distance}}{\text{downstream speed}} = 1$ $\Rightarrow \frac{24}{18-x} - \frac{24}{18+x} = 1$	½ 1 ½ 1 1 ½ ½ ½ ½ 1

$\Rightarrow 24\left[\frac{1}{18-x} - \frac{1}{18+x}\right] = 1 \Rightarrow 24\left[\frac{18+x-(18-x)}{(18-x).(18+x)}\right] = 1$ **[1]**

$\Rightarrow 24\left[\frac{2x}{(18-x).(18+x)}\right] = 1 \Rightarrow 24\left[\frac{2x}{(18-x).(18+x)}\right] = 1$

$\Rightarrow 48x = 324 - x^2 \Rightarrow x^2 + 48x - 324 = 0$ **[1]**

$\Rightarrow (x + 54)(x - 6) = 0 \Rightarrow x = -54$ or 6 **[½]**

As speed to stream can never be negative, the speed of the stream is 6 km/hr. **[½]**

33

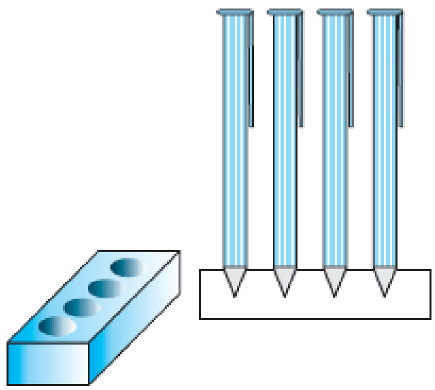
Figure **[½]**

Given, To prove, constructions **[1½]**

Proof **[2]**

Application ---- **[1]**

34



Volume of one conical depression = $\frac{1}{3} \times \pi r^2 h$ **[½]**

$= \frac{1}{3} \times \frac{22}{7} \times 0.5^2 \times 1.4 \text{ cm}^3 = 0.366 \text{ cm}^3$ **[1½]**

Volume of 4 conical depression = 4 x 0.366 cm^3

$= 1.464 \text{ cm}^3$ **[½]**

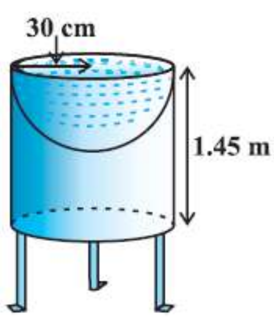
Volume of cuboidal box = L x B x H **[½]**

$= 15 \times 10 \times 3.5 \text{ cm}^3 = 525 \text{ cm}^3$ **[1½]**

Remaining volume of box = Volume of cuboidal box – Volume of 4 conical depressions **[½]**

$= 525 \text{ cm}^3 - 1.464 \text{ cm}^3 = 523.5 \text{ cm}^3$ **[1]**

[OR]



Let h be height of the cylinder, and r the common radius of the cylinder and hemisphere.

Then, the total surface area = CSA of cylinder + CSA of hemisphere **[½]**

$= 2\pi rh + 2\pi r^2 = 2\pi r(h + r)$ **[2]**

$= 2 \times \frac{22}{7} \times 30 (145 + 30) \text{ cm}^2$ **[1]**

$= 2 \times \frac{22}{7} \times 30 \times 175 \text{ cm}^2$ **[½]**

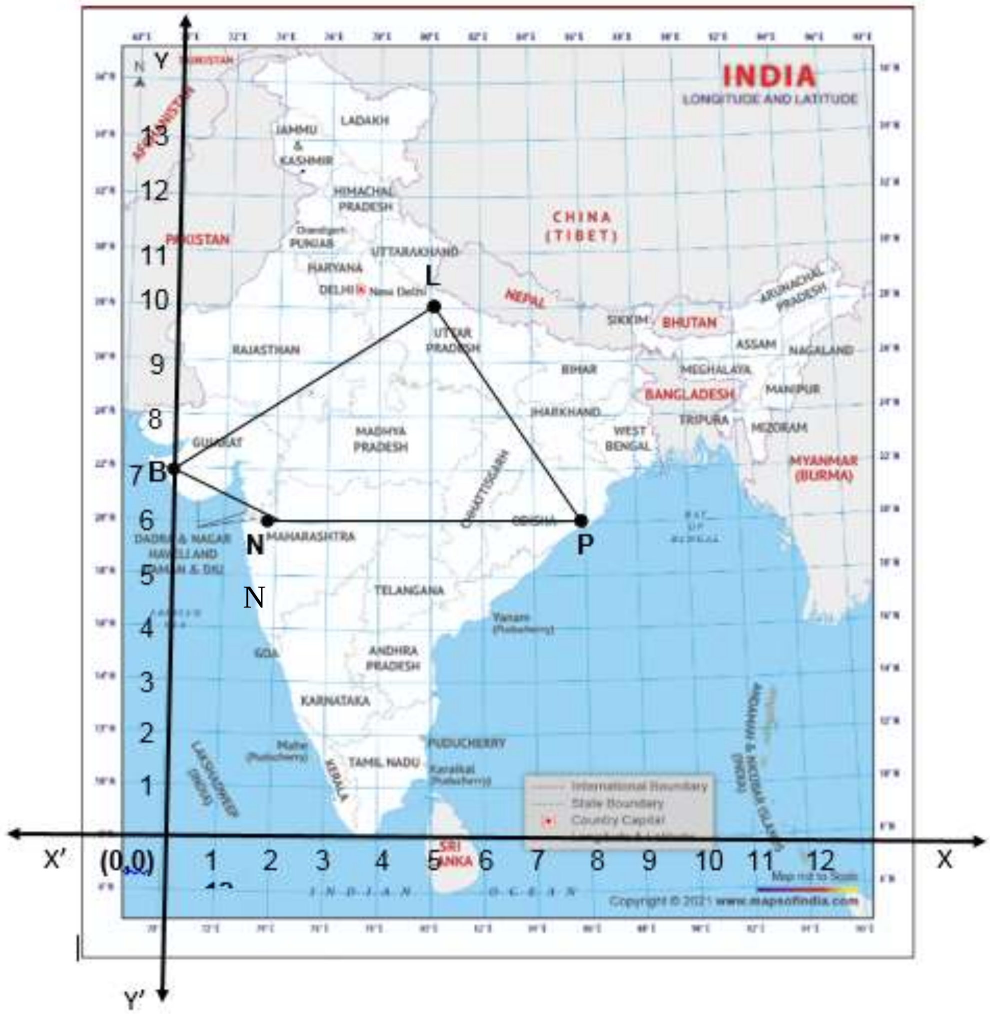
$= 33000 \text{ cm}^2 = 3.3 \text{ m}^2$ **[1]**

35

Class Interval	Number of policy holders (f)	Cumulative Frequency (cf)
Below 20	2	2
20-25	4	6
25-30	18	24
30-35	21	45
35-40	33	78
40-45	11	89
45-50	3	92
50-55	6	98
55-60	2	100

[1]

		n = 100 ⇒ n/2 = 50, Therefore, median class = 35 – 40, Class size, h = 5, Lower limit of median class, l = 35, frequency f = 33, cumulative frequency cf = 45 ⇒Median = l + $\left[\frac{\frac{n}{2} - cf}{f}\right] \times h$ ⇒Median = 35 + $\left[\frac{50 - 45}{33}\right] \times 5$ = 35 + $\frac{25}{33}$ = 35 + 0.76 = 35.76 Therefore, median age is 35.76 years	½ 1½ 1 1
		Section E	
36	1	Since the production increases uniformly by a fixed number every year, the number of Cars manufactured in 1st, 2nd, 3rd, . . .,years will form an AP. So, a + 3d = 1800 & a + 7d = 2600 So d = 200 & a = 1200	½ ½
	2	t_{12} = a + 11d ⇒ t_{30} = 1200 + 11 x 200 ⇒ t_{12} = 3400	½ ½
	3	$S_n = \frac{n}{2}[2a + (n-1)d]$ ⇒ $S_{10} = \frac{10}{2}[2\ x\ 1200 + (10 - 1)\ 200]$ ⇒ $S_{10} = \frac{13}{2}[2\ x\ 1200 + 9\ \text{x}\ 200]$ ⇒ S_{10} = 5 x [2400 + 1800] ⇒ S_{10} = 5 x 4200= 21000 [OR] Let in n years the production will reach to 31200 $S_n = \frac{n}{2}[2a + (n-1)d]$ = 31200 ⇒ $\frac{n}{2}[2\ x\ 1200 + (n-1)200]$ = 31200 ⇒ $\frac{n}{2}[2\ \text{x}\ 1200 + (n-1)200]$ = 31200 ⇒ $n\ [\ 12 + (n-1)\ ]$ = 312 ⇒ n^2 + 11n -312 = 0 ⇒ n^2 + 24n - 13n -312 = 0 ⇒ (n +24)(n -13) = 0 ⇒ n = 13 or – 24. As n can't be negative. So n = 13	½ ½ ½ ½ ½ ½ ½ ½ ½
37		**Case Study – 2**	



1	LB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \Rightarrow$ LB = $\sqrt{(0-5)^2 + (7-10)^2}$ LB = $\sqrt{(5)^2 + (3)^2} \Rightarrow$ LB = $\sqrt{25+9}$ LB = $\sqrt{34}$ Hence the distance is 150 $\sqrt{34}$ km	½ ½
2	Coordinate of Kota (K) is $\left(\frac{3 \text{ x } 5 + 2 \text{ x } 0}{3+2}, \frac{3 \text{ x } 7 + 2 \text{ x } 10}{3+2}\right)$ $= \left(\frac{15+0}{5}, \frac{21+20}{5}\right) = \left(3, \frac{41}{5}\right)$	½ ½
3	L(5, 10), N(2,6), P(8,6) LN = $\sqrt{(2-5)^2 + (6-10)^2} = \sqrt{(3)^2 + (4)^2} = \sqrt{9+16} = \sqrt{25} = 5$ NP = $\sqrt{(8-2)^2 + (6-6)^2} = \sqrt{(4)^2 + (0)^2}$ = 4 PL = $\sqrt{(8-5)^2 + (6-10)^2} = \sqrt{(3)^2 + (4)^2} \Rightarrow$ LB = $\sqrt{9+16} = \sqrt{25} = 5$ as LN = PL ≠ NP, so Δ LNP is an isosceles triangle. **[OR]**	½ ½ ½ ½

	Let A (0, b) be a point on the y – axis then AL = AP		
	$\Rightarrow \sqrt{(5-0)^2 + (10-b)^2} = \sqrt{(8-0)^2 + (6-b)^2}$	½	
	$\Rightarrow (5)^2 + (10-b)^2 = (8)^2 + (6-b)^2$	½	
	$\Rightarrow 25 + 100 - 20b + b^2 = 64 + 36 - 12b + b^2 \Rightarrow 8b = 25 \Rightarrow b = \frac{25}{8}$	½	
	So, the coordinate on y axis is $\left(0, \frac{25}{8}\right)$	½	

38 **Case Study – 3**

1	$\sin 60° = \frac{PC}{PA}$	½
	$\Rightarrow \frac{\sqrt{3}}{2} = \frac{18}{PA} \Rightarrow PA = 12\sqrt{3}$ m	½
2	$\sin 30° = \frac{PC}{PB}$	½
	$\Rightarrow \frac{1}{2} = \frac{18}{PB} \Rightarrow PB = 36$ m	½
3	$\tan 60° = \frac{PC}{AC} \Rightarrow \sqrt{3} = \frac{18}{AC} \Rightarrow$ AC = $6\sqrt{3}$ m	1
	$\tan 30° = \frac{PC}{CB} \Rightarrow \frac{1}{\sqrt{3}} = \frac{18}{CB} \Rightarrow$ CB = $18\sqrt{3}$ m	½
	Width AB = AC + CB = $6\sqrt{3} + 18\sqrt{3} = 24\sqrt{3}$ m	½
	[OR]	
	RB = PC =18 m & PR = CB = $18\sqrt{3}$ m	½
	$\tan 30° = \frac{QR}{PR} \Rightarrow \frac{1}{\sqrt{3}} = \frac{QR}{18\sqrt{3}} \Rightarrow$ QR = 18 m	1
	QB = QR + RB = 18 + 18 = 36m. Hence height BQ is 36m	½