Class-10th

Class- X

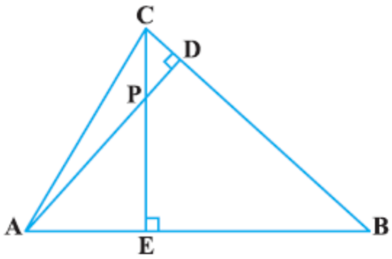
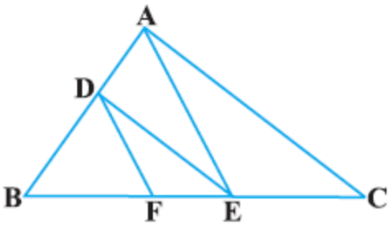
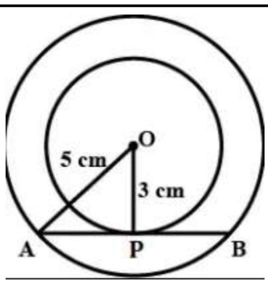
Mathematics Basic (241)

Marking Scheme SQP-2022-23

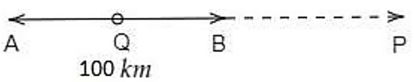
Time Allowed: 3 Hours

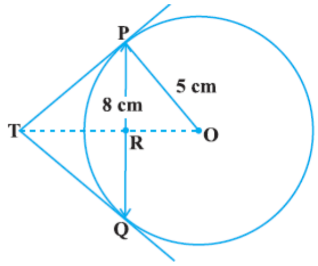
Maximum Marks: 80

	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) ∠B = ∠D	1
8	(b) 5 : 1	1
9	(a) 25°	1
1	(a) $\frac{2}{\sqrt{3}}$	1
1	(c) $\sqrt{3}$	1
1	(b) 0	1
1	(b) 14 : 11	1
1	(c) 16 : 9	1
1	(d) 147π cm^2	1
1	(c) 20	1
1	(b) 8	1
1	(a) $\frac{3}{26}$	1
1	(d) Assertion (A) is false but Reason (R) is true.	1
2	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1
	Section B	

2	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
2	 (i) In ΔABD and ΔCBE ∠ADB = ∠CEB = 90° ∠ABD = ∠CBE (Common angle) ⇒ ΔABD ~ ΔCBE (AA criterion) (ii) In ΔPDC and ΔBEC ∠PDC = ∠BEC = 90° ∠PCD = ∠BCE (Common angle) ⇒ ΔPDC ~ ΔBEC (AA criterion) [OR]  In ΔABC, DE || AC BD/AD = BE/EC ……..(i) (Using BPT) In ΔABE, DF || 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
2	 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	½ ½ ½ ½

	∴ AB = 2AP = 8 cm	
2	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
2	Perimeter of quadrant = 2r + $\frac{1}{4}$ × 2πr ⇒ 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	
2	Let us assume to the contrary, that $\sqrt{5}$ is rational. Then we can find a and b (≠ 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 $(5c)^2 = 5b^2 \Rightarrow 5c^2 = b^2$ 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, $\sqrt{5}$ is not a rational number. Therefore, the $\sqrt{5}$ is irrational	1 ½ ½ ½ ½

2	$6x^2 - 7x - 3 = 0 \Rightarrow 6x^2 - 9x + 2x - 3 = 0$ $\Rightarrow 3x(2x - 3) + 1(2x - 3) = 0 \Rightarrow (2x - 3)(3x + 1) = 0$ $\Rightarrow 2x - 3 = 0$ & $3x + 1 = 0$ x = 3/2 & x = –1/3 Hence, the zeros of the quadratic polynomials are 3/2 and –1/3 For verification Sum of zeros = $\frac{-\text{coefficient of } x}{\text{coefficient of } x^2} \Rightarrow 3/2 + (-1/3) = -(-7)/6 \Rightarrow 7/6 = 7/6$ Product of roots = $\frac{\text{constant}}{\text{coefficient of } x^2} \Rightarrow 3/2 \times (-1/3) = (-3)/6 \Rightarrow -1/2 = -1/2$ Therefore, the relationship between zeroes and their coefficients is verified.	½ ½ 1 1
2	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, $22 - 4y = 16 - 2y \Rightarrow 2y = 6 \Rightarrow y = 3$ Substituting y = 3 in equation (1), we get, $x = 22 - 4(3) \Rightarrow x = 22 - 12 \Rightarrow x = 10$ Therefore, fixed charge = Rs 10 and additional charge = Rs 3 per day [OR]  AB = 100 km. We know that, Distance = Speed × Time. $AP - BP = 100 \Rightarrow 5x - 5y = 100 \Rightarrow x - y = 20$.....(i) $AQ + BQ = 100 \Rightarrow x + y = 100$….(ii) Adding equations (i) and (ii), we get, $x - y + x + y = 20 + 100 \Rightarrow 2x = 120 \Rightarrow x = 60$ Substituting x = 60 in equation (ii), we get, $60 + y = 100 \Rightarrow y = 40$ Therefore, the speed of the first car is 60 km/hr and the speed of the second car is 40 km/hr.	½ ½ 1 ½ ½ 1 1

2		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, ΔTRP ~ ΔPRO [By A-A Rule of similar triangles] So, $\frac{TP}{PO} = \frac{RP}{RG}$ ⇒ $\frac{TP}{5} = \frac{4}{3} \Rightarrow TP = \frac{20}{3}\text{cm}$	½ ½ ½ ½ ½ ½
3	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 θ + 1 + sec = 1 + tan θ + sec θ = 1 + $\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$ = 1 + $\frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$ = 1 + $\frac{1}{\sin\theta\cos\theta}$ = 1 + sec θ cosec θ [OR] sin θ + cos θ = $\sqrt{3}$ ⇒ (sin θ + cos θ)2 = 3 ⇒ sin2θ + cos2θ + 2sin θ cos θ = 3 ⇒ 1 + 2sin θ cos θ = 3 ⇒ 1 sin θ cos θ = 1		½ ½ ½ ½ ½ ½ ½ ½ ½ ½ ½ ½

	Now $\tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$ $= \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$ $= \frac{1}{\sin\theta\cos\theta} = \frac{1}{1} = 1$	
3	(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	
3	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, $\frac{132}{x} - \frac{132}{x+11} = 1$ $\Rightarrow \frac{132(x+11-x)}{x(x+11)} = 1 \Rightarrow \frac{132 \times 11}{x(x+11)} = 1$ $\Rightarrow$ 132 × 11 = x(x + 11) $\Rightarrow$ $x^2 + 11x - 1452 = 0$ $\Rightarrow$ $x^2 + 44x - 33x - 1452 = 0$ $\Rightarrow$ x (x + 44) – 33(x + 44) = 0 $\Rightarrow$ (x + 44)(x – 33) = 0 $\Rightarrow$ 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, $\frac{\text{distance}}{\text{upstream speed}} - \frac{\text{distance}}{\text{downstream speed}} = 1$ $\Rightarrow \frac{24}{18-x} - \frac{24}{18+x} = 1$ $\Rightarrow 24\left[\frac{1}{18-x} - \frac{1}{18+x}\right] = 1 \Rightarrow 24\left[\frac{18+x-(18-x)}{(18-x).(18+x)}\right] = 1$	½ 1 ½ 1 1 ½ ½ ½ ½ 1 1 1 ½ ½

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

$\Rightarrow$ 48x = 324 – x^2 $\Rightarrow$ x^2 + 48x – 324 = 0

$\Rightarrow$ (x + 54)(x – 6) = 0 $\Rightarrow$ x = –54 or 6

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

3

Figure ½

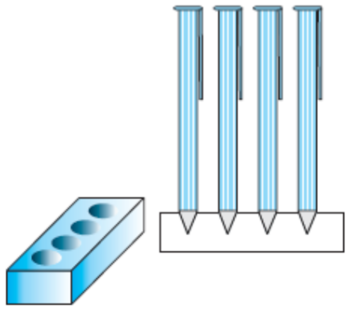
Given, To prove, constructions 1

Proof

Application ----- 2

1

3



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

$$=\frac{1}{3}\times\frac{22}{7}\times 0.5^2\times 1.4cm^3 = 0.366\ cm^3$$ 1

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

= 1.464 cm^3 ½

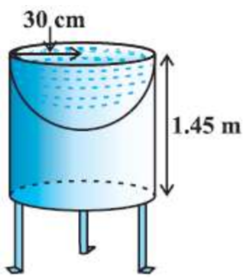
Volume of cuboidal box = L × B × H ½

= 15 × 10 × 3.5 cm^3 = 525 cm^3 1

Remaining volume of box = Volume of cuboidal box – Volume of 4 conical depressions

= 525 cm^3 – 1.464 cm^3 = 523.5 cm^3 ½

[OR] 1



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

= 2πrh + 2πr^2 = 2πr(h + r) ½

2

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

$$= 2\times\frac{22}{7}\times 30\times 175cm^2$$ ½

= 33000 cm^2 = 3.3 m^2 1

3

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

1

50-55	6	98
55-60	2	100

n = 100 $\Rightarrow$ 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 ½

$\Rightarrow$ Median = l + $\left[\dfrac{\frac{n}{2}-cf}{f}\right] \times h$ 1

$\Rightarrow$ Median = 35 + $\left[\dfrac{50-45}{33}\right] \times 5$ 1

= 35 + $\dfrac{25}{33}$ = 35 + 0.76 1

= 35.76 Therefore, median age is 35.76 years

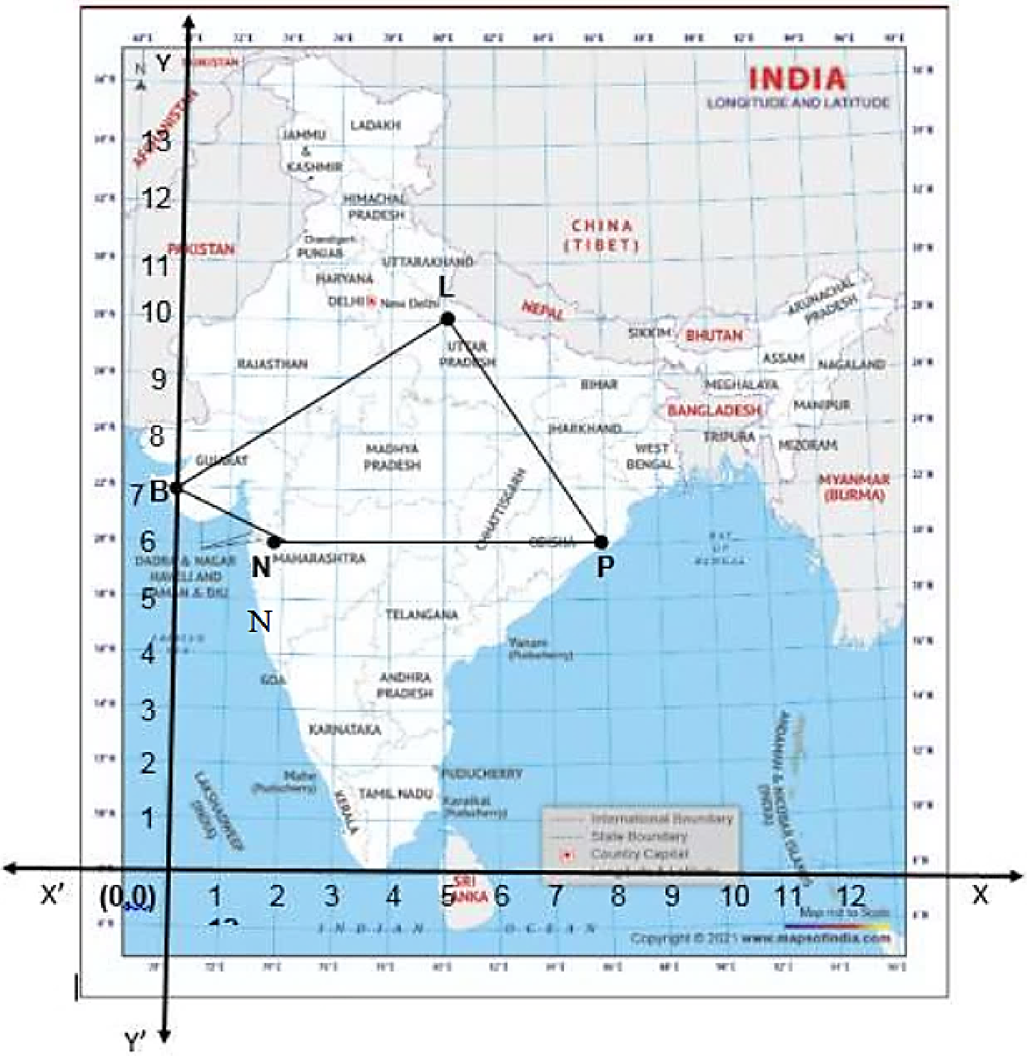
Section E

3

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 $\Rightarrow$ t_{30} = 1200 + 11 × 200 $\Rightarrow$ t_{12} = 3400	½ ½
3	$S_n = \dfrac{n}{2}$ [2a + (n – 1)d] $\Rightarrow$ $S_{10} = \dfrac{10}{2}$ [2 × 1200 + (10 – 1) 200] $\Rightarrow$ $S_{10} = \dfrac{13}{2}$ [2 × 1200 + 9 × 200] $\Rightarrow$ S_{10} = 5 × [2400 + 1800] $\Rightarrow$ S_{10} = 5 × 4200 = 21000 [OR] Let in n years the production will reach to 31200 $S_n = \dfrac{n}{2}$ [2a + (n – 1)d] = 31200 $\Rightarrow$ $\dfrac{n}{2}$ [2 × 1200 + (n − 1)200] = 31200 $\Rightarrow$ $\dfrac{n}{2}$ [2 × 1200 + (n − 1)200] = 31200 $\Rightarrow$ n[12 + (n − 1)] = 312 $\Rightarrow$ n^2 + 11n – 312 = 0 $\Rightarrow$ n^2 + 24n – 13n – 312 = 0	½ ½ ½ ½ ½ ½ ½ ½

	$\Rightarrow$ (n + 24)(n – 13) = 0 $\Rightarrow$ n = 13 or – 24. As n can't be negative. So n = 13	

3 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 $\left(\frac{3\times5+2\times0}{3+2},\frac{3\times7+2\times10}{3+2}\right)$ = $\left(\frac{15+0}{5},\frac{21+20}{5}\right)=\left(3,\frac{41}{5}\right)$	½ ½
3	L(5, 10), N(2,6), P(8,6) $LN=\sqrt{(2-5)^2+(6-10)^2}=\sqrt{(3)^2+(4)^2}=\sqrt{9+16}=\sqrt{25}=5$	½ ½

$NP = \sqrt{(8-2)^2 + (6-6)^2} = \sqrt{(4)^2 + (0)^2} = 4$

$PL = \sqrt{(8-5)^2 + (6-10)^2} = \sqrt{(3)^2 + (4)^2} \Rightarrow LB = \sqrt{9+16} = \sqrt{25} = 5$ ½

as LN = PL ≠ NP, so ΔLNP is an isosceles triangle.

[OR]

Let A (0, b) be a point on the y – axis then AL = AP ½

$\Rightarrow \sqrt{(5-0)^2 + (10-b)^2} = \sqrt{(8-0)^2 + (6-b)^2}$ 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 $\left(0, \frac{25}{8}\right)$

3 **Case Study – 3**

1	$\sin 60° = \frac{PC}{PA}$ $\Rightarrow \frac{\sqrt{3}}{2} = \frac{18}{PA} \Rightarrow PA = 12\sqrt{3}m$	
2	$\sin 30° = \frac{PC}{PB}$ $\Rightarrow \frac{1}{2} = \frac{18}{PB} \Rightarrow PB = 36m$	
3	$\tan 60° = \frac{PC}{AC} \Rightarrow \sqrt{3} = \frac{18}{AC} \Rightarrow AC = 6\sqrt{3}m$	1 ½

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