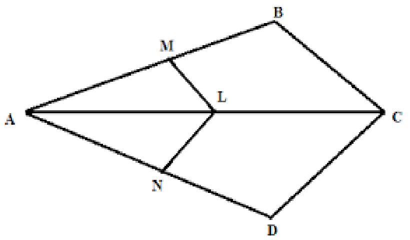
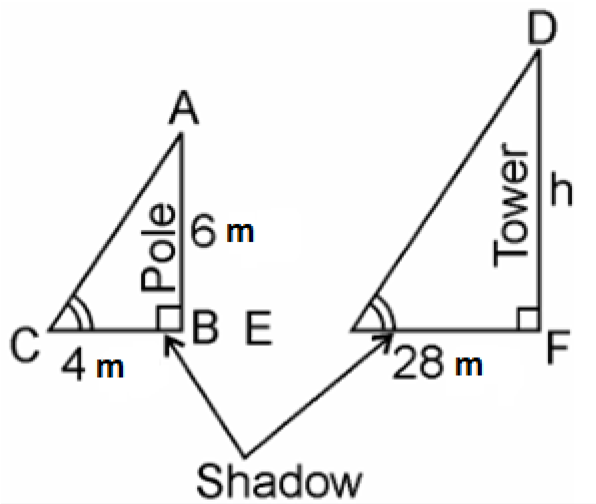
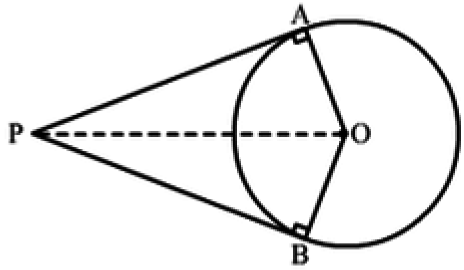
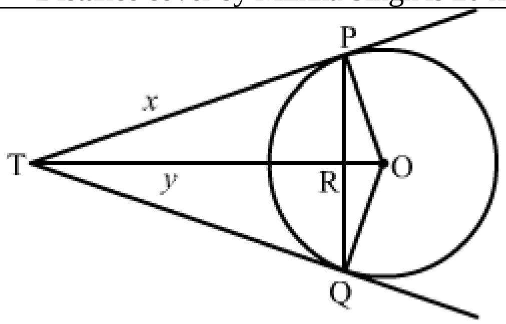
BAL BHARATI PUBLIC SCHOOL
PRE-BOARD EXAMINATION (2023-24)

Subject –Mathematics Basic(241)
Class - X
Answer Key for Set – B

Marking scheme		
Section - A		
Q1.	b) (0, -3)	1
Q2.	d) 12.5 cm	1
Q3.	a) 15°	1
Q4.	c) 75°	1
Q5.	a) 10 m	1
Q6.	d) 30 – 40	1
Q7.	b) 10	1
Q8.	a) 2	1
Q9.	d) 1/6	1
Q10.	b) 17.5	1
Q11.	b) 2	1
Q12.	c) x^2y^2	1
Q13.	c) 4	1
Q14.	b) $\frac{2}{3}$	1
Q15.	c) ΔPQR ~ ΔNSM	1
Q16.	a) 0	1
Q17.	c) 550 cm^2	1
Q18.	a) 60°	1
Q19.	b) Both A and R are true but R is not the correct explanation for A.	1
Q20.	a) Both A and R are true and R is the correct explanation for A.	1
Section - B		
Q21.	sin (A + B) = 1 so sin(A + B) = sin 90° ⇒ A + B = 90° ……………………….(i) cos (A – B) = $\frac{\sqrt{3}}{2}$ so cos (A – B) = cos 30° ⇒ A – B = 30° ……..…………………..(ii) From (i) and (ii) A = 60° and B = 30° **Or** $\cos A + \cos^2 A = 1$ ⇒ $\cos A = 1 - \cos^2 A$ ⇒ $\cos A = \sin^2 A$ …………………….(i) so $\sin^2 A + \sin^4 A = \sin^2 A + (\sin^2 A)^2$ $= \cos A + \cos^2 A$ (By using (i)) = 1	½ ½ 1 1 1
Q22.	Let the number of girls = x Let the number of boys = y ATQ	

	y = x + 4…………………..(i) x + y = 10 ………………...(ii) Using (i) into (ii) x + x + 4 = 10 2x = 6 x = 3 so y = 3 + 4 = 7 So Girls = 3 , Boys = 7	½ ½ 1
Q23.	Length of minute hand = 7 cm Central angle in 30 minutes = 180° So area swept by minute hand = $\frac{\theta}{360}\pi r^2$ $= \frac{180°}{360} \times \frac{22}{7} \times 7 \times 7$ = 77 cm^2	 ½ ½ 1
Q24.	 In ΔABC, ML ‖ BC So by BPT, $\frac{AM}{AB} = \frac{AL}{AC}$ ……………………(i) In ΔADC, NL ‖ DC So by BPT, $\frac{AN}{AD} = \frac{AL}{AC}$ ……………………(ii) From (i) and (ii) $\frac{AM}{AB} = \frac{AN}{AD}$ Or  Length of the vertical pole = 6m (Given) Length of the shadow of the pole = 4 m (Given) Let Height of tower = h m Length of shadow of the tower = 28 m (Given) In ΔABC and ΔDEF, ∠C = ∠E (angular elevation) ∠B = ∠F= 90∘	 ½ ½ 1

	∴ΔABC ~ ΔDFE (By AA similarity criterion) ∴ $\frac{AB}{DF} = \frac{BC}{EF}$ (If two triangles are similar then their corresponding sides are proportional.) ∴ $\frac{6}{h} = \frac{4}{28}$ ⇒h = $\frac{6\times28}{4}$ ⇒h = 6×7 ⇒h = 42 m	1 1
Q25.	 Let AP and BP be the two tangents to the circle with centre O. To Prove : AP = BP Proof : In ΔAOP and ΔBOP OA = OB (radii of the same circle) ∠OAP=∠OBP=90° (since tangent at any point of a circle is perpendicular to the radius through the point of contact) OP = OP (common) ∴ΔAOP≅ΔBOP (by R.H.S. congruence criterion) ∴ AP = BP (corresponding parts of congruent triangles) Hence the length of the tangents drawn from an external point to a circle are equal.	1 1
	Section - C	
Q26.	Let the numerator = x and the denominator = y So, the fraction = $\frac{x}{y}$ According to the question, Condition I: $\frac{x-1}{y} = \frac{1}{3}$ ⇒3(x−1) = y ⇒3x − 3 = y ⇒3x − y = 3 ……………...(i) Condition II: $\frac{x}{y+8} = \frac{1}{4}$ ⇒ 4x = y + 8 ⇒ 4x – y = 8 ⇒ 4x – y = 8 …………......(ii) By using elimination method in equation (i) and (ii) x = 5 and y = 12	1 1 1

	Hence, the fraction is $\frac{5}{12}$. Or Let the speed of Milkha Singh is x km/h. Let the time taken by him to cover certain distance is y hours. So distance cover by Milkha Singh is xy km. ATQ: Condition I: (x + 1)(y – 1) = xy xy + y – x – 1 = xy -x + y = 1 ………………….(i) Condition II: (x – 2)(y + 5) = xy xy – 2y + 5x – 10 = xy 5x – 2y = 10 ……………….(ii) From equation (i) and (ii) So x = 4 km/ h and y = 5 h ⇒ Distance cover by Milkha Singh is 20 km	1 1 1
Q27.	 Let TR = y and TP = x We know that the perpendicular drawn from the centre to the chord bisects it. ∴ PR = RQ Now, PR + RQ = 8 ⇒ PR + PR = 8 ⇒ PR = 4 Now, in right triangle POR By Using Pythagoras theorem, we have $PO^2 = OR^2 + PR^2$ ⇒ $5^2 = OR^2 + (4)^2$ ⇒ $OR^2 = 9$ ⇒ OR = 3 Now, in right triangle TPR By Using Pythagoras theorem, we have $TP^2 = TR^2 + PR^2$ ⇒ $x^2 = y^2 + (4)^2$ ⇒ $x^2 = y^2 + 16$ ....(i) Again, in right triangle TPO By Using Pythagoras theorem, we have $TO^2 = TP^2 + PO^2$ ⇒ $(y + 3)^2 = x^2 + 5^2$ ⇒ $y^2 + 6y + 9 = x^2 + 25$	1 1

	$\Rightarrow y^2 + 6y = x^2 + 16$ ....(ii) ~~y^2~~ $+ 6y =$ ~~y^2~~ $+ 16 + 16$ (using (i)) $6y = 32$ $y = \frac{32}{6} = \frac{16}{3}$ …………………..(ii) using $y = \frac{16}{3}$ in equation (i) $x^2 = \left(\frac{16}{3}\right)^2 + 16$ $= 16(\frac{16}{9} + 1)$ $= 16(\frac{25}{9})$ $x = \frac{20}{3} = 6.67$ cm	1
Q28.	To prove that √7 is an irrational number, we will use the contradiction method. Let us assume that √7 is a rational number with p and q as co-prime integers and $q \neq 0$ $\Rightarrow \sqrt{7} = p/q$ On squaring both sides we get, $\Rightarrow 7q^2 = p^2$ $\Rightarrow p^2$ is divisible by 7. Therefore, p is also divisible by 7. So we can assume that p = 7x where x is an integer. By substituting this value of p in $7q^2 = p^2$, $\Rightarrow 7q^2 = (7x)^2$ $\Rightarrow 7q^2 = 49x^2$ $\Rightarrow q^2 = 7x^2$ $\Rightarrow q^2$ is divisible by 7. Therefore, q is also divisible by 7. Since p and q both are divisible by 7, which gives contradiction that root 7 is a rational number in the form of p/q with "p and q both co-prime numbers" and $q \neq 0$. Thus, √7 is an irrational number by the contradiction method. Now $5 - 3\sqrt{7}$ is an irrational number because rational - irrational are always irrational. So $5 - 3\sqrt{7}$ is an irrational number.	½ ½ ½ ½ 1
Q29.	The two digits numbers are 10, 11, 12, …………….., 99. Total number of two digit numbers = 99 – 9 = 90 (i) Multiples of 7 are 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91, 98. So total multiples of 7 are 13 P(Multiples of 10) = $\frac{Number\ of\ favourable\ outcomes}{Total\ nuber\ out\ comes}$ $= \frac{13}{90}$ (ii) Prefect cube numbers from 10 to 99 are 27 and 64.	1

	So number of favourable outcomes = 2 P(two digits perfect square) = $\frac{2}{90} = \frac{1}{45}$ (iii) Even numbers less than 25 are 10, 12, 14, 16, 18, 20, 22 and 24. So number of favourable outcomes = 8 P(prime number less than 25) = $\frac{8}{90} = \frac{4}{45}$	1 1
Q30.	Let $4x^2 - 4x + 1 = 0$ $\Rightarrow 4x^2 - 2x - 2x + 1 = 0$ $2x(2x - 1) - 1(2x - 1) = 0$ $(2x - 1)(2x - 1) = 0$ Either $2x - 1 = 0$ or $2x - 1 = 0$ $x = 1/2$ or $x = 1/2$ Verification: Sum of zeroes = - b/a RHS = $\frac{-b}{a}$ LHS = Sum of zeroes = $\frac{1}{2} + \frac{1}{2}$ $= -(\frac{-4}{4})$ = 1 = 1 Product of zeroes = $\frac{c}{a}$ LHS = Product of zeroes = $\frac{1}{2} \times \frac{1}{2}$ RHS = $\frac{c}{a}$ $= \frac{1}{4}$ $= \frac{1}{4}$	 1 1 ½ ½
Q31.	$\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$ L.H.S. = $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta}$ We know that $\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\cot\theta = \frac{\cos\theta}{\sin\theta}$ Now, substitute it in the given equation, to convert it in a simplified form $= [(\sin\theta/\cos\theta)/1-(\cos\theta/\sin\theta)] + [(\cos\theta/\sin\theta)/1-(\sin\theta/\cos\theta)]$ $= [(\sin\theta/\cos\theta)/(\sin\theta-\cos\theta)/\sin\theta] + [(\cos\theta/\sin\theta)/(\cos\theta-\sin\theta)/\cos\theta]$ $= \sin^2\theta/[\cos\theta(\sin\theta-\cos\theta)] + \cos^2\theta/[\sin\theta(\cos\theta-\sin\theta)]$ $= \sin^2\theta/[\cos\theta(\sin\theta-\cos\theta)] - \cos^2\theta/[\sin\theta(\sin\theta-\cos\theta)]$ $= 1/(\sin\theta-\cos\theta)\ [(\sin^2\theta/\cos\theta) - (\cos^2\theta/\sin\theta)]$ $= 1/(\sin\theta-\cos\theta) \times [(\sin^3\theta - \cos^3\theta)/\sin\theta\cos\theta]$ $= [(\sin\theta-\cos\theta)(\sin^2\theta+\cos^2\theta+\sin\theta\cos\theta)]/[(\sin\theta-\cos\theta)\sin\theta\cos\theta]$ $= (1 + \sin\theta\cos\theta)/\sin\theta\cos\theta$	 1 1

= 1/sin θ cos θ + 1 — 1

= 1 + sec θ cosec θ = R.H.S.

Therefore, L.H.S. = R.H.S.

Or

(cos A + sin A+1)/(cos A– sin A + 1)

Divide the numerator and denominator by cos A, we get

= (cos A + sin A + 1)/cos A/(cos A – sin A+1)/cos A — 1

We know that sin A/cos A = tan A and 1/cos A = sec A

= (1 + tan A + sec A)/(1 – tan A + sec A)

= (($\sec^2$ A – $\tan^2$ A) + tan A + sec A)/(1– tan A + sec A)

= ((sec A – tan A) (sec A + tan A) + (tan A + sec A))/(1– tan A + sec A) — 1

= (sec A + tan A) (~~sec A – tan A + 1~~))/(~~1 – tan A + sec A~~)

= sec A + tan A

= 1/ cos A + sin A/ cos A

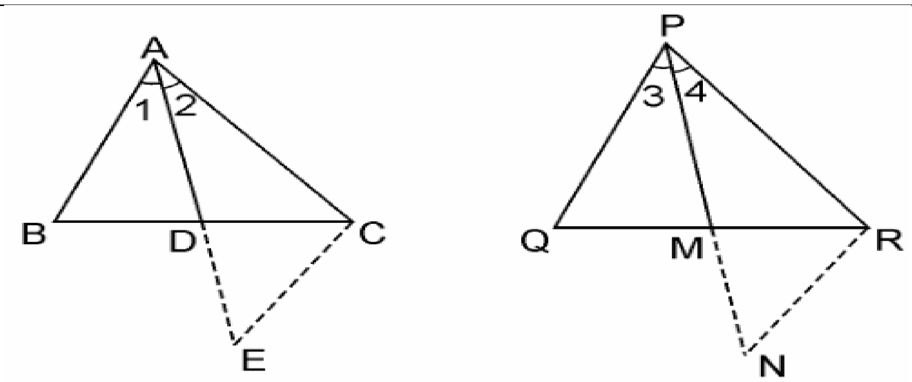
= (1 + sin A)/ cos A = R.H.S.

Therefore, $\dfrac{1+\cos\theta+\sin\theta}{1+\cos\theta-\sin\theta}=\dfrac{1+\sin\theta}{\cos\theta}$. — 1

Hence Proved

Section – D

Q32.



Given: In ΔABC and ΔPQR, AD and PM are medians such that $\frac{AB}{PQ}=\frac{AC}{PR}=\frac{AD}{PM}$.

To Prove: ΔABC~ΔPQR.

Construction: Produce AD to E such that AD = DE. Join CE. — 1

Similarly produce PM to N such that PM = MN, also Join RN.
Proof:
In ΔABD and ΔCDE, we have
AD = DE [By Construction]
BD = DC [∵ AD is the median]
And, ∠ADB = ∠CDE [Vertically opposite angles]
∴ΔABD ≅ ΔCED [By SAS criterion of congruence] 1
⇒ AB = CE[by CPCT]……..(i)
Also, in ΔPQM and ΔMNR,
PM = MN [By Construction]
QM = MR [∴PM is the median]
And, ∠PMQ = ∠NMR [Vertically opposite angles]
∴ΔPQM ≅ ΔMNR [By SAS criterion of congruence] 1
⇒ PQ = RN [by CPCT] ………(ii)
Now $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM}$.
⇒ $\frac{CE}{RN} = \frac{AC}{PR} = \frac{AD}{PM}$. [From(i)and(ii)]
⇒ $\frac{CE}{RN} = \frac{AC}{PR} = \frac{2AD}{2PM}$.
⇒ $\frac{CE}{RN} = \frac{AC}{PR} = \frac{AE}{PN}$. [∴2AD=AE and 2PM=PN]
∴ΔACE ~ ΔPRN [By SSS similarity criterion] 1
Therefore, ∠2 = ∠4
Similarly, ∠1 = ∠3
∴ ∠1 + ∠2 = ∠3 + ∠4
⇒∠A = ∠P...(iii)
Now, in ΔABC and ΔPQR, we have
$\frac{AB}{PQ} = \frac{AC}{PR}$ (Given)
∠A = ∠P[From(iii)]
∴ΔABC ~ ΔPQR [By SAS similarity criterion] 1

Q33. Frequency distribution table is

Variables	Frequency	Cumulative Frequency
10 – 20	12	12
20 – 30	30	42
30 – 40	x	42 + x
40 – 50	65	107 + x
50 – 60	y	107 + x + y
60 – 70	25	132 + x + y
70 – 80	18	150 + x + y
	n = 150 + x + y	

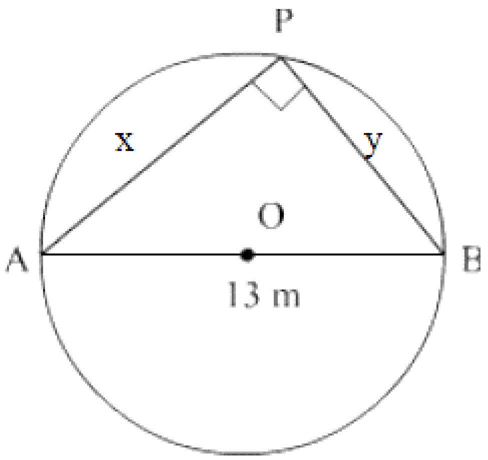
n = 230 (given)
So, 150 + x + y = 230
x + y = 80…………….(i)
Median = 46 so median class is 40 – 50.
So l = 40, f = 65, h = 10 and cf = 42 + x
Also n = 230 so $\frac{n}{2} = \frac{230}{2} = 115$.

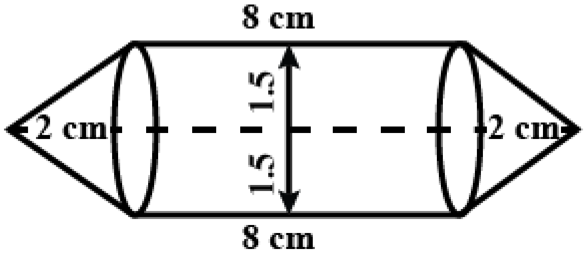
$$\text{Median} = l + \left(\frac{\frac{n}{2} - (42 + x)}{f}\right) \times h$$

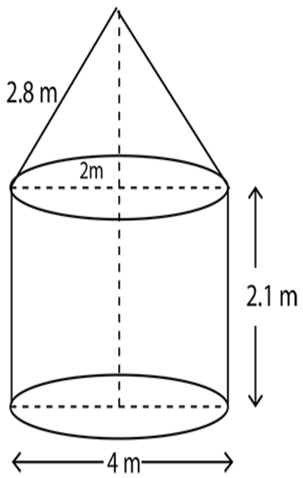
$$46 = 40 + \left(\frac{115 - 42 - x)}{65}\right) \times 10$$

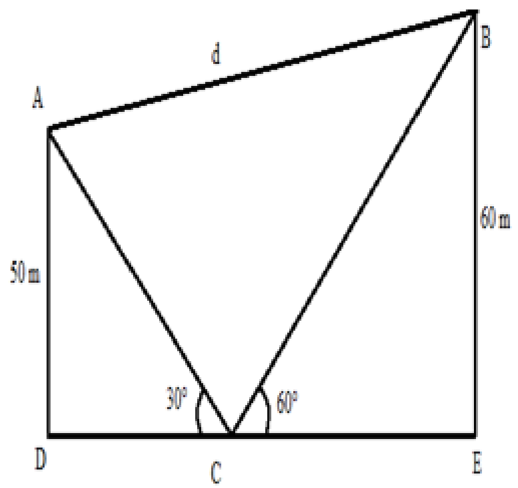
$$6 = \left(\frac{73 - x)}{65}\right) \times 10$$

390 = (73 – x) × 10
39 = 73 – x

	$x = 73 - 39$ $x = 34$………………….(ii) Using (ii) into (i) $34 + y = 80$ $y = 46$ Hence, the missing frequencies are 34 and 46.	
Q34.	Let the original average speed of train be x km/h. Time taken by train to cover 63 km with original speed = $\frac{63}{x}$ Time taken by train to cover 72 km with increased speed = $\frac{72}{x+6}$	1
	It is given that ; $\frac{63}{x} + \frac{72}{x+6} = 3$	1
	$\frac{63(x+6)+72x}{x(x+6)} = 3$ $\frac{63x+378+72x}{x(x+6)} = 3$	1
	$135x + 378 = 3(x^2 + 6x)$ $135x + 378 = 3x^2 + 18x$ $3x^2 - 117x - 378 = 0$ $x^2 - 39x - 126 = 0$	1
	$x^2 - 42x + 3x - 126 = 0$ $x(x - 42) + 3(x - 42) = 0$ $(x - 42)(x + 3) = 0$ $x - 42 = 0, x + 3 = 0$ $x = 42, x = -3$(rejected) Speed cannot be negative, so the original average speed is 42km/hr.	1
	Or  The pole should be erected at 12 m and 5 m from the two gates. Let A and B be the opposing fixed gates and P be the pole that needs to be built. Given that PA – PB = 7	

	Let PA = x, PB = y Hence x – y = 7 ⇒ x = 7 + y ..(1) In right triangle PAB $AB^2 = AP^2 – BP^2$ (By Pythagoras Theorem) Substituting the values we get $13^2 = x^2 – y^2$ $169 = (7 + y)^2 + y^2$ $169 = 49 + 14y + 2y^2$ $2y^2 + 14y – 120 = 0$ Taking common from above equation we get $y^2 + 7y – 60 = 0$ $y^2 + 12y – 5y – 60 = 0$ Taking common we get y(y + 12) – 5 (y + 12) = 0 (y + 12) (y – 5) = 0 y = 5 or y = -12 As y cannot be negative Therefore, y = 5, x = 7 + 5 = 12 Hence, PA = 12 m and PB = 5 m	1 1 1 1 1
Q35.	 Finding the radius and height of cone and cylinder Radius of the conical and cylindrical part (r)= $\frac{3}{2}$ cm Height of the cylindrical part (H)=8cm Height of the conical part (h)=2cm Step 2: Finding the volume of air in the model	1 1

	Volume of air in the model=Volume of cylinder +2×Volume of cone Volume of cylinder = $\pi r^2 H$ $= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 8$ Volume of cone = $\frac{1}{3} \pi r^2 h$ $= \frac{1}{3} \times \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 2$ Volume of air $= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 8 + 2 \times \frac{1}{3} \times \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 2$ $= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times \left(8 + 2 \times \frac{1}{3} \times 2\right)$ $= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times \left(8 + \frac{4}{3}\right)$ $= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times \frac{28}{3}$ $= 66 \text{ cm}^3$ Hence, the volume of air in the model is 66 cm^3 Or  Given: Height (h) of the cylindrical part = 2.1 m Diameter of the cylindrical part = 4 m Radius of the cylindrical part = 2 m Slant height (l) of conical part = 2.8 m Area of canvas used = CSA of conical part + CSA of cylindrical part $= \pi rl + 2\pi rh$ $= \pi \times 2 \times 2.8 + 2\pi \times 2 \times 2.1$ $= 2\pi [2.8 + 4.2]$ $= 2 \times \frac{22}{7} \times 7$ $= 44 \text{ m}^2$ Cost of 1 m^2 canvas = 500 rupees Cost of 44 m^2 canvas = 44 × 500 = 22000 rupees. Therefore, it will cost 22000 rupees for making such a tent.	1 1 1 1 1 2 1
Section - E		
Q36.	(i) So AP from the given situation will be: 51, 49, 47,…………… (ii) a = 51, d = 49 – 51= - 2, $a_n = 31$ 31 = 51 + (n – 1)(- 2)	1

	11 = n (iii) $a_n = 2n + 3$, $a_{n-1} = 2(n-1) + 3$ 2x, , d = $2n + 3 - 2n + 2 - 3 = 2$ Or x + 10 – 2x = 3x + 2 – x – 10 - x + 10 = 2x – 8 18 = 3x x = 6	1 2
Q37.	 In ΔADC, $\frac{AD}{DC} = tan\ 30°$ $\frac{50}{DC} = \frac{1}{\sqrt{3}}$ DC = $50\sqrt{3}$ m $\frac{AD}{AC} = sin\ 30°$ $\frac{50}{AC} = \frac{1}{2}$ AC = 100 m In ΔBEC, $\frac{BE}{EC} = tan\ 60°$ $\frac{60}{EC} = \sqrt{3}$ $\frac{60}{\sqrt{3}}$ = EC EC = $20\sqrt{3}$ m $\frac{BE}{BC} = sin\ 60°$ $\frac{60}{BC} = \frac{\sqrt{3}}{2}$ $\frac{60 \times 2}{\sqrt{3}}$ = BC $\frac{120}{\sqrt{3}}$ = BC BC = $40\sqrt{3}$ In ΔABC, ∠ACB = 90° $AB^2 = AC^2 + BC^2$ $= (100)^2 + (40\sqrt{3})^2$ = 10000 + 4800 = 14800 AB = $\sqrt{14800}$ AB = $20\sqrt{37}$ (i) CD = $50\sqrt{3}$ m (ii) CE = $20\sqrt{3}$ m (iii) Distance from kite A = 100 m, Distance from kite B = $40\sqrt{3}$ Or AB = $20\sqrt{37}$ m	1 1 2
Q38.	Coordinates from the given figure are: A(3, 0), B(5, 0), C(7, 2), D(7, 3), E(5, 5), F(3, 5), G(1, 3) and H(1, 2). (i) Abscissas of point B – Abscissas of point F = 5 – 3 = 2 (ii) Ordinates of point E – Ordinates of point H = 5 – 2 = 3 (iii) GD = $\sqrt{(7-1)^2 + (3-3)^2}$	 1 1

	$= \sqrt{(6)^2 + (0)^2} = 6$ AF $= \sqrt{(3-3)^2 + (5-0)^2}$ $= \sqrt{(0)^2 + (5-0)^2} = 5$ Difference of distance GD and distance FA = 6 – 5 = 1 Or GC $= \sqrt{(7-1)^2 + (2-3)^2}$ $= \sqrt{(6)^2 + (-1)^2} = \sqrt{36+1} = \sqrt{37}$	2