B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

PRE BOARD 3 SET1 (2025-26)
MATHEMATICS
MARKING KEY

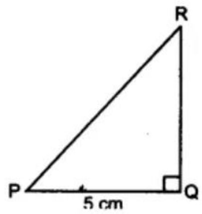
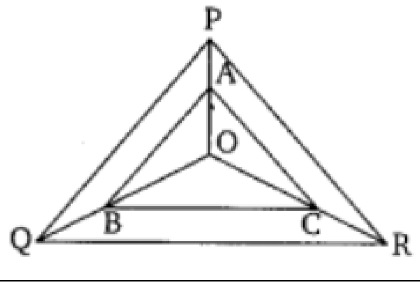
Class: X	**Time: 3hrs**
Date: 20-01-26	**Max Marks: 80**
Admission no:	**Roll no:**

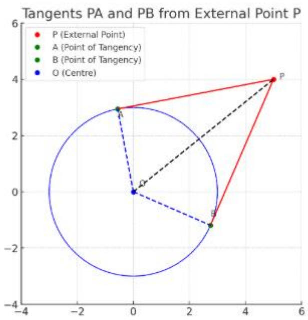
General Instructions:

1. This Question Paper has 5 Sections A, B, C, D and E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case-based integrated units of assessment (04 marks each) with sub-parts.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks have been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION A					
1.	If HCF (16, y) = 8 and LCM (16, y) = 48, then the value of y is				1m
	(a) 24	(b) 16	(c) 8	(d) none of these	
2.	The distance of the point (5, −4) from x-axis is				1m
	(a) 5 units	*(b) 4 units*	(c) 1 unit	(d) none of these	
3.	If the lines given by 3x + 2ky = 2 and 2x + 5y +1= 0 are not parallel, then k has to be				1m
	(a) 15/4	*(b) ≠ 15/4*	(c) any rational number	(d) none of these	
4.	The number of tangents that can be drawn to a circle from a point in its exterior is:				1m
	(a) 2	(b) 1	(c) infinite	(d) none of these	
5.	The value of sin 60^0+ cos 30^0 is:				1m
	(a) 0	*(b) 1*	(c) 2	(d) none of these	
6.	If one root of x^2−7x+10 = 0 is 2, then the other root is:				1m
	(a) 3	(b) 4	*(c) 5*	(d) none of these	
7	The area of a semicircular protractor of diameter 14 cm is:				1m
	(a) 77 cm^2	(b) 154 cm^2	(c) 308 cm^2	(d) none of these	
8	Two coins are tossed together. The probability of getting at least one head is:				1m
	(a) ¼	(b) ½	*(c) 3/4*	(d) none of these	
9	(cos ^4x – sin ^4x) is equal to				1m
	(a) $2\sin^2x$-1	(b)1 – $2\cos^2x$	(c) $\sin^2x – \cos^2x$	(d) $2\cos^2x – 1$	
10	HCF of the given number 'x' and 'y' where y is a multiple of 'x' is given by				1m
	(a) x	(b) y	(c) xy	(d) none of these	

11	**A solid sphere of radius 7 cm is melted to form small spherical balls each of radius 1 cm. The number of such balls formed is:**				**1m**
	(a) 343	**(b) 539**	**(c) 1029**	**(d) none of these**	
12	**The discriminant of the quadratic equation $3x^2 - 2x + 5 = 0$ is:**				**1m**
	(a) - 56	**(b) 56**	**(c) 64**	**(d) none of these**	
13	**The perimeter of a semicircle of radius 7 cm is**				**1m**
	(a) 22 cm	***(b) 36 cm***	**(c) 44**	**(d) none of these**	
14	**If tan A = 1, then the value of A is**				**1m**
	(a) 0^0	**(b) 30^0**	***(c) 45^0***	**(d) none of these**	
15	**A bag contains 5 red balls and 3 black balls. A ball is drawn at random. The probability of getting a black ball is:**				**1m**
	(a) 5/8	***(b) 3/8***	**(c) 1/8**	**(d) none of these**	
16	**The centroid of the triangle whose vertices are (1, 2), (3, 4), (5, 6) is:**				**1m**
	(a) (3, 4)	**(b) (2, 3)**	**(c) (3, 5)**	**(d) none of these**	
17	**If the mode of a distribution is 65 and the median is 61, then the mean is approximately:**				**1m**
	(a) 59	**(b) 63**	**(c) 67**	**(d) none of these**	
18	**Tangents drawn at the ends of a diameter of a circle are:**				**1m**
	(a) Parallel	**(b) Perpendicular**	**(c) Intersect at 45°**	**(d) none of these**	
19	**Assertion (A): Every positive integer can be uniquely factorised into primes.** **Reason (R): The Fundamental Theorem of Arithmetic states that every composite number can be expressed as the product of primes in a unique way, apart from the order of the factors.**				**1m**
	(a) Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A). **(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).** **(c) Assertion (A) is true and Reason (R) is false.** **(d) Assertion (A) is false and Reason (R) is true.**				
20	**Assertion (A): tan45 ^{0} = 1.** **Reason (R): In an isosceles right triangle, perpendicular = base.**				**1m**
	(a) Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A). **(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).** **(c) Assertion (A) is true and Reason (R) is false.** **(d) Assertion (A) is false and Reason (R) is true.**				
	SECTION B				
21	**Which term of the AP 2, 7, 12, 17, … will be 82?**				**2m**
	Or **How many terms of the AP 9, 17, 25, 33, ...must be taken to get a sum of 636?**				

A:-	Given AP: $a = 2,\ d = 5$. Want n such that $a_n = 82$. Use $a_n = a + (n-1)d$. 1. $82 = 2 + (n-1)\cdot 5$. 2. Subtract: $82 - 2 = 80$. 3. Divide: $80 \div 5 = 16$. So $n - 1 = 16$. 4. Add 1: $n = 16 + 1 = 17$. Double-check by computing the 17th term: $$a_{17} = 2 + (17-1)\cdot 5 = 2 + 16 \cdot 5.$$ Compute $16 \cdot 5 = (10\cdot 5) + (6 \cdot 5) = 50 + 30 = 80$. Thus $2 + 80 = 82$.	1m 1m
	Or $a = 9,\ d = 8,\ S_n = 636$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $636 = \frac{n}{2}[18 + 8n - 8] = \frac{n}{2}(8n + 10)$ $1272 = n(8n+10) \Rightarrow 8n^2 + 10n - 1272 = 0 \Rightarrow n = 12$ $\boxed{12 \text{ terms}}$	1m 1m
22	**In ΔPQR, right-angled at Q, PR + QR = 25 cm and PQ = 5 cm. Determine the values of sin P, cos P and tan P.**	2m
A:-	In right angled ΔPQR $PR^2 = PQ^2 + QR^2 \Rightarrow PQ^2 = PR^2 - QR^2$ $\Rightarrow (5)^2 = (PR + QR)(PR - QR)$ $\Rightarrow 25 = 25(PR - QR) \Rightarrow \frac{25}{25} = PR - QR$ $\Rightarrow PR - QR = 1$ ... (*i*) and $PR + QR = 25$ ... (*ii*) On adding equation (*i*) and (*ii*), we get $2PR = 26 \Rightarrow PR = \frac{26}{2} = 13$ cm From equation (*i*), $PR - QR = 1 \Rightarrow QR = 13 - 1$ $QR = 12$ cm 	1m 1m
23	**In the given figure, A, B and C are points on OP, OQ and OR respectively such that AB || PQ and AC || PR. Show that BC || QR.**	3m
		
24	**The minute hand of a clock is 14 cm long. Find the area swept by it in 5 minutes.**	2m
A:-	Sol: In 5 min, angle = 30° (since 60 min → 360°). Area = 30/360 × πr² = 1/12 × 22/7 × 14² = 51.33 cm².	1m 1m
	Or **Find the length of an arc of a circle of radius 14 cm which subtends an angle of 45° at the centre.**	
A:-	Arc length = (45°/360°) × 2πr = (1/8) × 2 × (22/7) × 14 = 11 cm	1m 1m
25	**From an external point P, tangents PA and PB are drawn to a circle with centre O. Prove PA = PB.**	2m

<table>
<tr><td>A:-</td><td>

In ΔOPA and ΔOPB, OP common, ∠OPA = ∠OPB = 90°, OA = OB. By RHS, PA = PB ✅</td><td>1m

1m</td></tr>
<tr><td></td><td><u>SECTION C</u></td><td></td></tr>
<tr><td>26</td><td>A circle is inscribed in a quadrilateral ABCD such that it touches AB, BC, CD, DA at P, Q, R, S respectively. Prove that:
AB+CD=AD+BC.</td><td>3m</td></tr>
<tr><td>A:-</td><td>Let the circle touch AB, BC, CD, DA at P, Q, R, S. Tangents from the same vertex are equal, so

$$AP = AS, \quad BP = BQ, \quad CQ = CR, \quad DR = DS.$$

Now write the sides:

$$AB = AP + BP, \quad BC = BQ + CQ, \quad CD = CR + DR, \quad DA = DS + SA.$$

Hence

$$AB + CD = (AP + BP) + (CR + DR)$$

and

$$AD + BC = (DS + SA) + (BP + CQ) = (DR + AP) + (BP + CQ).$$

Using $CQ = CR$ and $DS = DR$ the two sums are identical, so

$$\boxed{AB + CD = AD + BC}.$$</td><td>1m

1m

1m</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>27</td><td>The traffic lights at three different road crossings change after every 48 seconds, 72 seconds and 108 seconds respectively. If they change together at 7:00 a.m., at what time will they change together again?</td><td>3m</td></tr>
<tr><td>A:-</td><td>Find LCM of 48, 72, 108
Prime factors:
$48 = 2^4 \times 3$
$72 = 2^3 \times 3^2$
$108 = 2^2 \times 3^3$
LCM = $2^4 \times 3^3 = 16 \times 27 = 432$ s = 7 min 12 s
✅ They will change together again at 7:07:12 a.m.</td><td>1m

1m

1m</td></tr>
<tr><td>28</td><td>If α and β are the zeros of $2x^2 - x - 3$, find the quadratic polynomial (with integer coefficients) having 1/ α and 1 / β as its zeros.</td><td>3m</td></tr>
</table>

A:-	Given polynomial: $2x^2 - x - 3$ $$\alpha+\beta=\tfrac{1}{2},\quad \alpha\beta=-\tfrac{3}{2}$$ $$\frac{1}{\alpha}+\frac{1}{\beta}=\frac{\alpha+\beta}{\alpha\beta}=\frac{\frac{1}{2}}{-\frac{3}{2}}=-\tfrac{1}{3},\quad \frac{1}{\alpha}\cdot\frac{1}{\beta}=\frac{1}{\alpha\beta}=-\tfrac{2}{3}$$ New polynomial: $$x^2-\left(-\tfrac{1}{3}\right)x+\left(-\tfrac{2}{3}\right)=x^2+\tfrac{1}{3}x-\tfrac{2}{3}$$ Multiply by 3: $$\boxed{3x^2+x-2}$$	**2m** **1m**
29	**Prove that:** $$\frac{\sin\theta-\cos\theta}{\sin\theta+\cos\theta}+\frac{\sin\theta+\cos\theta}{\sin\theta-\cos\theta}=\frac{2}{2\sin^2\theta-1}$$ **Or** **Prove that:** $$\frac{\sin\theta}{1+\cos\theta}+\frac{1+\cos\theta}{\sin\theta}=2\operatorname{cosec}\theta$$	**3m**
A:-	(i) Prove $\dfrac{\sin\theta-\cos\theta}{\sin\theta+\cos\theta}+\dfrac{\sin\theta+\cos\theta}{\sin\theta-\cos\theta}=\dfrac{2}{2\sin^2\theta-1}$. Short solution: LHS $=\dfrac{(\sin\theta-\cos\theta)^2+(\sin\theta+\cos\theta)^2}{\sin^2\theta-\cos^2\theta}$ $=\dfrac{2\sin^2\theta+2\cos^2\theta}{\sin^2\theta-\cos^2\theta}=\dfrac{2}{\sin^2\theta-\cos^2\theta}$. But $\sin^2\theta-\cos^2\theta=2\sin^2\theta-1$. Hence LHS $=\dfrac{2}{2\sin^2\theta-1}=$ RHS. □ (ii) Prove $\dfrac{\sin\theta}{1+\cos\theta}+\dfrac{1+\cos\theta}{\sin\theta}=2\csc\theta$. Short solution: LHS $=\dfrac{\sin^2\theta+(1+\cos\theta)^2}{\sin\theta(1+\cos\theta)}$ $=\dfrac{\sin^2\theta+1+2\cos\theta+\cos^2\theta}{\sin\theta(1+\cos\theta)}=\dfrac{2(1+\cos\theta)}{\sin\theta(1+\cos\theta)}=\dfrac{2}{\sin\theta}=2\csc\theta$. □	**1m** **1m** **1m** **1m** **1m** **1m**
30	**A card is drawn from a well-shuffled pack of 52 cards. Find the probability of getting:** **(i) neither a red card nor a king,** **(ii) a black card or a jack.**	**3m**

A:-	**(i) Probability of getting neither a red card nor a king** • Red cards in a deck = 26 (hearts + diamonds). • Kings in a deck = 4 (two red + two black). So, "red card or a king" = $26 + 4 - 2$ (subtract the two red kings counted twice) = 28. Thus, "neither a red card nor a king" = $52 - 28 = 24$. $$P(\text{neither red card nor king}) = \frac{24}{52} = \frac{6}{13}$$ **(ii) Probability of getting a black card or a jack** • Black cards = 26. • Jacks = 4. • Black jacks = 2 (common in both). So, total favourable = $26 + 4 - 2 = 28$. $$P(\text{black card or jack}) = \frac{28}{52} = \frac{7}{13}$$	**2m** **1m**
	Or	
	A bag contains 12 balls, out of which x are black. If one ball is drawn at random, the probability of getting a black ball is 1/3. Find the value of x.	
A	**Total balls = 12** **Black balls = x** **Probability of getting a black ball = 1/3** $$P(\text{black ball}) = \frac{\text{Number of black balls}}{\text{Total number of balls}}$$ $$\frac{x}{12} = \frac{1}{3}$$ Cross multiply: $$x = \frac{12}{3} = 4$$	**1m** **2m**
31	**In a park, the entry fee for adults and children is different. The total cost for entry of one adult and two children is Rs.100. The total cost for two adults and three children is Rs.160.** **Form a pair of linear equations for this situation and find the entry fee for:** **(i) one adult, and** **(ii) one child.**	**3m**

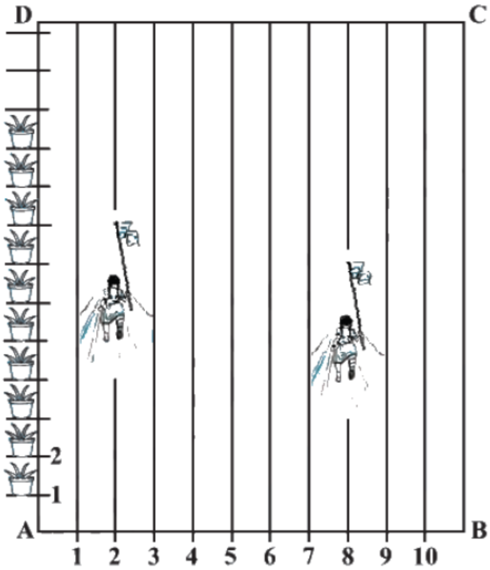
A:-	**Step 1: Assume variables** Let the entry fee for one adult = Rs. x Let the entry fee for one child = Rs. y **Step 2: Form equations** From the first condition: $$x + 2y = 100 \quad \ldots(1)$$ From the second condition: $$2x + 3y = 160 \quad \ldots(2)$$ **Step 3: Solve equations (Elimination method)** Multiply (1) by 2: $$2x + 4y = 200 \quad \ldots(3)$$ Subtract (2) from (3): $$(2x + 4y) - (2x + 3y) = 200 - 160$$ $$y = 40$$ Substitute $y = 40$ in (1): $$x + 2(40) = 100$$ $$x + 80 = 100 \;\Rightarrow\; x = 20$$	**1m** **1m** **1m**
	SECTION D	
32	**The product of two consecutive positive integers is 306. Find the integers.** **Or** **A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 48 minutes less for the journey. Find the speed of the train.**	**5m**

A:-	**Step 1: Assume numbers** Let the integers be $$x \quad \text{and} \quad x+1$$ **Step 2: Form the equation** $$x(x+1) = 306$$ $$x^2 + x - 306 = 0$$ **Step 3: Solve quadratic** Discriminant: $$D = 1^2 - 4(1)(-306) = 1 + 1224 = 1225$$ $$\sqrt{D} = 35$$ $$x = \frac{-1 \pm 35}{2}$$ $$x = \frac{34}{2} = 17 \quad \text{or} \quad x = \frac{-36}{2} = -18$$ **Step 4: Choose positive integers** Only positive: $x = 17$. So integers are 17 and 18.	**2m** **2m** **1m**
	Let the speed of the train = x km/h. Then, $$\text{Time}_1 = \frac{360}{x}, \quad \text{Time}_2 = \frac{360}{x+5}$$ Given: $$\frac{360}{x} - \frac{360}{x+5} = \frac{48}{60} = 0.8$$ $$360\left(\frac{5}{x(x+5)}\right) = 0.8 \Rightarrow 1800 = 0.8x(x+5)$$ $$x^2 + 5x - 2250 = 0 \Rightarrow (x+50)(x-45) = 0$$ $$x = 45$$ ✅ **Speed of the train = 45 km/h**	**2m** **2m** **1m**
33	**State and prove Basic Proportionality theorem.**	**5m**

A:-	**Statement:** In $\triangle ABC$, if a line $DE \parallel BC$ meets AB at D and AC at E, then $$\frac{AD}{DB}=\frac{AE}{EC}.$$ **Proof (short):** Since $DE \parallel BC$, $$\angle ADE=\angle ABC \quad \text{and} \quad \angle AED=\angle ACB \quad (\text{corresponding angles}).$$ So, $\triangle ADE \sim \triangle ABC$ (by AA similarity). Hence, $$\frac{AD}{AB}=\frac{AE}{AC}.$$ Now, write $AB=AD+DB$ and $AC=AE+EC$. From the above ratio, $$\frac{AD}{AD+DB}=\frac{AE}{AE+EC}.$$ Cross multiply and simplify → $$\frac{AD}{DB}=\frac{AE}{EC}.$$ Thus proved. ✅	1m 2m 2m
34	**A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are 2.1 m and 4 m respectively, and the slant height of the top is 2.8 m, find the cost of canvas needed to make the tent, if the canvas costs ₹500 per m². (Note: Leave out the floor of the tent.)**	5m
A:-	**Ans.** Radius $r=2$ m CSA (cylinder) = $2\pi rh=2\times\frac{22}{7}\times2\times2.1=26.4\,m^2$ CSA (cone) = $\pi rl=\frac{22}{7}\times2\times2.8=17.6\,m^2$ Total CSA = $26.4+17.6=44\,m^2$ Cost = $44\times500=₹22{,}000$	2m 2m 1m
	Or	
	A wooden toy is in the form of a cone surmounted on a hemisphere. The diameter of the base of the cone is 6 cm and its height is 4 cm. Find the volume of the toy and the area of the surface painted (total surface area). **(Use π = 3.14)**	
	Radius (r) = 3 cm, height (h) = 4 cm **(i) Volume** $$V=\frac{2}{3}\pi r^3+\frac{1}{3}\pi r^2h=\frac{1}{3}\pi(2\times27+9\times4)=94.2\text{ cm}^3$$ **(ii) Total surface area** $$TSA=\pi r(l+r)$$ where $l=\sqrt{r^2+h^2}=\sqrt{9+16}=5$ $$TSA=3.14\times3(5+3)=3.14\times24=75.36\text{ cm}^2$$ ✅ Volume = 94.2 cm³, TSA = 75.36 cm²	2m 2m 1m

35	**The marks obtained by 100 students are given below. If the mean marks are 29, find the missing frequencies x and y.**	**5m**
	Classes: 0-10, 10-20, 20-30, 30-40, 40-50; frequency: 10, x, 30, y, 20	
A:-	Solution (step-by-step) 1. Use total frequency condition: $$10 + f_1 + 30 + f_2 + 20 = 100 \quad \Rightarrow \quad f_1 + f_2 = 40. \qquad (1)$$ 2. Use mean formula: $$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} \quad \Rightarrow \quad \sum f_i x_i = 100 \times 29 = 2900.$$ Compute contribution of known classes: $$10 \times 5 + 30 \times 25 + 20 \times 45 = 50 + 750 + 900 = 1700.$$ So the contribution from the unknown classes must satisfy: $$1700 + 15f_1 + 35f_2 = 2900 \quad \Rightarrow \quad 15f_1 + 35f_2 = 1200.$$ Divide by 5: $$3f_1 + 7f_2 = 240. \qquad (2)$$ 3. **Solve (1) and (2):** from (1), $f_2 = 40 - f_1$. Substitute into (2): $$3f_1 + 7(40 - f_1) = 240$$ $$3f_1 + 280 - 7f_1 = 240$$ $$-4f_1 = -40 \quad \Rightarrow \quad f_1 = 10.$$ Then $f_2 = 40 - 10 = 30$.	**2m** **2m** **1m**
	SECTION E	
36	**Electric poles are placed along a straight road at equal distances. The first pole is at a distance of 50 m, the second at 55 m, the third at 60 m, and so on. The poles thus form an arithmetic progression (AP).** **Answer the following questions:** **(i) Which pole will be at 200 m?** **(ii) How many poles are there between 50 m and 200 m (inclusive)?** **(iii) At what distance from the starting point is the 15th pole?** **Or** **(iii) If the total length of the road is 500 m, how many poles will be placed along the road?**	**4m**
A:-	(i) $a_n = 200$ $200 = 50 + (n-1)5$ $n = 31$ ✅ **31st pole** (ii) From 1st (50 m) to 31st (200 m) ✅ **31 poles** (iii) $a_{15} = 50 + (15-1) \cdot 5 = 120$ ✅ **15th pole at 120 m** (iv) $a_n \leq 500$ $50 + (n-1)5 \leq 500 \Rightarrow n = 91$ ✅ **91 poles**	**1m** **1m** **2m**
37	**In order to conduct Sports Day activities in your School, lines have been drawn with chalk powder at a distance of 1 m each, in a rectangular shaped ground ABCD, 100 flowerpots have been placed at a distance of 1 m from each other along AD, as shown in**	**4m**

given figure below. Niharika runs 1/4 th the distance AD on the 2nd line and posts a green flag. Preet runs 1/5 th distance AD on the eighth line and posts a red flag.



(i) What are the coordinates of Red Flag ?
(ii) What are the coordinates of Green flag ?
(iii) What is the distance between both the flags?

Or

(iii) If Rashmi has to post a blue flag exactly halfway between the line segment joining the two flags, where should she post her flag?

A:-

1. Red flag (Preet)
   $x = 8,\ y = \frac{1}{5} \times 100 = 20$
   Answer: $(8,\ 20)$. **1m**
2. Green flag (Niharika)
   $x = 2,\ y = \frac{1}{4} \times 100 = 25$
   Answer: $(2,\ 25)$. **1m**
3. Distance between flags
   $d = \sqrt{(8-2)^2 + (20-25)^2} = \sqrt{6^2 + (-5)^2} = \sqrt{36+25} = \sqrt{61}$ m ≈ 7.81 m. **2m**

Or (midpoint for blue flag)

Midpoint $= \left(\frac{2+8}{2}, \frac{25+20}{2}\right) = (5,\ 22.5)$.

38 **Two poles of equal height are standing opposite each other on either side of a road 80 m wide. At a point between them, angles of elevation of the tops are 60° and 30°.** **4m**
(i) Let height = h. Write equations using tan 60° and tan 30°.

Or

(i) Find the distance of the point from the poles.
(ii) Find the height of each pole.
(iii) Verify that the sum of distances = 80 m.

A:-	1. From $\tan 60^\circ = \sqrt{3}$: $\sqrt{3} = \frac{h}{x} \Rightarrow h = x\sqrt{3}$. (Equation 1) 2. From $\tan 30^\circ = \frac{1}{\sqrt{3}}$: $\frac{1}{\sqrt{3}} = \frac{h}{80 - x} \Rightarrow h = \frac{80 - x}{\sqrt{3}}$. (Equation 2)	**2m**
	3. Equate (1) and (2): $x\sqrt{3} = \frac{80 - x}{\sqrt{3}}$. Multiply both sides by $\sqrt{3}$: $x(\sqrt{3} \cdot \sqrt{3}) = 80 - x \rightarrow x \cdot 3 = 80 - x$. So $3x = 80 - x$. Rearranging: $3x + x = 80 \rightarrow 4x = 80$. Divide: $x = \frac{80}{4} = 20$. **Checked arithmetic**: $4 \times 20 = 80$ ✓.	**1m**
	4. Distance to other pole: $80 - x = 80 - 20 = 60$. ✓ 5. Height $h = x\sqrt{3} = 20\sqrt{3}$.	**1m**

*****************Best of luck****************