Mind Curve Mid-Term Test Series 2026–27

Class X | Test 04 – Answer Key

Chapters 8–9: Trigonometry & Some Applications of Trigonometry

Q.No	Step-by-Step Solution	Marks per Step
	SECTION – A (Q1–10, 1 mark each)	
1	**Q1** Given $3\tan x = 4 \Rightarrow \tan x = \frac{4}{3}$ In a right triangle with $\tan x = \frac{4}{3}$: opposite $= 4k$, adjacent $= 3k$, hypotenuse $= 5k$ So $\sin x = \frac{4}{5}$ and $\cos x = \frac{3}{5}$ $\sin x + \cos x = \frac{4}{5} + \frac{3}{5} = \frac{7}{5}$ **Answer: (c) 7/5**	*1 mark for the correct option.*
2	**Q2** $\tan 30^\circ = \frac{1}{\sqrt{3}} \Rightarrow \tan^2 30^\circ = \frac{1}{3}$ $\frac{1-\tan^2\theta}{1+\tan^2\theta} = \frac{1-\frac{1}{3}}{1+\frac{1}{3}} = \frac{\frac{2}{3}}{\frac{4}{3}} = \frac{1}{2}$ **Answer: (a) 1/2**	*1 mark for the correct option.*
3	**Q3** Squaring both sides: $(\sin\theta + \cos\theta)^2 = 2$ $\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 2 \Rightarrow 1 + 2\sin\theta\cos\theta = 2$ $\sin\theta\cos\theta = \frac{1}{2}$ $\tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta} = \frac{1}{\frac{1}{2}} = 2$ **Answer: (b) 2**	*1 mark for the correct option.*
4	**Q4** $\tan\beta = \frac{4}{5}$ Dividing numerator and denominator by $\cos\beta$: $\frac{5\sin\beta - 2\cos\beta}{5\sin\beta + 2\cos\beta} = \frac{5\tan\beta - 2}{5\tan\beta + 2}$ $= \frac{5\times\frac{4}{5} - 2}{5\times\frac{4}{5} + 2} = \frac{4-2}{4+2} = \frac{2}{6} = \frac{1}{3}$ **Answer: (a) 1/3**	*1 mark for the correct option.*
5	**Q5** Let height $= h$, shadow $= \sqrt{3}\,h$ $\tan\theta = \frac{h}{\sqrt{3}\,h} = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30^\circ$ **Answer: (a) 30°**	*1 mark for the correct option.*

Q.No	Step-by-Step Solution	Marks per Step
6	**Q6** Let height of tower $= h$ Shadow at $30°$: $\tan 30° = \frac{h}{s_1} \Rightarrow s_1 = h\sqrt{3}$ Shadow at $60°$: $\tan 60° = \frac{h}{s_2} \Rightarrow s_2 = \frac{h}{\sqrt{3}}$ $s_1 - s_2 = h\sqrt{3} - \frac{h}{\sqrt{3}} = h\left(\frac{3-1}{\sqrt{3}}\right) = \frac{2h}{\sqrt{3}}$ $\frac{2h}{\sqrt{3}} = 70 \Rightarrow h = \frac{70\sqrt{3}}{2} = 35\sqrt{3}$ **Answer: (b) 35√3 m**	*1 mark for the correct option.*
7	**Q7** Squaring: $(\sin\theta + \operatorname{cosec}\theta)^2 = 4$ $\sin^2\theta + \operatorname{cosec}^2\theta + 2\sin\theta\operatorname{cosec}\theta = 4$ Since $\sin\theta \cdot \operatorname{cosec}\theta = 1$: $\sin^2\theta + \operatorname{cosec}^2\theta + 2 = 4$ $\sin^2\theta + \operatorname{cosec}^2\theta = 2$ **Answer: (d) 2**	*1 mark for the correct option.*
8	**Q8** $\cot^4\theta - \operatorname{cosec}^4\theta = (\cot^2\theta - \operatorname{cosec}^2\theta)(\cot^2\theta + \operatorname{cosec}^2\theta)$ Since $\operatorname{cosec}^2\theta - \cot^2\theta = 1$, we get $\cot^2\theta - \operatorname{cosec}^2\theta = -1$ So $\cot^4\theta - \operatorname{cosec}^4\theta = -(\cot^2\theta + \operatorname{cosec}^2\theta)$ Expression $= -(\cot^2\theta + \operatorname{cosec}^2\theta) + \cot^2\theta + \operatorname{cosec}^2\theta = 0$ **Answer: (a) 0**	*1 mark for the correct option.*
9	**Q9** Given $\sin A = \frac{1}{3}$ $\cos A = \sqrt{1 - \sin^2 A} = \sqrt{1 - \frac{1}{9}} = \sqrt{\frac{8}{9}} = \frac{2\sqrt{2}}{3}$ Reason (R) — the identity $\sin^2\theta + \cos^2\theta = 1$ — is a true, standard identity Since (A) is false and (R) is true **Answer: (a) Both A and R are true, but R is the correct explanation of A**	*1 mark for the correct option.*
10	**Q10** $\tan\theta = \frac{3}{4}$ in a right triangle: opposite $= 3k$, adjacent $= 4k$, hypotenuse $= 5k$ $\sin\theta = \frac{3}{5}$ — Assertion (A) is TRUE Reason (R) states $\sin\theta \le 1$ for $0° \le \theta \le 90°$ — this is TRUE in general, but it does not explain why $\tan\theta = \frac{3}{4}$ gives $\sin\theta = \frac{3}{5}$ **Answer: (b) Both A and R are true, but R is not the correct explanation of A**	*1 mark for the correct option.*
SECTION – B (Q11–13, 2 marks each)		

Q.No	Step-by-Step Solution	Marks per Step
11 (A)	**Q11 (A)** $\cot 45^\circ = 1 \Rightarrow 4\cot^2 45^\circ = 4$ $\sec 60^\circ = 2 \Rightarrow \sec^2 60^\circ = 4$ $\sin 60^\circ = \frac{\sqrt{3}}{2} \Rightarrow \sin^2 60^\circ = \frac{3}{4}$ $4 - 4 + \frac{3}{4} + p = \frac{3}{4} \Rightarrow p = 0$ **Answer: p = 0**	*1 mark for substituting standard values; 1 mark for the value of p.*
11 (B)	**Q11 (B)** $\cos 45^\circ = \frac{1}{\sqrt{2}} \Rightarrow \cos^2 45^\circ = \frac{1}{2} \Rightarrow 2\cos^2 45^\circ = 1$ $\tan 45^\circ = 1 \Rightarrow \tan^2 45^\circ = 1 \Rightarrow 3\tan^2 45^\circ = 3$ $\sin 90^\circ = 1 \Rightarrow \sin^2 90^\circ = 1 \Rightarrow 4\sin^2 90^\circ = 4$ $1 - 3 + 4 = 2$ **Answer: 2**	*1 mark for substituting standard values; 1 mark for the final value.*
12	**Q12** $\sin(A+B) = 1 \Rightarrow A + B = 90^\circ$ $2\cos(A-B) = \sqrt{3} \Rightarrow \cos(A-B) = \frac{\sqrt{3}}{2} \Rightarrow A - B = 30^\circ$ Adding the two equations: $2A = 120^\circ \Rightarrow A = 60^\circ$ Then $B = 90^\circ - 60^\circ = 30^\circ$ **Answer: A = 60°, B = 30°**	*1 mark for forming both equations; 1 mark for the values of A and B.*
13 (A)	**Q13 (A)** $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} = \frac{\frac{1}{2} + \frac{1}{3}}{1 - \frac{1}{2} \cdot \frac{1}{3}}$ $= \frac{\frac{5}{6}}{\frac{5}{6}} = 1$ $\tan(A+B) = 1 \Rightarrow A + B = 45^\circ$ **Answer: A + B = 45°**	*1 mark for substituting values; 1 mark for the final angle.*
13 (B)	**Q13 (B)** (i) $\sec^2 A - \tan^2 A = 1$ for every angle A (standard identity), independent of the value of $\cos A$ (ii) $\cos A = \frac{4}{5} \Rightarrow \sin A = \sqrt{1 - \frac{16}{25}} = \frac{3}{5}$ (using the 3–4–5 triangle) $\sin^2 A = \frac{9}{25}$ $\frac{1 - \sin^2 A}{1 + \sin^2 A} = \frac{1 - \frac{9}{25}}{1 + \frac{9}{25}} = \frac{\frac{16}{25}}{\frac{34}{25}} = \frac{16}{34} = \frac{8}{17}$ **Answer: (i) 1 (ii) 8/17**	*1 mark for part (i); 1 mark for part (ii).*
SECTION – C (Q14–15, 3 marks each)		
14	**Q14**	*1 mark for dividing by cosθ; 1 mark for*

Q.No	Step-by-Step Solution	Marks per Step
	Dividing numerator and denominator of the LHS by $\cos\theta$: $\dfrac{1-\tan\theta}{1+\tan\theta} = \dfrac{1-\sqrt{3}}{1+\sqrt{3}}$ Comparing both sides: $\tan\theta = \sqrt{3}$ $\Rightarrow \theta = 60^\circ$ **Answer: θ = 60°**	*comparing; 1 mark for the final angle.*
15	**Q15** Let the distance between the two buildings be d, and the height of the second building be h From the foot of the second building, the angle of elevation of the top of the first building (30 m) is 60°: $\tan 60^\circ = \dfrac{30}{d}$ $\sqrt{3} = \dfrac{30}{d} \Rightarrow d = \dfrac{30}{\sqrt{3}} = 10\sqrt{3}$ m From the foot of the first building, the angle of elevation of the top of the second building is 30°: $\tan 30^\circ = \dfrac{h}{d}$ $\dfrac{1}{\sqrt{3}} = \dfrac{h}{10\sqrt{3}} \Rightarrow h = \dfrac{10\sqrt{3}}{\sqrt{3}} = 10$ m **Answer: Distance between buildings = 10√3 m ≈ 17.3 m; height of second building = 10 m**	*1 mark for setting up the first equation; 1 mark for the distance; 1 mark for the height.*
	SECTION – D (Q16–17, 4 marks each)	
16	**Q16** **(i) Height of section B** Let the height of the top of section B above the ground be h_B $\tan 30^\circ = \dfrac{h_B}{36}$ $h_B = 36\tan 30^\circ = 36 \times \dfrac{1}{\sqrt{3}} = \dfrac{36}{\sqrt{3}} = 12\sqrt{3}$ m ≈ 20.8 m **Answer: Height of section B = 12√3 m ≈ 20.8 m** **(ii) Length of the wire from O to the top of section B** $\cos 30^\circ = \dfrac{36}{OB}$ $OB = \dfrac{36}{\cos 30^\circ} = \dfrac{36}{\frac{\sqrt{3}}{2}} = \dfrac{72}{\sqrt{3}} = 24\sqrt{3}$ m ≈ 41.6 m **Answer: Length of wire O to top of B = 24√3 m ≈ 41.6 m** **(iii)(A) Height of section A** Total height of the tower (top of section A) above the ground: $\tan 45^\circ = \dfrac{h_A}{36} \Rightarrow h_A = 36$ m Height of section A alone $= h_A - h_B = 36 - 12\sqrt{3}$ m ≈ 15.2 m **Answer: Height of section A ≈ (36 − 12√3) m ≈ 15.2 m**	*(i) 1 mark. (ii) 1 mark. (iii)(A)/(B) 2 marks.*

Q.No	Step-by-Step Solution	Marks per Step
	(iii)(B) Length of the wire from O to the top of section A $\cos 45^\circ = \frac{36}{OA}$ $OA = \frac{36}{\cos 45^\circ} = \frac{36}{\frac{1}{\sqrt{2}}} = 36\sqrt{2}\ \text{m} \approx 50.9\ \text{m}$ **Answer: Length of wire O to top of A = 36√2 m ≈ 50.9 m**	
17	**Q17** **(i) Distance of the first position of the pigeon from the eyes of the boy** Height of the pigeon above the boy's eye level $= 54 - 4 = 50$ m $\sin 60^\circ = \frac{50}{PB_1}$ $PB_1 = \frac{50}{\sin 60^\circ} = \frac{50}{\frac{\sqrt{3}}{2}} = \frac{100}{\sqrt{3}} = \frac{100\sqrt{3}}{3} = \frac{100 \times 1.73}{3} \approx 57.7\ \text{m}$ **Answer: ≈ 57.7 m** **(ii) Distance between the boy and the first pole (before the pigeon flies)** $\tan 60^\circ = \frac{50}{x_1}$ $x_1 = \frac{50}{\tan 60^\circ} = \frac{50}{\sqrt{3}} = \frac{50\sqrt{3}}{3} = \frac{50 \times 1.73}{3} \approx 28.8\ \text{m}$ **Answer: ≈ 28.8 m** **(iii)(A) Distance the pigeon covers in 8 seconds** After flying, $\tan 45^\circ = \frac{50}{x_2} \Rightarrow x_2 = 50$ m Horizontal distance covered $= x_2 - x_1 = 50 - 28.8 = 21.2$ m **Answer: ≈ 21.2 m** **(iii)(B) Speed of the pigeon in m/s** Speed $= \frac{\text{distance covered}}{\text{time taken}} = \frac{21.2}{8} \approx 2.65\ \text{m/s}$ **Answer: ≈ 2.65 m/s**	*(i) 1 mark. (ii) 1 mark. (iii)(A)/(B) 2 marks.*
SECTION – E (Q18–19, 5 marks each)		
18 (A)	**Q18 (A)** From $\tan A = n \tan B$: $\tan B = \frac{\tan A}{n}$ From $\sin A = m \sin B$: $\sin B = \frac{\sin A}{m}$ $\cos B = \frac{\sin B}{\tan B} = \frac{\sin A/m}{\tan A/n} = \frac{n \sin A}{m \tan A} = \frac{n \sin A \cos A}{m \sin A} = \frac{n \cos A}{m}$ Using $\sin^2 B + \cos^2 B = 1$: $\left(\frac{\sin A}{m}\right)^2 + \left(\frac{n \cos A}{m}\right)^2 = 1$ $\sin^2 A + n^2 \cos^2 A = m^2$	*1 mark for expressing tanB, sinB; 2 marks for cosB; 1 mark for substituting in $\sin^2B+\cos^2B=1$; 1 mark for the final result.*

Q.No	Step-by-Step Solution	Marks per Step
	$(1-\cos^2 A)+n^2\cos^2 A = m^2$ $\cos^2 A(n^2-1) = m^2-1$ $\cos^2 A = \frac{m^2-1}{n^2-1}$ — Hence proved **Answer: Proved: cos²A = (m² − 1)/(n² − 1)**	
18 (B)	**Q18 (B)** LHS numerator: $\cos^4 x - \sin^4 x = (\cos^2 x - \sin^2 x)(\cos^2 x + \sin^2 x) = \cos^2 x - \sin^2 x = (\cos x - \sin x)(\cos x + \sin x)$ LHS denominator: $1 - \tan x = 1 - \frac{\sin x}{\cos x} = \frac{\cos x - \sin x}{\cos x}$ LHS $= \frac{(\cos x - \sin x)(\cos x + \sin x)}{\frac{\cos x - \sin x}{\cos x}} = (\cos x + \sin x)\cos x = \cos^2 x + \sin x \cos x$ RHS numerator: $\cot x + 1 = \frac{\cos x}{\sin x} + 1 = \frac{\cos x + \sin x}{\sin x}$ RHS denominator: $\sec x \operatorname{cosec} x = \frac{1}{\cos x \sin x}$ RHS $= \frac{\frac{\cos x + \sin x}{\sin x}}{\frac{1}{\cos x \sin x}} = (\cos x + \sin x)\cos x = \cos^2 x + \sin x \cos x$ LHS = RHS — Hence proved **Answer: Proved: LHS = RHS = cos²x + sinx cosx**	*2 marks for simplifying LHS; 2 marks for simplifying RHS; 1 mark for concluding LHS = RHS.*
19 (A)	**Q19 (A)** Let $t = \tan\theta$, so $\cot\theta = \frac{1}{t}$ $\frac{\tan\theta}{1-\cot\theta} = \frac{t}{1-\frac{1}{t}} = \frac{t^2}{t-1}$ $\frac{\cot\theta}{1-\tan\theta} = \frac{\frac{1}{t}}{1-t} = \frac{1}{t(1-t)} = \frac{-1}{t(t-1)}$ Sum $= \frac{t^2}{t-1} - \frac{1}{t(t-1)} = \frac{t^3-1}{t(t-1)}$ Since $t^3-1 = (t-1)(t^2+t+1)$: Sum $= \frac{(t-1)(t^2+t+1)}{t(t-1)} = \frac{t^2+t+1}{t} = t+1+\frac{1}{t}$ $= \tan\theta + \cot\theta + 1$ — Hence proved **Answer: Proved: LHS = 1 + tanθ + cotθ**	*2 marks for converting to a single variable t; 2 marks for combining the fractions; 1 mark for the final result.*
19 (B)	**Q19 (B)** $\tan^2 A - 1 = \frac{\sin^2 A - \cos^2 A}{\cos^2 A}$, so $\frac{\tan^2 A}{\tan^2 A - 1} = \frac{\sin^2 A}{\sin^2 A - \cos^2 A}$ $\sec^2 A - \operatorname{cosec}^2 A = \frac{1}{\cos^2 A} - \frac{1}{\sin^2 A} = \frac{\sin^2 A - \cos^2 A}{\sin^2 A \cos^2 A}$ $\frac{\operatorname{cosec}^2 A}{\sec^2 A - \operatorname{cosec}^2 A} = \frac{1/\sin^2 A}{\frac{\sin^2 A - \cos^2 A}{\sin^2 A \cos^2 A}} = \frac{\cos^2 A}{\sin^2 A - \cos^2 A}$	*2 marks for simplifying each term; 2 marks for combining into a single fraction; 1 mark for the final result.*

Q.No	Step-by-Step Solution	Marks per Step
	Sum $= \frac{\sin^2 A + \cos^2 A}{\sin^2 A - \cos^2 A} = \frac{1}{\sin^2 A - \cos^2 A}$ Since $\sin^2 A - \cos^2 A = (1 - \cos^2 A) - \cos^2 A = 1 - 2\cos^2 A$ $= \frac{1}{1 - 2\cos^2 A}$ — Hence proved **Answer: Proved: LHS = 1/(1 − 2cos²A)**	