27th November 2025

PBMT-04

Syllabus: Trignometry and Applications of Trignometry.

Section-A

(1) 1. (option-d)

(2) $\frac{1}{2}$ (option-b)

(3) $\sin\theta + \sin^2\theta = 1$

$\Rightarrow \sin\theta = 1 - \sin^2\theta$

$\Rightarrow \sin\theta = \cos^2\theta$

Now, $\cos^2\theta + \cos^4\theta$

$\Rightarrow \cos^2\theta \, (1 + \cos^2\theta)$

$\Rightarrow \sin\theta \, (1 + \sin\theta)$ $[\because \sin\theta = \cos^2\theta]$

$= \sin\theta + \sin^2\theta = 1.$

ans: 1 (option-b)

(4) $\frac{1}{2}$ (option-c).

(5) 16 (option-a).

(6) 30° (option-a).

(7) 1 (option-a).

(8) 10° (option-d).

(9) 2 (option-a).

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(10) Both (A) and (R) are true and (R) is the correct explanati
of (A) [option-a].

Section-B

(11) $x = \frac{\operatorname{cosec}\theta}{2}$

$\Rightarrow x^2 = \frac{\operatorname{cosec}^2\theta}{4}$ —— (1)

$\cot\theta = \frac{2}{x}$ [given].

$\Rightarrow x = \frac{2}{\cot\theta}$

$\Rightarrow x^2 = \frac{4}{\cot^2\theta}$

$\Rightarrow \frac{1}{x^2} = \frac{\cot^2\theta}{4}$ —— (2)

To find $2\left(x^2 - \frac{1}{x^2}\right)$

$2\left(\frac{\operatorname{cosec}^2\theta}{4} - \frac{\cot^2\theta}{4}\right)$ [putting 1 & 2].

$2\left(\frac{\operatorname{cosec}^2\theta - \cot^2\theta}{4}\right) = \frac{1}{2}$

$\therefore 2\left(x^2 - \frac{1}{x^2}\right) = \frac{1}{2}$

Q. 12(A) $\sin A + \cos\theta = \sqrt{2}$

Sq.

$\sin^2 A + \cos^2\theta + 2\sin\theta\cos\theta = 2$

$2\sin\theta\cos\theta = 2-1$

$\sin\theta\cos\theta = \frac{1}{2}$

Now, $\tan\theta + \cot\theta$

$\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$

$\frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta} = \frac{1}{\sin\theta\cos\theta} = 2$

12. (B.) $\tan(A+B) = \sqrt{3}$

$\Rightarrow \cancel{\tan}(A+B) = \cancel{\tan} 60°$

$\Rightarrow A + B = 60°$ —— (1)

$\tan(A - B) = \dfrac{1}{\sqrt{3}}$

$\cancel{\tan}(A - B) = \cancel{\tan} 30°$

$A - B = 30°$ —— (2)

Eliminating (1) and (2)

$$\cancel{A + B = 60°}$$
$$\cancel{A + B = 30°}$$
$$\cancel{(-)\quad(-)\quad(-)}$$

$$A + \cancel{B} = 60°$$
$$A - \cancel{B} = 30°$$
$$\overline{2A = 90°}$$
$$A = 45°$$

putting $A = 45°$ in (1)

$B = 15°$

$\therefore A = 45°$ and $B = 15°$.

13. $1 + \sin^2\theta = 3\sin\theta\cos\theta$

divide both sides by $\cos^2\theta$.

$$\frac{1}{\cos^2\theta} + \frac{\sin^2\theta}{\cos^2\theta} = \frac{3\sin\theta\cos\theta}{\cos^2\theta}$$

$\Rightarrow \sec^2\theta + \tan^2\theta = 3\tan\theta$

$\Rightarrow 1 + \tan^2\theta + \tan^2\theta - 3\tan\theta = 0$

$\Rightarrow 2\tan^2\theta - 3\tan\theta + 1 = 0$

$\Rightarrow 2\tan^2\theta - 2\tan\theta - \tan\theta + 1 = 0$

$\Rightarrow 2\tan\theta(\tan\theta - 1) - 1(\tan\theta - 1) = 0$

$\Rightarrow (2\tan\theta - 1)(\tan\theta - 1) = 0$

$\Rightarrow \tan\theta = \frac{1}{2}$ or $\tan\theta = 1$. Hence, proved.

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Section-C

(14) $\frac{(\sec A - \tan A)^2 + 1}{\sec A - \tan A} = 2\sec A$

L.H.S $\frac{(\sec A - \tan A)^2}{\sec A - \tan A} + \frac{1}{\sec A - \tan A} \times \frac{\sec A + \tan A}{\sec A + \tan A}$

$\cancel{\sec A} - \tan A \cancel{+ \cot A} \cancel{- \cot A}$

$\cancel{\frac{\sec^2 A - \tan^2 A}{\sec A - \tan A}}$

$(\sec A - \tan A) + \frac{\sec A + \tan A}{\sec^2 A - \tan^2 A}$

$\sec A - \cancel{\tan A} + \sec A + \cancel{\tan A}$

$2\sec A.$

15. A $(\operatorname{cosec} A - \sin A)(\sec A - \cos A) = \dfrac{1}{\tan A + \cot A}$

L.H.S.

$$\left(\frac{1}{\sin A} - \sin A\right)\left(\frac{1}{\cos A} - \cos A\right)$$

$$\Rightarrow \left(\frac{1 - \sin^2 A}{\sin A}\right)\left(\frac{1 - \cos^2 A}{\cos A}\right)$$

$$\Rightarrow \frac{\cos^2 A}{\cancel{\sin A}} \times \frac{\sin^2 A}{\cancel{\cos A}}$$

$$\Rightarrow \cos A \sin A$$

R.H.S

$$\frac{1}{\tan A + \cot A}$$

$$\Rightarrow \frac{1}{\dfrac{\sin A}{\cos A} + \dfrac{\cos A}{\sin A}}$$

$$\Rightarrow \frac{1}{\dfrac{\sin^2 A + \cos^2 A}{\cos A \sin A}}$$

$$\Rightarrow \cos A \sin A$$

$\therefore$ L.H.S = R.H.S

Hence, proved.

(B) $\dfrac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} = 2 + \dfrac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta}$.

L.H.S

$$\Rightarrow \frac{\sin\theta}{\frac{\cos\theta}{\sin\theta} + \frac{1}{\sin\theta}}$$

$$\Rightarrow \frac{\sin^2\theta}{\cos\theta + 1}$$

$$\Rightarrow \frac{1-\cos^2\theta}{\cos\theta+1}$$

$$\Rightarrow \frac{\cancel{(1+\cos\theta)}(1-\cos\theta)}{\cancel{\cos\theta+1}}$$

$$\Rightarrow 1-\cos\theta$$

R.H.S

$$\Rightarrow 2 + \frac{\sin\theta}{\frac{\cos\theta}{\sin\theta} - \frac{1}{\sin\theta}}$$

$$\Rightarrow 2 + \frac{\sin^2\theta}{\cos\theta - 1}$$

$$\Rightarrow 2 + \frac{1-\cos^2\theta}{(\cos\theta - 1)}$$

$$\Rightarrow \cancel{2} + \frac{(1-\cancel{\cos\theta})(1+\ldots}{\cancel{\cos\theta}-\ldots}$$

$$\Rightarrow 1 + \cos\theta = -2$$

$$\Rightarrow \cos\theta = -1$$

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~~Section-D~~

$$\Rightarrow 2 + \frac{(1-\cancel{\cos\theta})(1+\cos\theta)}{-(1-\cancel{\cos\theta})}$$

$$\Rightarrow \frac{1+\cos\theta}{-1} + 2 \Rightarrow -1-\cos\theta + 2$$

$$\Rightarrow 1-\cos\theta$$

$\therefore$ L.H.S = R.H.S

Hence, proved.

Section-D

16. BC = d = distance b/w building & tower.

AB = 60m = height of building.

DE = h = height of tower.

x = difference b/w heights

In ΔABC,

$$\tan 60^\circ = \frac{P}{B}$$

$$\sqrt{3} = \cancel{\frac{d}{60}} \quad \frac{60}{d}$$

$\cancel{d = 60 \times \sqrt{3}}$

$\cancel{d = 60 \times 1.732}$

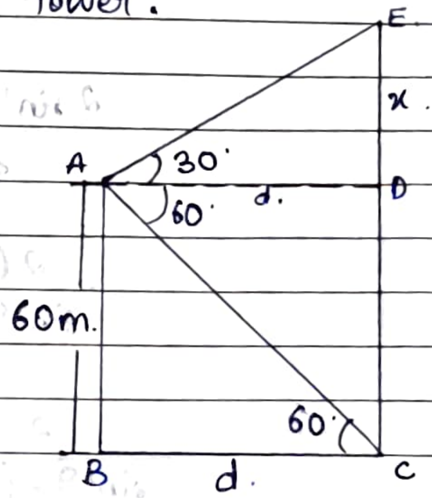
$\cancel{d = 103.928}$

$\cancel{\frac{60}{\sqrt{3}}}$

$$d = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$d = 20\sqrt{3}\,m. = 20 \times 1.732$$

$$= 34.640$$



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In ΔADE,

$$\tan 30^\circ = \frac{d}{x} \quad \frac{x}{d}$$

$$\frac{1}{\sqrt{3}} = \frac{x}{20\sqrt{3}}$$

$$x = 20m.$$

$\therefore$ Difference between heights of building is 40m & distance b/w them is 34.64m.

17. A. $$\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} + \frac{\sin\theta - \cos\theta}{\sin\theta + \cos\theta} = \frac{2}{\sin^2\theta - 1}$$

$$\frac{(\sin\theta + \cos\theta)^2 + (\sin\theta - \cos\theta)^2}{\sin^2\theta - \cos^2\theta}$$

$$\frac{\sin^2\theta + \cancel{2\sin\theta\cos\theta} + \cos^2\theta + \sin^2\theta - \cancel{2\cos\theta\sin\theta} + \cos^2\theta}{\sin^2\theta - \cos^2\theta}$$

$$\frac{2\sin^2\theta + 2\cos^2\theta}{\sin^2\theta - \cos^2\theta}$$

$$\frac{2(1)}{\sin^2\theta - \cos^2\theta}$$

$$\frac{2}{\sin^2\theta - (1 - \sin^2\theta)}$$

$$\frac{2}{\sin^2\theta - 1 + \sin^2\theta} \Rightarrow \frac{2}{2\sin^2\theta - 1}$$

$\therefore$ L.H.S = R.H.S

Hence proved.

(OR) (B.) $\left(1 + \frac{1}{\tan^2 A}\right)\left(1 + \frac{1}{\cot^2 A}\right) = \frac{1}{\cos^2 A - \cos^4 A}$

L.H.S

$$\left(1 + \frac{1}{\tan^2 A}\right)\left(1 + \frac{1}{\cot^2 A}\right)$$

$$\left(\frac{\tan^2 A + 1}{\tan^2 A}\right)\left(\frac{\cot^2 A + 1}{\cot^2 A}\right)$$

$$\left(\frac{\sec^2 A}{\tan^2 A}\right)\left(\frac{\operatorname{cosec}^2 A}{\cot^2 A}\right)$$

$$\frac{1}{\cos^2 A} \times \frac{\cancel{\cos^2}}{\sin^2 A} \times \frac{1}{\cancel{\sin^2 A}} \times \frac{\cancel{\sin^2 A}}{\cancel{\cos^2 A}}$$

R.H.S

$$\frac{1}{\cos^2 A \times \sin^2 A}$$

$$\frac{1}{\cos^2 A - \cos^4 A}$$

$$\frac{1}{\cos^2 A(1 - \cos^2 A)}$$

$$\frac{1}{\cos^2 A \times \sin^2 A}$$

$\therefore$ L.H.S = R.H.S

Hence, proved

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Section E

(18) (i) $\tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{\cancel{15}}{\cancel{15}} = 1$

$\therefore$ angle is $45°$

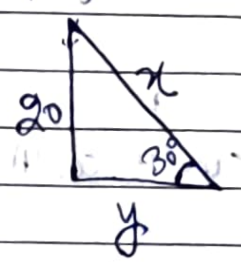
(ii) $x^2 = 15^2 + 15^2$
$= 225 + 225$
$= 450$
$\therefore x = 15\sqrt{2}$ ft.

(iii) (a) $\sin 60° = \frac{h}{20}$

$\frac{\sqrt{3}}{2} \times 20 = h$

$\therefore h = 10\sqrt{3}$ ft

(OR) (b) $\sin 30° = \frac{20}{x}$



$\frac{1}{2} = \frac{20}{x}$

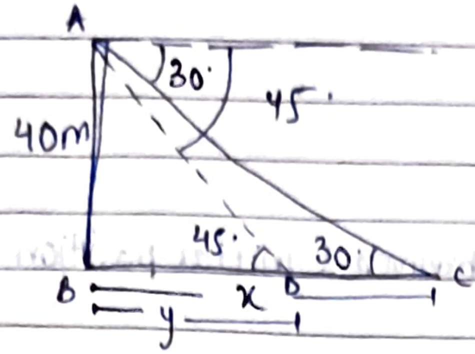
$x = 40$ feet.

$\cos 30° = \frac{y}{x}$

$\frac{\sqrt{3}}{2} = \frac{y}{40}$

$20\sqrt{3}$ feet $= y$

(19.) (i.)



(ii.) (a.) In ΔABD,

$$\tan 45° = \frac{AB}{BD}$$

$$1 = \frac{40}{BD}$$

$$BD = 40m.$$

In ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{40}{BC}$$

$$BC = 40\sqrt{3}m.$$

$\therefore$ distance $= 40\sqrt{3} - 40$

$= 40(\sqrt{3} - 1)$

$= 40\ (1.73 - 1)$

$= 40 \times 0.73$

CD. $= 29.2m.$

(b.) $\sin 30° = \frac{AB}{AC}$

$\frac{1}{2} = \frac{40}{AC}$

$AC = 80m$

∴ distance b/w observer & initial position of ship is 80m

(iii.) $speed = \frac{distance}{time}$

$= \frac{CD}{8}$

$= \frac{29.2}{8}$

$= 3.65 m/s.$

$3.65 \times \frac{18}{5}$

3.65×3.6

∴ speed $= 13.14 km/h$