

Trigonometry CAT Questions

Question: The maximum value of $3 \cos x + 4 \sin x + 8$ is -----?

Answer: 13

Explanation:

Let us consider the function $f(x) = a \cos x + b \sin x + c$

The range of $f(x)$ is given as $c - \sqrt{a^2 + b^2} \leq f(x) \leq c + \sqrt{a^2 + b^2}$

Then the maximum value of $3 \cos x + 4 \sin x + 8$ is $8 + \sqrt{3^2 + 4^2}$
 $= 8 + 5 = 13$

Question: If $\sin \alpha = \frac{5}{13}$ and $\cos \beta = \frac{4}{5}$, then, what is the value of $\sin(\alpha + \beta)$?

Answer: 56/65

Explanation:

P stands for Perpendicular, H stands for hypotenuse and B stands for Base.

$$\Rightarrow \sin \alpha = \frac{5}{13} = \frac{P}{H}$$

$$\Rightarrow B = \sqrt{(H^2 - P^2)} = \sqrt{(169 - 25)} = 12$$

$$\cos \alpha = \frac{B}{H} = \frac{12}{13} \quad \dots\dots(1)$$

$$\Rightarrow \cos \beta = \frac{4}{5} = \frac{B}{H}$$

$$\Rightarrow P = \sqrt{(H^2 - B^2)} = \sqrt{(25 - 16)} = \sqrt{9} = 3$$

$$\Rightarrow \sin \beta = \frac{3}{5} \quad \dots\dots(2)$$

We know that: $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \sin \beta \cos \alpha$

$$\Rightarrow \sin(\alpha + \beta) = \left(\frac{5}{13} \times \frac{4}{5}\right) + \left(\frac{3}{5} \times \frac{12}{13}\right)$$

$$\Rightarrow \sin(\alpha + \beta) = \frac{20}{65} + \frac{36}{65}$$

$$\Rightarrow \sin(\alpha + \beta) = \frac{56}{65}$$

Question: The angle of elevation of the top of a tower from a point on the ground, which is 30 m away from the foot of the tower, is 30° . Find the height of the tower.

Answer: $10\sqrt{3}$ m

Explanation:

Here, $b = 30$ m, Angle of Elevation = 30°

$$\tan 30^\circ = p/30$$

$$\Rightarrow 1/\sqrt{3} = p/30$$

$$\Rightarrow p = 10\sqrt{3}$$

\therefore Height = $10\sqrt{3}$ m

Question: If $\cos^4\theta - \sin^4\theta = 3/4$, then the value of $2\cos^2\theta - 1$ is:

Answer: 0.75

Explanation:

Given: $\cos^4\theta - \sin^4\theta = 3/4$

We know that $x^2 - y^2 = (x - y)(x + y)$

So, $(\cos^2\theta - \sin^2\theta)(\cos^2\theta + \sin^2\theta) = 3/4$

$\Rightarrow (\cos^2\theta - \sin^2\theta) = 3/4$

$\Rightarrow (\cos^2\theta - 1 + \cos^2\theta) = 3/4$

$\Rightarrow 2\cos^2\theta - 1 = 3/4$

Question: If $\sin(x + y) = \cos(x - y)$, then the value of \cos^2x is:

Answer: $1/2$

Explanation:

Given:

$\sin(x + y) = \cos(x - y)$

$\Rightarrow \sin(x + y) = \sin(90^\circ - x + y)$

$\Rightarrow x + y = 90^\circ - x + y$

$\Rightarrow 2x = 90^\circ$

$\Rightarrow x = 45^\circ$

Therefore, $\cos^2x = \cos^245^\circ = \left(\frac{1}{\sqrt{2}}\right)^2 = 1/2$