

$$1 \sin\left(-\frac{\pi}{4}\right)$$

$$\cos\left(\frac{\pi}{4}\right)$$

$$\sin\left(\frac{\pi}{4}\right)$$

$$\cos -3\frac{\pi}{4}$$

$$2. \text{ False}$$

$$3. \frac{5\sqrt{3}}{4}$$

$$4. \frac{2 \tan 5x}{1 - \tan^2 5x}$$

$$5. \sin(A + 2B)$$

$$6. 2$$

$$7. a) \tan \frac{\pi}{4}$$

$$b) \sin 2x$$

$$8. a) \cos x = \frac{-3}{\sqrt{4^2 + 3^2}} = \frac{-3}{5}$$

$$b) \tan x = \frac{-4}{3}$$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$$

$$= \frac{2 \left(-\frac{4}{3}\right)}{1 - \left(-\frac{4}{3}\right)^2}$$

$$= \frac{-\frac{8}{3}}{1 - \frac{16}{9}}$$

$$= \frac{-\frac{8}{3}}{\frac{9-16}{9}}$$

$$= \frac{-\frac{8}{3}}{\frac{-7}{9}} = \frac{-\frac{8}{3} \times \frac{9}{-7}}{1} = \frac{24}{7}$$

$$= \frac{-24}{-7}$$

$$= \frac{24}{7}$$

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$$9. \cos\left(\frac{2\pi}{9}\right)\cos\left(\frac{\pi}{18}\right) + \sin\left(\frac{2\pi}{9}\right)\sin\left(\frac{\pi}{18}\right)$$

$$= \cos\left(\frac{2\pi}{9} - \frac{\pi}{18}\right)$$

$$= \cos\left(\frac{\pi}{6}\right)$$

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

$$10. \sin\left(\frac{7\pi}{12}\right) = \sin\left(\frac{\pi}{4} + \frac{\pi}{3}\right)$$

$$= \sin\frac{\pi}{4}\cos\frac{\pi}{3} + \cos\frac{\pi}{4}\sin\frac{\pi}{3}$$

$$= \frac{\sqrt{2}}{2} \times \frac{1}{2} + \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{2}$$

$$= \frac{\sqrt{2} + \sqrt{6}}{4}$$

$$11. d(t) = 4 + 2 \sin \frac{\pi}{6} t$$

$$d(0) = 4$$

$$d = 3$$

$$3 = 4 + 2 \sin \left(\frac{\pi}{6} t \right)$$

$$\sin \left(\frac{\pi}{6} t \right) = -\frac{1}{2} \quad 0 \leq t \leq 24$$

$$\frac{\pi}{6} t = \sin^{-1} -\frac{1}{2}$$

$$\frac{\pi}{6} t = \left(\frac{7\pi}{6} \right) + 2k\pi \quad \text{on } \frac{11\pi}{6} + 2k\pi$$

$$t = 7 + 12k \quad \text{on } 11 + 12k \quad (k \in \mathbb{N})$$

$$k = 0$$

$$t = 7, 11$$

$$k = 1$$

$$t = 19, 23$$

$$t = 7 \text{ a.m.}, 11 \text{ a.m.}, 19 \text{ p.m.}, 23 \text{ p.m.}$$

$$12. \sin x = \frac{15}{17} \quad \cos y = -\frac{3}{5}$$

$$\cos x = \frac{8}{17}$$

$$\sin y = \frac{4}{5}$$

$$\begin{aligned} \cos(x+y) &= \cos x \cos y - \sin x \sin y \\ &= \left(\frac{8}{17} \times -\frac{3}{5} \right) - \left(\frac{15}{17} \times \frac{4}{5} \right) \\ &= -\frac{24}{85} - \frac{60}{85} \\ &= -\frac{84}{85} \end{aligned}$$

$$13a) (\tan x - 1)(\cos x + \frac{1}{2}) = 0 ; 0 \leq x < 2\pi$$

$$\tan x - 1 = 0 ; 0 \leq x < 2\pi : x = \frac{\pi}{4}, x = \frac{5\pi}{4}$$

$$\cos x + \frac{1}{2} = 0 \quad 0 \leq x < 2\pi : x = \frac{2\pi}{3}, x = \frac{4\pi}{3}$$

$$x = \frac{\pi}{4}, x = \frac{5\pi}{4}, x = \frac{2\pi}{3}, x = \frac{4\pi}{3}$$

$$(b) \sin x - \cos 2x = 0 \quad 0 \leq x \leq 2\pi$$

Rewriting using identities

$$\cos 2x = 1 - 2\sin^2 x$$

$$\sin x - (1 - 2\sin^2 x) = 0$$

$$\sin x - 1 + 2\sin^2 x = 0$$

$$-1 + \sin x + 2\sin^2 x = 0$$

$$\sin x = \frac{1}{2}, \quad \sin^2 x = -1$$

$$\sin x = \frac{1}{2}, \quad 0 \leq x \leq 2\pi \quad \& \quad x = \frac{\pi}{6}, \frac{5\pi}{6}$$

$$\sin^2 x = -1 \quad 0 \leq x \leq 2\pi : x = \frac{3\pi}{2}$$

$$x = \frac{\pi}{6}, x = \frac{5\pi}{6}, x = \frac{3\pi}{2}$$

$$14) \frac{\tan x - \sin x}{\sin 3x} = \frac{\sec x}{1 + \cos x}$$

$$\tan x = \frac{\sin x}{\cos x}$$

$$\frac{\frac{\sin x}{\cos x} - \sin x}{\sin^3 x} = \frac{1 - \cos x}{\cos x \sin^2 x}$$

$$= \frac{1 - \cos x}{\cos x \sin^2 x}$$

$$= \frac{1}{(1 + \cos x)(\cos x)}$$

$$\frac{1}{\cos x} = \sec x$$

$$= \frac{\sec x}{1 + \cos x}$$

$$\Rightarrow \frac{\tan x - \sin x}{\sin^3 x} = \frac{\sec x}{1 + \cos x}$$

$$14 \text{ (b)} \quad \sin 2A = \frac{2 \tan A}{1 + \tan^2 A}$$

Expressing in terms of sin and cos

$$\frac{2 \cos A \sin A}{\cos^2 A + \sin^2 A}$$

But $\cos^2 A + \sin^2 A = 1$

$$\Rightarrow \frac{2 \cos A \sin A}{1} \quad \text{using identities}$$

$$= 2 \cos A \sin A = \sin 2A$$

$$\Rightarrow \sin 2A = \frac{2 \tan A}{1 + \tan^2 A}$$