

Double Angle Identities

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Name Solutions

$$\sin A = -\frac{24}{25}$$

$$\cos P = \frac{8}{17} \quad \text{A.M.D.G.}$$

$$\cos A = -\frac{7}{25} \text{ in Quadrant III, } \sin P = -\frac{15}{17} \text{ in Quadrant IV, } \tan B = -\sqrt{3} \text{ in Quadrant II}$$

Use the above information to answer problems 1 and 2

1) Find the value of $\cos(2A)$

$$\begin{aligned} \cos(2A) &= \cos^2 A - \sin^2 A \\ &= \left(-\frac{7}{25}\right)^2 - \left(-\frac{24}{25}\right)^2 = \frac{49}{625} - \frac{576}{625} = -\frac{527}{625} \end{aligned}$$

2) Find the value of $\sin(2P)$

$$\begin{aligned} &= 2\sin P \cos P = 2\left(\frac{8}{17}\right)\left(-\frac{15}{17}\right) \\ &= -\frac{240}{289} \end{aligned}$$

3) Find the value of $\tan(2B)$ (hint: use sine and cosine)

$$\begin{aligned} \frac{\sin 2B}{\cos 2B} &= \frac{2\sin B \cos B}{\cos^2 B - \sin^2 B} \\ &= \frac{2\left(\frac{\sqrt{3}}{2}\right)\left(-\frac{1}{2}\right)}{\left(-\frac{1}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2} \\ &= \frac{-\frac{\sqrt{3}}{2}}{\frac{1}{4} - \frac{3}{4}} = \sqrt{3} \end{aligned}$$

4) Find all possible solutions for $0 \leq x \leq 360^\circ$ or $0 \leq \theta \leq 360^\circ$

a) $2 \sin x \cos x = -\frac{\sqrt{3}}{2}$

$$\sin 2x = -\frac{\sqrt{3}}{2}$$

$$2x = -60^\circ \pm 360^\circ n$$
$$240^\circ \pm 360^\circ n$$

$$x = -30^\circ \pm 180^\circ n$$
$$120^\circ \pm 180^\circ n$$

b) $2 \cos^2 A = 1 + \frac{\sqrt{2}}{2}$

$$2 \cos^2 A - 1 = \frac{\sqrt{2}}{2}$$

$$\cos(2A) = \frac{\sqrt{2}}{2}$$

$$2A = \pm 45^\circ \pm 360^\circ n$$

$$A = \pm \frac{45^\circ}{2} \pm 180^\circ n$$

$$\downarrow$$
$$\text{or } \pm 22.5^\circ$$

c) $\cos^2(3\theta) - \sin^2(3\theta) = -\frac{1}{2}$

$$\cos 2(3\theta) = -\frac{1}{2}$$

$$\cos(6\theta) = -\frac{1}{2}$$

$$6\theta = \pm 120^\circ \pm 360^\circ n$$

$$\theta = \pm 20^\circ \pm 60^\circ n$$