

C3 Trigonometry Harmonic Form

1. Express $2 \sin x + 3 \cos x$ in the form $R \sin(x + \alpha)$ where $0^\circ < \alpha < 90^\circ$. $\sqrt{13} \sin(x + 56.3)$
2. Express $\cos x - \sin x$ in the form $R \cos(x + \alpha)$ where $0 < \alpha < \frac{\pi}{2}$. $\sqrt{2} \cos(x + \frac{\pi}{4})$
3. Express $3 \cos 2x + 4 \sin 2x$ in the form $R \cos(2x - \alpha)$ where $0^\circ < \alpha < 90^\circ$. $5 \cos(2x - 53.1)$
4. Express $\sin \theta + \sqrt{3} \cos \theta$ in the form $R \sin(\theta + \alpha)$ where $0 < \alpha < \frac{\pi}{2}$. $2 \sin(\theta + \frac{\pi}{3})$
5. Express $2 \cos n\theta + \frac{1}{2} \sin n\theta$ in the form $R \cos(n\theta - \alpha)$ where $0 < \alpha < \frac{\pi}{2}$. $\frac{\sqrt{17}}{2} \cos(n\theta - 0.245)$
6. Express $\sqrt{3} \sin 3\theta - \cos 3\theta$ in the form $R \sin(3\theta - \alpha)$ where $0^\circ < \alpha < 90^\circ$.
7. Solve $\cos 2\theta + 3 \sin 2\theta = -1$ for $0 < \theta < 2\pi$.
8. By expressing $3 \sin x + 2 \cos x$ in the form $R \sin(x + \alpha)$, find the maximum value of

$$3 \sin x + 2 \cos x$$

and the smallest positive value of x (in degrees) for which this occurs. Max value of $\sqrt{13}$ when $x = 56.3^\circ$

9. (a) What is the maximum value of $\frac{8}{5 + 2 \cos(\theta - 20)}$?
- (b) What is the smallest positive value of θ for which this maximum occurs?