

Equations and Multiple-Angle Identities

Solve each equation for $0 \leq \theta < 2\pi$.

1) $-\sin 2\theta = \sqrt{2}\sin \theta - 2\sin 2\theta$

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

3) $0 = \cos 2\theta + 3\sin \theta + 4\sin^2 \theta$

4) $\cos \theta + \cos 2\theta = 0$

5) $\cos \frac{\theta}{2} = \cos \theta + 1$

6) $\cos \theta = 2 + 3\sin \frac{\theta}{2}$

7) $3 + 2\cos \theta = 4\cos \frac{\theta}{2}$

8) $\sqrt{3}\sin \frac{\theta}{2} + \cos \theta = 1$

Find all solutions to each equation in degrees.

9) $\sin 4x + \sin 6x = 0$

10) $0 = \cos 2x + \cos 6x$

11) $0 = \cos 8x + \cos 6x$

12) $\cos x + \cos 7x = 0$

13) $\sin 8x + \sin 2x = \cos 3x$

14) $\sin 3x + \sin 2x + \sin 4x = 0$

15) $\sin 2x = -\cos 3x + \sin 4x$

16) $0 = \sin x + \sin 3x + \sin 5x$

Critical thinking question:

17) Write an equation involving $\cos x$ and $\sin \frac{x}{2}$ that has no solution.

Equations and Multiple-Angle Identities

Solve each equation for $0 \leq \theta < 2\pi$.

1) $-\sin 2\theta = \sqrt{2}\sin \theta - 2\sin 2\theta$

$$\left\{0, \frac{\pi}{4}, \pi, \frac{7\pi}{4}\right\}$$

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

$$\left\{\frac{\pi}{2}, \frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}\right\}$$

3) $0 = \cos 2\theta + 3\sin \theta + 4\sin^2 \theta$

$$\left\{\frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}\right\}$$

4) $\cos \theta + \cos 2\theta = 0$

$$\left\{\frac{\pi}{3}, \pi, \frac{5\pi}{3}\right\}$$

5) $\cos \frac{\theta}{2} = \cos \theta + 1$

$$\left\{\frac{2\pi}{3}, \pi\right\}$$

6) $\cos \theta = 2 + 3\sin \frac{\theta}{2}$

No solution.

7) $3 + 2\cos \theta = 4\cos \frac{\theta}{2}$

$$\left\{\frac{2\pi}{3}\right\}$$

8) $\sqrt{3}\sin \frac{\theta}{2} + \cos \theta = 1$

$$\left\{0, \frac{2\pi}{3}, \frac{4\pi}{3}\right\}$$

Find all solutions to each equation in degrees.

9) $\sin 4x + \sin 6x = 0$

$$\{36n, 90 + 180n\}$$

10) $0 = \cos 2x + \cos 6x$

$$\left\{\frac{45}{2} + 45n, 45 + 90n\right\}$$

11) $0 = \cos 8x + \cos 6x$

$$\left\{\frac{90}{7} + \frac{180n}{7}\right\}$$

12) $\cos x + \cos 7x = 0$

$$\left\{\frac{45}{2} + 45n, 30 + 60n\right\}$$

13) $\sin 8x + \sin 2x = \cos 3x$

$$\{30 + 60n, 6 + 72n, 30 + 72n\}$$

14) $\sin 3x + \sin 2x + \sin 4x = 0$

$$\{60n\}$$

15) $\sin 2x = -\cos 3x + \sin 4x$

$$\{30 + 60n\}$$

16) $0 = \sin x + \sin 3x + \sin 5x$

$$\{60n\}$$

Critical thinking question:

17) Write an equation involving $\cos x$ and $\sin \frac{x}{2}$ that has no solution.

Many. Ex: $\cos x + \sin \frac{x}{2} = 100$