

Answers: Trigonometric identities (radians)

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Summary

A selection of questions on trigonometric identities, using radians to measure angles.

These are the answers to [Questions: Trigonometric identities \(radians\)](#).

Please attempt the questions before reading these answers!

Q1

$$1.1. \quad 2(6 \sin^2(\theta)) + 3(4 \cos^2(\theta)) = 12(\sin^2(\theta) + \cos^2(\theta)) = 12$$

$$1.2. \quad 10(7 \sin^2(\theta)) + 14(5 \cos^2(\theta)) = 70$$

$$1.3. \quad 5 \left(\frac{6}{\csc^2(\theta)} \right) + 15 \left(\frac{2}{\sec^2(\theta)} \right) = 30$$

$$1.4. \quad (\cos^2(\theta) - \sin^2(\theta))^2 + 4 \sin^2(\theta) \cos^2(\theta) = \cos^2(2\theta) + \sin^2(2\theta) = 1$$

$$1.5. \quad 2 \sin(\pi/6) \cos(\pi/12) + 2 \cos(\pi/6) \sin(\pi/12) = 2 \sin(\pi/6 + \pi/12) = 2 \sin(\pi/4) = \sqrt{2}$$

$$1.6. \quad 3 \cos(\pi/4) \cos(\pi/12) - 3 \sin(\pi/4) \sin(\pi/12) = 3 \cos(\pi/3) = \frac{3}{2}$$

$$1.7. \quad \sin(5\pi/6) + \sin(\pi/6) = 2 \sin\left(\frac{180}{2}\right) \cos\left(\frac{120}{2}\right) = 2 \sin(\pi/2) \cos(\pi/3) = 1$$

$$1.8. \quad \cos(5\pi/6) + \sin(\pi/6) = 2 \cos(\pi/2) \cos(\pi/3) = 0$$

Q2

$$2.1. \quad \tan(\theta) \cos(-\theta) = \frac{\sin(\theta)}{\cos(\theta)} \cdot \cos(\theta) = \sin(\theta)$$

$$2.2. \quad \tan(-\theta) \csc(-\theta) \sec(-\theta) = \left(-\frac{\sin(\theta)}{\cos(\theta)} \right) \left(\frac{1}{-\sin(\theta)} \right) \left(\frac{1}{\cos(\theta)} \right) = \left(\frac{1}{\cos^2(\theta)} \right) = \sec^2(\theta)$$

$$2.3. \quad \tan^2(\theta) + \sin^2(\theta) + \cos^2(\theta) = \tan^2(\theta) + 1 = \sec^2(\theta)$$

$$\begin{aligned}
2.4. \quad & \frac{2 \sin(\theta)}{\cos(\theta)(1 - \tan^2(\theta))} = \tan(2\theta) \\
2.5. \quad & \frac{\sin(7\theta) + \sin(3\theta)}{\cos(7\theta) - \cos(3\theta)} = \frac{2 \sin(5\theta) \cos(2\theta)}{-2 \sin(5\theta) \sin(2\theta)} = -\cot(\theta) \\
2.6. \quad & \frac{\sin(5\theta) - \sin(\theta)}{\cos(5\theta) + \cos(\theta)} = \tan(2\theta)
\end{aligned}$$

Q3

$$\begin{aligned}
3.1. \quad & \cos(5\pi/6) = \frac{\sqrt{3}}{2} \\
3.2. \quad & \text{Here } \sin(3\pi/4) = \frac{1}{\sqrt{2}}, \text{ and } \sin(5\pi/4) = -\frac{1}{\sqrt{2}}. \\
3.3. \quad & \cos(13\pi/18) = -0.766 \text{ to three decimal places.}
\end{aligned}$$

Q4

$$\begin{aligned}
4.1. \quad & \sin(\pi/12) = \sin(\pi/4) \cos(\pi/6) - \cos(\pi/4) \sin(\pi/6) = \frac{\sqrt{3}}{2\sqrt{2}} - \frac{1}{2\sqrt{2}} = \frac{\sqrt{3}-1}{2\sqrt{2}} \\
4.2. \quad & \cos(\pi/12) = \frac{\sqrt{3}+1}{2\sqrt{2}} \\
4.3. \quad & \tan(\pi/12) = \frac{\sqrt{3}+1}{\sqrt{3}-1} \\
4.4. \quad & \sin(5\pi/12) = \sin(\pi/4) \cos(\pi/6) + \cos(\pi/4) \sin(\pi/6) = \frac{\sqrt{3}+1}{2\sqrt{2}} \\
4.5. \quad & \cos(5\pi/12) = \frac{\sqrt{3}-1}{2\sqrt{2}} \\
4.6. \quad & \tan(5\pi/12) = \frac{\sqrt{3}+1}{\sqrt{3}-1}
\end{aligned}$$