

TRIGONOMETRY

Study Materials: Key Concepts, Practice Questions, Answers

Mathema
Contest

Trigonometry -Study guide and Practice Questions



Name: _____

Key Concepts

1. Basic Trigonometric Ratios

- Sine (sin): $\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$
- Cosine (cos): $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$
- Tangent (tan): $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$

2. Reciprocal Trigonometric Ratios

- Cosecant (csc): $\csc\theta = \frac{1}{\sin\theta} = \frac{\text{hypotenuse}}{\text{opposite}}$
- Secant (sec): $\sec\theta = \frac{1}{\cos\theta} = \frac{\text{hypotenuse}}{\text{adjacent}}$
- Cotangent (cot): $\cot\theta = \frac{1}{\tan\theta} = \frac{\text{adjacent}}{\text{opposite}}$

3. Pythagorean Identity

- $\sin^2\theta + \cos^2\theta = 1$

4. Unit Circle

- The unit circle is a circle with a radius of 1 centered at the origin of the coordinate plane.
- Key angles in both degrees and radians:
 - 0° or 0 radians
 - 30° or $\frac{\pi}{6}$ radians
 - 45° or $\frac{\pi}{4}$ radians
 - 60° or $\frac{\pi}{3}$ radians
 - 90° or $\frac{\pi}{2}$ radians

5. Trigonometric Identities

- Sum and Difference Formulas:
 - $\sin(a \pm b) = \sin(a)\cos(b) \pm \cos(a)\sin(b)$

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- $\cos(a \pm b) = \cos(a)\cos(b) \mp \sin(a)\sin(b)$
- $\tan(a \pm b) = \frac{\tan(a) \pm \tan(b)}{1 \mp \tan(a)\tan(b)}$
- Double-Angle Formulas:
 - $\sin(2a) = 2\sin(a)\cos(a)$
 - $\cos(2a) = \cos^2(a) - \sin^2(a) = 2\cos^2(a) - 1 = 1 - 2\sin^2(a)$
 - $\tan(2a) = \frac{2\tan(a)}{1 - \tan^2(a)}$

Practice Questions

1. Basic Trigonometric Ratios

- Given a right triangle where θ is an angle, the opposite side is 3 units, and the hypotenuse is 5 units, find $\sin\theta$, $\cos\theta$, and $\tan\theta$.

2. Reciprocal Trigonometric Ratios

- If $\sin\theta = \frac{4}{5}$, find $\csc\theta$ and $\cot\theta$.

3. Unit Circle

- Find the coordinates of the point on the unit circle corresponding to an angle of 45° or $\frac{\pi}{4}$ radians

4. Trigonometric Identities

- Verify the identity $\sin^2(x) + \cos^2(x) = 1$ for $x = 30^\circ$

5. Double-Angle Formulas

- Use the double-angle formulas to find $\sin(2\theta)$ and $\cos(2\theta)$ if $\sin\theta = \frac{1}{2}$ and $\cos\theta = \frac{\sqrt{3}}{2}$

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Answers

1. Basic Trigonometric Ratios:

- $\sin\theta = \frac{3}{5}$
- $\cos\theta = \frac{4}{5}$
- $\tan\theta = \frac{3}{4}$

2. Reciprocal Trigonometric Ratios:

- $\csc\theta = \frac{5}{3}$
- $\cot\theta = \frac{4}{3}$

3. Unit Circle:

- $(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$

4. Trigonometric Identities:

- $\sin^2 30^\circ + \cos^2 30^\circ = (\frac{1}{2})^2 + (\frac{\sqrt{3}}{2})^2 = \frac{1}{4} + \frac{3}{4} = 1$

5. Double-Angle Formulas:

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