

## Trigonometry

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Trigonometry uses the techniques that students have previously learned from the study of algebra and geometry. The trigonometric functions studied are defined geometrically rather than in terms of algebraic equations. Facility with these functions as well as the ability to prove basic identities regarding them is especially important for students intending to study calculus, more advanced mathematics, physics and other sciences, and engineering in college.

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- 1.0 Students understand the notion of angle and how to measure it, in both degrees and radians. They can convert between degrees and radians.
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- 2.0 Students know the definition of sine and cosine as  $y$ - and  $x$ -coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions.
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- 3.0 Students know the identity  $\cos^2(x) + \sin^2(x) = 1$ :
- 3.1 Students prove that this identity is equivalent to the Pythagorean theorem (i.e., students can prove this identity by using the Pythagorean theorem and, conversely, they can prove the Pythagorean theorem as a consequence of this identity).
- 3.2 Students prove other trigonometric identities and simplify others by using the identity  $\cos^2(x) + \sin^2(x) = 1$ . For example, students use this identity to prove that  $\sec^2(x) = \tan^2(x) + 1$ .
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- 4.0 Students graph functions of the form  $f(t) = A \sin(Bt + C)$  or  $f(t) = A \cos(Bt + C)$  and interpret  $A$ ,  $B$ , and  $C$  in terms of amplitude, frequency, period, and phase shift.
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- 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.
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- 6.0 Students know the definitions of the secant and cosecant functions and can graph them.
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- 7.0 Students know that the tangent of the angle that a line makes with the  $x$ -axis is equal to the slope of the line.
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- 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

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- 9.0** Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.
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- 10.0** Students demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities.
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- 11.0** Students demonstrate an understanding of half-angle and double-angle formulas for sines and cosines and can use those formulas to prove and/or simplify other trigonometric identities.
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- 12.0** Students use trigonometry to determine unknown sides or angles in right triangles.
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- 13.0** Students know the law of sines and the law of cosines and apply those laws to solve problems.
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- 14.0** Students determine the area of a triangle, given one angle and the two adjacent sides.
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- 15.0** Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.
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- 16.0** Students represent equations given in rectangular coordinates in terms of polar coordinates.
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- 17.0** Students are familiar with complex numbers. They can represent a complex number in polar form and know how to multiply complex numbers in their polar form.
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- 18.0** Students know DeMoivre's theorem and can give  $n$ th roots of a complex number given in polar form.
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- 19.0** Students are adept at using trigonometry in a variety of applications and word problems.