



# Pre-Calculus L2 - Unit D - Trigonometry

## Unit Focus

This unit covers all the basics of trigonometry, from radian measure to right triangle and unit circle definitions to graphing. These fundamentals will be built upon in further units, so it is important students understand these concepts thoroughly, without relying on the calculator.

## Stage 1: Desired Results - Key Understandings

| Standard(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Transfer                                                                                                                                                                                                                                                                                                                                                   |
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| <b>Common Core</b><br>Mathematics: 9-12 <ul style="list-style-type: none"> <li>Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (CCSS.MATH.CONTENT.HSA.CED.A.2)</li> <li>Explain why the x-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* (CCSS.MATH.CONTENT.HSA.REI.D.11)</li> <li>Write a function that describes a relationship between two quantities. (CCSS.MATH.CONTENT.HSF.BF.A.1)</li> <li>Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. (CCSS.MATH.CONTENT.HSF.TF.A.1)</li> <li>Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. (CCSS.MATH.CONTENT.HSF.TF.A.2)</li> <li>Use special triangles to determine geometrically the values of sine, cosine, tangent for <math>\pi/3</math>, <math>\pi/4</math> and <math>\pi/6</math>, and use the unit circle to express the values of sine, cosine, and tangent for <math>x</math>, <math>\pi + x</math>, and <math>2\pi - x</math> in terms of their values for <math>x</math>, where <math>x</math> is any real number. (CCSS.MATH.CONTENT.HSF.TF.A.3)</li> <li>Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. (CCSS.MATH.CONTENT.HSF.TF.A.4)</li> <li>Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. (CCSS.MATH.CONTENT.HSF.TF.B.5)</li> <li>Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. (CCSS.MATH.CONTENT.HSF.TF.B.6)</li> </ul> | <i>Students will be able to independently use their learning to...</i><br><b>T1</b> model relationships among quantities.<br><b>T2</b> demonstrate fluency with math facts, computation and concepts.<br><b>T3</b> make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution.                                  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <i>Students will understand that...</i><br><b>U1</b> the numerical, algebraic and graphic representation all represent the same situation.<br><b>U2</b> Mathematicians apply the mathematics they know to solve problems occurring in everyday life.<br><b>U3</b> Mathematicians create or use models to examine, describe, solve and/or make predictions. |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <i>Students will be skilled at...</i><br><b>S1</b> convert from degrees, minutes and second to degrees<br><b>S2</b> convert between degrees and radians<br><b>S3</b> Finding the reference angle                                                                                                                                                           |

## Stage 1: Desired Results - Key Understandings

- Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. (CCSS.MATH.CONTENT.HSF.TF.B.7)
- Prove the Pythagorean identity  $\sin^2(\theta) + \cos^2(\theta) = 1$  and use it to find  $\sin(\theta)$ ,  $\cos(\theta)$ , or  $\tan(\theta)$  given  $\sin(\theta)$ ,  $\cos(\theta)$ , or  $\tan(\theta)$  and the quadrant of the angle. (CCSS.MATH.CONTENT.HSF.TF.C.8)
- Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems. (CCSS.MATH.CONTENT.HSF.TF.C.9)
- Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. (CCSS.MATH.CONTENT.HSG.CO.A.1)
- Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. (CCSS.MATH.CONTENT.HSG.SRT.C.6)
- Explain and use the relationship between the sine and cosine of complementary angles. (CCSS.MATH.CONTENT.HSG.SRT.C.7)
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. (CCSS.MATH.CONTENT.HSG.SRT.C.8)
- Derive the formula  $A = \frac{1}{2} ab \sin(C)$  for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. (CCSS.MATH.CONTENT.HSG.SRT.D.9)
- Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). (CCSS.MATH.CONTENT.HSG.SRT.D.11)
- Make sense of problems and persevere in solving them. (CCSS.MATH.MP.1)
- Model with mathematics. (CCSS.MATH.MP.4)
- Look for and make use of structure. (CCSS.MATH.MP.7)

### Madison Public Schools Profile of a Graduate

- Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

- K3** there are patterns within values of trig functions in the unit circle
- K4** the trig reciprocal identities
- K5** the periodic properties of the trig functions
- K6** the Pythagorean identities
- K7** that the sin of an angle on the unit circle is the y and the cosine is the x coordinate
- K8** How the complementary angles are related (cofunction identities)
- K9** Sum and Difference Identities
- K10** Double Angle Identities (for sine & cosine only)
- K11** Vocabulary: coterminal, unit circle, periodicity, asymptotes, inverse functions

- S4** applying angle measure to find arc length
- S5** finding trig functions on the unit circle of special angles using points
- S6** identifying if a trig function is odd or even or neither
- S7** Sketching graphs of sine and cosine identifying key features
- S8** Determine equations of sine and cosine graphs
- S9** Graphing other trig functions and the relationship to their inverses
- S10** Using trig identities to simplify expression and/or solve equations