Indiana Academic Standards Precalculus: Trigonometry Crosswalk

2014 Standard Language	2020 Standard Language	Suggested Changes
Precalculus: Trigonometry		
Conics - MOVED CLUSTER TO PRECALCULUS: ALGEBRA		
TR.CO.1: Determine how the graph of a parabola changes if a, b and c changes in the equation y = a(x – b)^2 + c. Find an equation for a parabola when given sufficient information.		Removed standard
TR.CO.2: Derive the equation of a parabola given a focus and directrix.		Removed standard Moved to 2020 PC.CO.1 Language change Changed “Derive” to “Construct”
TR.CO.3: Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.		Removed standard Moved to 2020 PC.CO.2 Language change Changed “Derive” to “Construct” Removed “using Pythagorean Theorem”

TR.CO.4: Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.		Removed standard Moved to 2020 PC.CO.3 Language change Added “given at least 2 of the following: foci, vertices, length of an axis, or point on the curve”. Removed “using the fact that the sum or difference of distances from the foci is constant”.
TR.CO.5: Graph conic sections. Identify and describe features like center, vertex or vertices, focus or foci, directrix, axis of symmetry, major axis, minor axis, and eccentricity.		Removed standard Moved to 2020 PC.CO.4 No language change
TR.CO.6: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri’s principle, and informal limit arguments.		Removed standard
Unit Circle		
TR.UC.1: Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	TR.UC.1: Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	No change

TR.UC.2: 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.	TR.UC.2: 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.	No change
	TR.UC.3: Use special triangles to determine the values of sine, cosine, and tangent for π/3, π/4, and π/6. Apply special right triangles to the unit circle and use them to express the values of sine, cosine, and tangent for x, π ± x, and 2π ± x in terms of their values for x, where x is any real number.	New standard Moved from 2014 TR.G.3 Language change Added +/-
TR.UC.3: Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.		Removed standard Moved standard to 2020 TR.PF.3 No language change
Triangles (Formally Geometry)		
	TR.T.1: Define and use the trigonometric ratios (sine, cosine, tangent, cotangent, secant, cosecant) in terms of angles of right triangles and the coordinates on the unit circle.	New standard Moved from 2014 TR.PF.7 No language change

TR.G.1: Solve real-world problems with and without technology that can be modeled using right triangles, including problems that can be modeled using trigonometric ratios. Interpret the solutions and determine whether the solutions are reasonable.	TR.T.2: Solve real-world problems with and without technology that can be modeled using right triangles, including problems that can be modeled using trigonometric ratios. Interpret the solutions and determine whether the solutions are reasonable.	Indicator change No language change
TR.G.2: Explain and use the relationship between the sine and cosine of complementary angles.	TR.T.3: Explain and use the relationship between the sine and cosine of complementary angles.	Indicator change No language change
TR.G.3: Use special triangles to determine the values of sine, cosine, and tangent for π/3, π/4, and π/6. Apply special right triangles to the unit circle and use them to express the values of sine, cosine, and tangent for x, π + x, and 2π – x in terms of their values for x, where x is any real number.		Removed standard Moved to 2020 TR.UC.3 No language change
TR.G.4: Prove the Laws of Sines and Cosines and use them to solve problems.	TR.T.4: Prove the Laws of Sines and Cosines.	Indicator change Language change Removed “and use them to solve problems”.
TR.G.5: Understand and apply the Laws of Sines and Cosines to solve real-world and other mathematical problems	TR.T.5: Understand and apply the Laws of Sines and Cosines to solve real-world and other mathematical problems	Indicator change No language change

involving right and non-right triangles.	involving right and non-right triangles.	
TR.G.6: Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line. Use the formula to find areas of triangles.	TR.T.6: Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line. Use the formula to find areas of triangles.	Indicator change No language change
Periodic Functions		
TR.PF.1: Find a sinusoidal function to model a data set and explain the parameters of the model.	TR.PF.2: Model a data set with periodicity using a sinusoidal function and explain the parameters of the model.	Indicator change Language change Change “Find a sinusoidal function to model a data set” to “Model a data set with periodicity using a sinusoidal function”.
TR.PF.2: Graph trigonometric functions with and without technology. Use the graphs to model and analyze periodic phenomena, stating amplitude, period, frequency, phase shift, and midline (vertical shift).	TR.PF.1: Graph trigonometric functions with and without technology. Use the graphs to model and analyze periodic phenomena, stating amplitude, period, frequency, phase shift, and midline (vertical shift).	Indicator change No language change
	TR.PF.3: Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions	New standard Moved from 2014 TR.UC.3 No language change
TR.PF.3: Construct the inverse trigonometric functions of sine, cosine, and tangent by restricting the domain.	TR.PF.4: Construct the inverse trigonometric functions of sine, cosine, and tangent by restricting the domain.	Indicator change No language change

TR.PF.4: 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.	TR.PF.5: 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.	Indicator change No language change
TR.PF.5: Prove the addition and subtraction formulas for sine, cosine, and tangent. Use the formulas to solve problems.		Removed standard Moved to 2020 TR.ID.3 Language change Changed “formulas” to “identities”
TR.PF.6: Prove the double- and half-angle formulas for sine, cosine, and tangent. Use the formulas to solve problems.		Removed standard Moved to 2020 TR.ID.4 Language change Changed “formulas” to “identities”
TR.PF.7: Define and use the trigonometric ratios (sine, cosine, tangent, cotangent, secant, cosecant) in terms of angles of right triangles and the coordinates on the unit circle.		Removed standard Moved to 2020 TR.T.1 No language change
Identities		
TR.ID.1: Prove the Pythagorean identity sin^2(x) + cos^2(x) = 1 and use it to find	TR.ID.1: Prove the Pythagorean identity $\sin^2(x) + \cos^2(x) = 1$ and use it to find	No change

trigonometric ratios, given sin(x), cos(x), or tan(x), and the quadrant of the angle.	trigonometric ratios, given sin(x), cos(x), or tan(x), and the quadrant of the angle.	
TR.ID.2: Verify basic trigonometric identities and simplify expressions using these and other trigonometric identities.	TR.ID.2: Verify trigonometric identities and simplify expressions using trigonometric identities.	Language change Removed “basic” and “these and other”
	TR.ID.3: Prove the addition and subtraction identities for sine, cosine, and tangent. Use the identities to solve problems.	New standard Moved from TR.PF.5 Language change Changed “formulas” to “identities”
	TR.ID.4: Prove the double- and half-angle identities for sine, cosine, and tangent. Use the identities to solve problems.	Moved from old TR.PF.6 Language change Changed “formulas” to “identities”
Polar Coordinates and Complex Numbers (Formally Polar Coordinates)		
	TR.PC.1: Understand and use complex numbers, including real and imaginary numbers, on the complex plane in rectangular and polar form, and explain why the rectangular and polar forms of a given complex number represent the same number.	New standard Moved from 2014 PC.PCN.2 No language change

TR.PC.1: Define polar coordinates and relate polar coordinates to Cartesian coordinates.	TR.PC.3: Define polar coordinates and relate polar coordinates to Cartesian coordinates.	Indicator change No language change
	TR.PC.2: State, prove, and use DeMoivre's Theorem.	New standard Moved from 2014 PC.PCN.4 No language change
TR.PC.2: Translate equations from rectangular coordinates to polar coordinates and from polar coordinates to rectangular coordinates. Graph equations in the polar coordinate plane.	TR.PC.4: Translate equations from rectangular coordinates to polar coordinates and from polar coordinates to rectangular coordinates. Graph equations in the polar coordinate plane.	Indicator change No language change
Vectors		
TR.V.1: Solve problems involving velocity and other quantities that can be represented by vectors.	TR.V.7: Solve problems involving velocity and other quantities that can be represented by vectors.	Indicator change No language change
TR.V.2: Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(vx, vy) = (cvx, cvy).	TR.V.5: Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(**v**x, **v**y) = (c**v**x, c**v**y).	Indicator change No language change
TR.V.3: Compute the magnitude of a scalar multiple cv using ||cv|| = |c|v. Compute	TR.V.6: Compute the magnitude of a scalar multiple c**v** using ||c**v**|| = |c|**v**. Compute	Indicator change No language change

the direction of cv knowing that when |c|v ≠ 0, the direction of cv is either along v (for c > 0) or against v (for c < 0).	the direction of c**v** knowing that when |c|**v** ≠ 0, the direction of c**v** is either along **v** (for c > 0) or against **v** (for c < 0).	
	TR.V.1: Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., **v**, |**v**|, ||**v**||).	New standard
	TR.V.2: Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	New standard
	TR.V.3: Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.	New standard
	TR.V.4: Understand vector subtraction **v** - **w** as **v** + (-**w**), where -**w** is the additive inverse of **w**, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the	New standard

	tips in the appropriate order, and perform vector subtraction component-wise.	