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| **F-TF** | **Trigonometric Functions**<br>Extend the domain of trigonometric functions using the unit circle | |
| F-TF.1 | Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. | Angles and Radian Measure<br>Trigonometric Functions on the Unit Circle |
| F-TF.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. | Angles of Rotation<br>Functions of Angles<br>Circular Functions<br>Angles and Radian Measure<br>Trigonometric Functions on the Unit Circle |
| F-TF.3 | Use special triangles to determine geometrically the values of sine, cosine, tangent for pi/3, pi/4 and pi/6, and use the unit circle to express the values of sine, cosine, and tangent for pi-x, pi+x, and 2pi-x in terms of their values for x, where x is any real number. | Circular Functions<br>Trigonometric Ratios in Right Triangles<br>Trigonometric Functions on the Unit Circle<br>Applying Trigonometric Functions |
| F-TF.4 | Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. | The Sine Function<br>The Cosine Function<br>The Tangent Function<br>Circular Functions<br>Trigonometric Functions on the Unit Circle<br>Graphs of Sine and Cosine: Sinusoids<br>Amplitude and Period |

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| | Model periodic phenomena with trigonometric functions | |
| F-TF.5 | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. | The Sine Function<br>The Cosine Function<br>The Tangent Function<br>Inverses of Trigonometric Functions<br>Circular Functions<br>Trigonometric Functions on the Unit Circle<br>Applying Trigonometric Functions<br>Graphs of Sine and Cosine: Sinusoids<br>Graphs of Tangent, Cotangent, Secant, and Cosecant<br>Periodic Graphs and Amplitude<br>Periodic Graphs and Phase Shifts<br>Trigonometric Inverses and Their Graphs<br>Amplitude and Period<br>Wavelength and Frequency |
| F-TF.6 | Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. | Inverses of Trigonometric Functions<br>Applying Trigonometric Functions<br>Graphs of Sine and Cosine: Sinusoids<br>Graphs of Tangent, Cotangent, Secant, and Cosecant<br>Periodic Graphs and Amplitude<br>Periodic Graphs and Phase Shifts<br>Trigonometric Inverses and Their Graphs |

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| F-TF.7 | 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. | |
| | | Inverses of Trigonometric Functions<br>Solving Right Triangles<br>Trigonometric Inverses and Their Graphs<br>Inverse Functions |
| | Prove and apply trigonometric identities | |
| F-TF.8 | 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. | |
| | | Trigonometric Identities<br>Verifying Trigonometric Identities<br>Basic Trigonometric Identities<br>Verifying Trigonometric Identities<br>Sum and Difference Identities |
| F-TF.9 | Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems. | |
| | | Verifying Trigonometric Identities<br>Solving Trigonometric Equations<br>Basic Trigonometric Identities<br>Verifying Trigonometric Identities<br>Sum and Difference Identities<br>Double-Angle and Half-Angle Identities<br>Solving Trigonometric Equations<br>Normal Form of a Linear Equation<br>Distance from a Point to a Line |

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| **G-SRT** | **Similarity, Right Triangles, and Trigonometry** | |
| | Understand similarity in terms of similarity transformations | |
| G-SRT.1 | Verify experimentally the properties of dilations given by a center and a scale factor: | |
| G-SRT.1.a | A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. | |
| G-SRT.1.b | The dilation of a line segment is longer or shorter in the ratio given by the scale factor. | |
| G-SRT.2 | Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. | |
| G-SRT.3 | Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. | |
| | Prove theorems involving similarity | |
| G-SRT.4 | Prove theorems about triangles. | Pythagorean Theorem<br>Special Right Triangles |
| G-SRT.5 | Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. | Special Right Triangles |
| | Define trigonometric ratios and solve problems involving right triangles | |
| G-SRT.6 | 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. | Trigonometric Ratios in Right Triangles<br>Right Triangles<br>Trigonometric Ratios |
| G-SRT.7 | Explain and use the relationship between the sine and cosine of complementary angles. | Angle Relationships<br>Special Right Triangles<br>Trigonometric Ratios |

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| G-SRT.8 | Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. | |
| | | Circular Functions<br>Trigonometric Identities<br>Trigonometric Ratios in Right Triangles<br>Trigonometric Functions on the Unit Circle<br>Applying Trigonometric Functions<br>Solving Right Triangles<br>Right Triangles<br>Inverse Functions<br>Pythagorean Theorem<br>Angles of Elevation and Depression |
| | Apply trigonometry to general triangles | |
| G-SRT.9 | Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. | |
| | | The Law of Sines |
| G-SRT.10 | Prove the Laws of Sines and Cosines and use them to solve problems. | |
| | | Verifying Trigonometric Identities<br>The Law of Sines<br>The Ambiguous Case for the Law of Sines<br>The Law of Cosines |
| G-SRT.11 | 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). | |
| | | The Law of Sines<br>The Ambiguous Case for the Law of Sines<br>The Law of Cosines |