|  |  |  |
| --- | --- | --- |
| **Common Core Standards** | **Common Core Standards** | **Mathematic Practices** |
| N = Number and Quantity Overview N-RN = The Real Number System N-Q = Quantities N-CN = The Complex Number System N-VM = Vector and Matrix QuantitiesA= Algebra Overview A-SSE = Seeing Structure in Expressions A-APR= Arithmetic with Polynomials and Rational Expressions A-CED= Creating Equations A-REI = Reasoning with Equations  and inequalitiesF= Functions Overview  F-IF = Interpreting Functions F-BF = Building Functions F-LE = Linear and Exponential ModelsF-TF = Trigonometric Functions | G = Geometry Overview G-CO = Congruence G-SRT = Similarity, Right Triangles and Trigonometry G-C = Circles G-GPE = Expressing Geometric Properties with Equations G-GMD = Geometric Measurement and Dimension G-MG = Modeling with GeometryS=Statistics and Probability S-ID = Categorical and Quantitative Data S-IC = Inferences and Justifying Conclusions S-CP = Conditional Probability and Rules of Probability S-MD = Using Probability to Make Decisions | 1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.
 |
| **Common Core Standards** | **Converted/Unpacked Standards** |  |
| CC.9-12.G.CO.1 Experiment with transformations in the plane. 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. | G.CO.1 Understand and use definitions of angles, circles, perpendicular lines, parallel lines, and line segments based on the undefined term of a point, a line, the distance along a line, and the length of an arc. |  |
| CC.9-12.G.CO.2 Experiment with transformations in the plane. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). | G.CO.2 Use various technologies such as transparencies, geometry software, interactive whiteboards, and digital visual presenters to represent and compare rigid and size transformations of figures in a coordinate plane. Comparing transformations that preserve distance and angle to those that do not.G.CO.2 Describe and compare function transformations on a set of points as inputs to produce another set of points as outputs, to include translations and horizontal and vertical stretching. |  |
| CC.9-12.G.CO.3 Experiment with transformations in the plane. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. | G.CO.3 Describe the rotations and reflections of a rectangle, parallelogram, trapezoid, or regular polygon that maps each figure onto itself. |  |
| CC.9-12.G.CO.4 Experiment with transformations in the plane. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. | G.CO.4 Using previous comparisons and descriptions of transformations, develop and understand the meaning of rotations, reflections, and translations based on angles, circles, perpendicular lines, parallel lines, and line segments. |  |
| CC.9-12.G.CO.5 Experiment with transformations in the plane. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. | G.CO.5 Transform a geometric figure given a rotation, reflection, or translation using graph paper, tracing paper, or geometric software.G.CO.5 Create sequences of transformations that map a geometric figure on to itself and another geometric figure. |  |
| CC.9-12.G.CO.6 Understand congruence in terms of rigid motions. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. | G.CO.6 Use descriptions of rigid motion and transformed geometric figures to predict the effects rigid motion has on figures in the coordinate plane.G.CO.6 Knowing that rigid transformations preserve size and shape or distance and angle, use this fact to connect the idea of congruency and develop the definition of congruent. |  |
| CC.9-12.G.CO.7 Understand congruence in terms of rigid motions. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. | G.CO.7 Use the definition of congruence, based on rigid motion, to show two triangles are congruent if and only if their corresponding sides and corresponding angles are congruent. |  |
| CC.9-12.G.CO.8 Understand congruence in terms of rigid motions. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. | G.CO.8 Use the definition of congruence, based on rigid motion, to develop and explain the triangle congruence criteria; ASA, SSS, and SAS. |  |
| CC.9-12.G.CO.9 Prove geometric theorems. Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment’s endpoints. | G.CO.9 Prove theorems pertaining to lines and angles. o Prove vertical angles are congruent.•Prove when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angels are congruent.•Prove points on a perpendicular bisector of a line segment are exactly those equidistant from the segment’s endpoints. |  |
| CC.9-12.G.CO.10 Prove geometric theorems. Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. | G.CO.10 Prove theorems pertaining to triangles. •Prove the measures of interior angles of a triangle have a sum of 180o. •Prove base angles of isosceles triangles are congruent. •Prove the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length. •Prove the medians of a triangle meet at a point. |  |
| CC.9-12.G.CO.11 Prove geometric theorems. Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. | G.CO.11 Prove theorems pertaining to parallelograms.•Prove opposite sides are congruent. •Prove opposite angles are congruent. •Prove the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. |  |
| CC.9-12.G.CO.12 Make geometric constructions. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. | G.CO.12 Copy a segment G.CO.12 Copy an angle.G.CO.12 Bisect a segmentG.CO.12 Bisect an angle G.CO.12 Construct perpendicular lines, including the perpendicular bisector of a line segment. G.CO.12 Construct a line parallel to a given line through a point not on the line. |  |
| CC.9-12.G.CO.13 Make geometric constructions. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. | G.CO.13 Construct an equilateral triangle so that each vertex of the equilateral triangle is on the circle. G.CO.13 Construct a square so that each vertex of the square is on the circle. G.CO.13 Construct a regular hexagon so that each vertex of the regular hexagon is on the circle. |  |
| CC.9-12.G.SRT.1 Understand similarity in terms of similarity transformations. Verify experimentally the properties of dilations given by a center and a scale factor: -- 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. -- b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. | G.SRT.1a Given a center and a scale factor, verify experimentally, that when dilating a figure in a coordinate plane, a segment of the pre-image that does not pass through the center of the dilation, is parallel to it’s image when the dilation is preformed. However, a segment that passes through the center remains unchanged.G.SRT.1b Given a center and a scale factor, verify experimentally, that when performing dilations of a line segment, the pre-image, the segment which becomes the image is longer or shorter based on the ratio given by the scale factor. |  |
| CC.9-12.G.SRT.2 Understand similarity in terms of similarity transformations. 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.2 Use the idea of dilation transformations to develop the definition of similarity.G.SRT.2 Given two figures determine whether they are similar and explain their similarity based on the equality of corresponding angles and the proportionality of corresponding sides. |  |
| CC.9-12.G.SRT.3 Understand similarity in terms of similarity transformations. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. | G.SRT.3 Use the properties of similarity transformations to develop the criteria for proving similar triangles; AA. |  |
| CC.9-12.G.SRT.4 Prove theorems involving similarity. Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. | G.SRT.4 Use AA, SAS, SSS similarity theorems to prove triangles are similar.G.SRT.4 Use triangle similarity to prove other theorems about triangles •Prove a line parallel to one side of a triangle divides the other two proportionally, and it’s converse•Prove the Pythagorean Theorem using triangle similarity. |  |
| CC.9-12.G.SRT.5 Prove theorems involving similarity. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. | G.SRT.5 Using similarity theorems, prove that two triangles are congruent. G.SRT.5 Prove geometric figures, other than triangles, are similar and/or congruent. |  |
| CC.9-12.G.SRT.6 Define trigonometric ratios and solve problems involving right triangles. 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. | G.SRT.6 Using a corresponding angle of similar right triangles, show that the relationships of the side ratios are the same, which leads to the definition of trigonometric ratios for acute angles. |  |
| CC.9-12.G.SRT.7 Define trigonometric ratios and solve problems involving right triangles. Explain and use the relationship between the sine and cosine of complementary angles. | G.SRT.7 Explore the sine of an acute angle and the cosine of its complement and determine their relationship. |  |
| CC.9-12.G.SRT.8 Define trigonometric ratios and solve problems involving right triangles. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. | G.SRT.8 Apply both trigonometric ratios and Pythagorean Theorem to solve application problems involving right triangles. |  |
| CC.9-12.G.SRT.9 (+) Apply trigonometry to general triangles. 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. | G.SRT.9 For a triangle that is not a right triangle, draw an auxiliary line from a vertex, perpendicular to the opposite side and derive the formula, A=1⁄2 ab sin (C), for the area of a triangle, using the fact that the height of the triangle is, h=a sin(C). |  |
| CC.9-12.G.SRT.10 (+) Apply trigonometry to general triangles. Prove the Laws of Sines and Cosines and use them to solve problems. | G.SRT.10 Using trigonometry and the relationship among sides and angles of any triangle, such as sin(C)=(h/a) , prove the Law of Sines.G.SRT.10 Using trigonometry and the relationship among sides and angles of any triangle and the Pythagorean Theorem to prove the Law of Cosines.G.SRT.10 Use the Laws of Sines to solve problems. G.SRT.10 Use the Laws of Cosines to solve problems. |  |
| CC.9-12.G.SRT.11 (+) Apply trigonometry to general triangles. 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). | G.SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measures in right triangles.G.SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measures in non-right triangles. |  |
| CC.9-12.G.C.1 Understand and apply theorems about circles. Prove that all circles are similar. | G.C.1 Using the fact that the ratio of diameter to circumference is the same for circles, prove that all circles are similar. |  |
| CC.9-12.G.C.2 Understand and apply theorems about circles. Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle. | G.C.2 Using definitions, properties, and theorems, identify and describe relationships among inscribed angles, radii, and chords. Include central, inscribed, and circumscribed angles.G.C.2 Understand that inscribed angles on a diameter are right angles. G.C.2 Understand that the radius of a circle is perpendicular to the tangent where the radius intersects the circle. |  |
| CC.9-12.G.C.3 Understand and apply theorems about circles. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. | G.C.3 Construct inscribed circles of a triangle. G.C.3 Construct circumscribed circles of a triangle.G.C.3 Using definitions, properties, and theorems, prove properties of angles for a quadrilateral inscribed in a circle. |  |
| CC.9-12.G.C.4 (+) Understand and apply theorems about circles. Construct a tangent line from a point outside a given circle to the circle. | G.C.4 Construct a tangent line from a point outside a given circle to the circle. |  |
| CC.9-12.G.C.5 Find arc lengths and areas of sectors of circles. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. | G.C.5 Use similarity to derive the fact that the length of the arc intercepted by an angle is proportional to the radius, identifying the constant of proportionality as the radian measure of the angle.G.C.5 Find the arc length of a circle. G.C.5 Using similarity, derive the formula for the area of a sector. G.C.5 Find the area of a sector in a circle. |  |
| CC.9-12.G.GPE.1 Translate between the geometric description and the equation for a conic section. 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. | G.GPE.1 Use the Pythagorean Theorem to derive the equation of a circle, given the center and the radius. G.GPE.1 Given an equation of a circle, complete the square to find the center and radius of a circle. |  |
| CC.9-12.G.GPE.2 Translate between the geometric description and the equation for a conic section. Derive the equation of a parabola given a focus and directrix. | G.GPE.2 Given a focus and directrix, derive the equation of a parabola.G.GPE.2 Given a parabola, identify the vertex, focus, directrix, and axis of symmetry, noting that every point on the parabola is the same distance from the focus and the directrix. |  |
| CC.9-12.G.GPE.3 (+) Translate between the geometric description and the equation for a conic section. 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. | G.GPE.3 Given the foci, derive the equation of an ellipse, noting that the sum of the distances from the foci to any fixed point on the ellipse is constant, identifying the major and minor axis.G.GPE.3 Given the foci, derive the equation of a hyperbola, noting that the absolute value of the differences of the distances form the foci to a point on the hyperbola is constant, and identifying the vertices, center, transverse axis, conjugate axis, and asymptotes. |  |
| CC.9-12.G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2). | G.GPE.4 Use coordinate geometry to prove geometric theorems algebraically; such as prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2). |  |
| CC.9-12.G.GPE.5 Use coordinates to prove simple geometric theorems algebraically. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). | G.GPE.5 Using slope, prove lines are parallel or perpendicularG.GPE.5 Find equations of lines based on certain slope criteria such as; finding the equation of a line parallel or perpendicular to a given line that passes through a given point. |  |
| CC.9-12.G.GPE.6 Use coordinates to prove simple geometric theorems algebraically. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. | G.GPE.6 Given two points, find the point on the line segment between the two points that divides the segment into a given ratio. |  |
| CC.9-12.G.GPE.7 Use coordinates to prove simple geometric theorems algebraically. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.\* | G.GPE.7 Use coordinate geometry and the distance formula to find the perimeters of polygons and the areas of triangles and rectangles. |  |
| CC.9-12.G.GMD.1 Explain volume formulas and use them to solve problems. 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. | G.GMD.1 Explain the formulas for the circumference of a circle and the area of a circle by determining the meaning of each term or factor.G.GMD.1 Explain the formulas for the volume of a cylinder, pyramid and cone by determining the meaning of each term or factor. |  |
| CC.9-12.G.GMD.2 Explain volume formulas and use them to solve problems. Give an informal argument using Cavalieri’s principle for the formulas for the volume of a sphere and other solid figures. | G.GMD.2 Using Cavalieri’s Principle, provide informal arguments to develop the formulas for the volume of spheres and other solid figures. |  |
| CC.9-12.G.GMD.3 Explain volume formulas and use them to solve problems. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.\* | G.GMD.3 Solve problems using volume formulas for cylinders, pyramids, cones, and spheres. |  |
| CC.9-12.G.GMD.4 Visualize relationships between two-dimensional and three-dimensional objects. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. | G.GMD.4 Given a three- dimensional object, identify the shape made when the object is cut into cross-sections.G.GMD.4 When rotating a two- dimensional figure, such as a square, know the three-dimensional figure that is generated, such as a cylinder. Understand that a cross section of a solid is an intersection of a plane (two- dimensional) and a solid (three-dimensional). |  |