

Objective	Common Core Standards	What does this mean?
Congruence, Proof, and Constructions		
*Experiment with transformations in the plane	G.CO.1 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	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.
	G.CO.2 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).	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.
		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.
		Representing and Combining Transformations, a Mathematics Assessment Project Lesson

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	G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	Describe the rotations and reflections of a rectangle, parallelogram, trapezoid, or regular polygon that maps each figure onto itself.
	G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	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.
	G.CO.5 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.	Transform a geometric figure given a rotation, reflection, or translation using graph paper, tracing paper, or geometric software.
		Create sequences of transformations that map a geometric figure on to itself and another geometric figure.
*Understand congruence in terms of rigid motions.	G.CO.6 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.	Use descriptions of rigid motion and transformed geometric figures to predict the effects rigid motion has on figures in the coordinate plane.

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		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.
	G.CO.7 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.	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.
	G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	Use the definition of congruence, based on rigid motion, to develop and explain the triangle congruence criteria; ASA, SSS, and SAS.
*Prove geometric theorems. <i>Encourage multiple ways of writing proofs, such as in narrative paragraphs, using flow diagrams, in two-column format, and using diagrams without words.</i>	G.CO.9 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.	Prove theorems pertaining to lines and angles. Prove vertical angles are congruent. Prove when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent. Prove points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

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	<p>G.CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; 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.</p>	<p>Prove theorems pertaining to triangles. Prove the measures of interior angles of a triangle have a sum of 180°. 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.</p>
	<p>G.CO.11 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.</p>	<p>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.</p>
		<p>Evaluating Statements About Length and Area, a Mathematics Assessment Project Lesson</p>

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*Make geometric constructions.	G.CO.12 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.	Copy a segment. Copy an angle. Bisect a segment. Bisect an angle. Construct perpendicular lines, including the perpendicular bisector of a line segment. Construct a line parallel to a given line through a point not on the line.
	G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	Construct an equilateral triangle so that each vertex of the equilateral triangle is on the circle.
		Construct a square so that each vertex of the square is on the circle.
		Construct a regular hexagon so that each vertex of the regular hexagon is on the circle.
Similarity, Proof, 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.	

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	<p>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.</p>	<p>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.</p>
	<p>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</p>	<p>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.</p>
	<p>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.</p>	<p>Use the idea of dilation transformations to develop the definition of similarity. based on the equality of corresponding angles and the proportionality of corresponding sides.</p>
		<p>Given two figures determine whether they are similar and explain their similarity.</p>

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	G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	Use the properties of similarity transformations to develop the criteria for proving similar triangles; AA
*Prove theorems involving similarity.	G.SRT.4 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.	Use AA, SAS, SSS similarity theorems to prove triangles are similar.
		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.
	G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	Using similarity theorems, prove that two triangles are congruent
		Prove geometric figures, other than triangles, are similar and/or congruent
*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.	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.

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	G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.	Explore the sine of an acute angle and the cosine of its complement and determine their relationship
	G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*	Apply both trigonometric ratios and Pythagorean Theorem to solve application problems involving right triangles.
		Geometry Problems: Circles and Triangles Mathematics Assessment Project Lesson
		Calculating Volumes of Compound Objects, a Mathematics Assessment Project Lesson
Apply geometric concepts in modeling situations.	G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
	G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*	Use the concept of density when referring to situations involving area and volume models, such as persons per square mile.

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	G.MG.3 Apply geometric methods to solve design problems (e.g. designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*	Solve design problems by designing an object or structure that satisfies certain constraints, such as minimizing cost or working with a grid system based on ratios (i.e., The enlargement of a picture using a grid and ratios and proportions)
*Apply trigonometry to general triangles.	G.SRT.9 (+) 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.	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, $A = \frac{1}{2} ab \sin(C)$, for the area of a triangle, using the fact that the height of the triangle is, $h = a \sin(C)$.
	G.SRT.10 (+) Prove the Laws of Sines and Cosines and use them to solve problems.	Using trigonometry and the relationship among sides and angles of any triangle, such as $\sin(C) = \frac{h}{a}$, prove the Law of Sines.
		Using trigonometry and the relationship among sides and angles of any triangle and the Pythagorean Theorem to prove the Law of Cosines.
		Use the Laws of Sines to solve problems.
		Use the Laws of Cosines to solve problems

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	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).	Understand and apply the Law of Sines and the Law of Cosines to find unknown measures in right triangles.
		Understand and apply the Law of Sines and the Law of Cosines to find unknown measures in non-right triangles.
Extending to Three Dimensions		
*Explain volume formulas and use them to solve problems.	G.GMD.1 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.	Explain the formulas for the circumference of a circle and the area of a circle by determining the meaning of each term or factor.
		Explain the formulas for the volume of a cylinder, pyramid and cone by determining the meaning of each term or factor.
	G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*	Solve problems using volume formulas for cylinders, pyramids, cones, and spheres.
		Evaluating Statements About Enlargements, a Mathematics Assessment Project Lesson
		Calculating Volumes of Compound Objects, a Mathematics Assessment Project Lesson

Objective	Common Core Standards	What does this mean?
*Visualize relationships between two-dimensional and three-dimensional objects.	G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	Given a three-dimensional object, identify the shape made when the object is cut into cross-sections.
		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).
Apply geometric concepts in modeling situations.	G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
Connecting Algebra and Geometry Through Coordinates		
*Use coordinates to prove simple geometric theorems algebraically.	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 $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.	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 $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.

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	G.GPE.5 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).	Using slope, prove lines are parallel or perpendicular
		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.
	G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	Given two points, find the point on the line segment between the two points that divides the segment into a given ratio.
	G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula..	Use coordinate geometry and the distance formula to find the perimeters of polygons and the areas of triangles and rectangles.
		Finding Equations of Parallel & Perpendicular Lines, a Mathematics Assessment Project Lesson
*Translate between the geometric description and the equation for a conic section.	G.GPE.2 Derive the equation of a parabola given a focus and a directrix	Given a focus and directrix, derive the equation of a parabola

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		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.
Circles With and Without Coordinates		
*Understand and apply theorems about circles.	G.C.1 Prove that all circles are similar.	Using the fact that the ratio of diameter to circumference is the same for circles, prove that all circles are similar.
	G.C.2 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.	Using definitions, properties, and theorems, identify and describe relationships among inscribed angles, radii, and chords. Include central, inscribed, and circumscribed angles.
		Understand that inscribed angles on a diameter are right angles
		Understand that the radius of a circle is perpendicular to the tangent where the radius intersects the circle.
	G.C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	Construct inscribed circles of a triangle.
		Construct circumscribed circles of a triangle.

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		Using definitions, properties, and theorems, prove properties of angles for a quadrilateral inscribed in a circle.
	G.C.4 (+) Construct a tangent line from a point outside a given circle to the circle.	Construct a tangent line from a point outside a given circle to the circle.
*Find arc lengths and areas of sectors of circles.	G.C.5 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.	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.
		Find the arc length of a circle.
		Using similarity, derive the formula for the area of a sector.
		Find the area of a sector in a circle.
*Translate between the geometric description and the equation for a conic section.	G.GPE.1 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.	Use the Pythagorean Theorem to derive the equation of a circle, given the center and the radius.
		Given an equation of a circle, complete the square to find the center and radius of a circle.

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*Use coordinates to prove simple geometric theorems algebraically.	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 $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.	Include simple proofs involving circles.
Apply geometric concepts in modeling situations.	G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
Applications of Probability		
*Understand independence and conditional probability and use them to interpret data.	S.CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").	Define a sample space and events within the sample space. Identify subsets from sample space given defined events, including unions, intersections and complements of events.
	S.CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	Identify two events as independent or not. Explain properties of Independence and Conditional Probabilities in context and simple English.

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	<p>S.CP.3 Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.</p>	<p>Define and calculate conditional probabilities. Use the Multiplication Principal to decide if two events are independent and to calculate conditional probabilities.</p>
	<p>S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</p>	<p>Construct and interpret two-way frequency tables of data for two categorical variables. Calculate probabilities from the table. Use probabilities from the table to evaluate independence of two variables.</p>
	<p>S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</p>	<p>Recognize and explain the concepts of independence and conditional probability in everyday situations.</p>

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Use the rules of probability to compute probabilities of compound events in a uniform probability model.	S.CP.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.	Calculate conditional probabilities using the definition: "the conditional probability of A given B as the fraction of B's outcomes that also belong to A". Interpret the probability in context.
	S.CP.7 Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.	Identify two events as disjoint (mutually exclusive). Calculate probabilities using the Addition Rule. Interpret the probability in context.
	S.CP.8 (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$, and interpret the answer in terms of the model.	Calculate probabilities using the General Multiplication Rule. Interpret in context.
	S.CP.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.	Identify situations as appropriate for use of a permutation or combination to calculate probabilities. Use permutations and combinations in conjunction with other probability methods to calculate probabilities of compound events and solve problems.
Use probability to evaluate outcomes of decisions.	S.MD.6 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	Make decisions based on expected values. Use expected values to compare long term benefits of several situations.
	S.MD.7 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	Explain in context decisions made based on expected values.