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Pacing Guide

Unit 1 - Geometry Basics

Number of Instructional Days 16

	Common Core Standard Covered	Major Topics/Concepts	Number of days
1-1	**Nets and Drawings for Visualizing Geometry** CCSS.MATH.CONTENT.6.G.A.4	• Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	1
1-2	**Points Lines and Planes** CCSS.MATH.CONTENT.4.G.A.1 CCSS.MATH.CONTENT.HSG.CO.A.1	• Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. • 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.	2
1-3	**Measuring Segments** CCSS.MATH.CONTENT.HSG.GPE.B.6 CCSS.MATH.CONTENT.HSG.CO.A.1	• Find the point on a directed line segment between two given points that partitions the segment in a given ratio. • 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.	2
1-4	**Measuring Angles** CCSS.MATH.CONTENT.4.MD.C.5 CCSS.MATH.CONTENT.4.MD.C.5.B CCSS.MATH.CONTENT.4.MD.C.6 CCSS.MATH.CONTENT.HSG.CO.A.1	• Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement. • An angle that turns through n one-degree angles is said to have an angle measure of n degrees. • Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	2

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		• 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.	
1-5	**Exploring Angle Pairs** CCSS.MATH.CONTENT.7.G.B.5	• Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	**2**
1-6	**Classifying Polygons** CCSS.MATH.CONTENT.5.G.B.3 CCSS.MATH.CONTENT.5.G.B.4	• Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. • Classify two-dimensional figures in a hierarchy based on properties.	**2**
1-7	**Midpoint and Distance in the Coordinate Plane** CCSS.MATH.CONTENT.HSG.CO.C.9 CCSS.MATH.CONTENT.HSG.GPE.B.7	• 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. • Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*	**2**
1-8	**Perimeter Circumference and Area** CCSS.MATH.CONTENT.6.G.A.3 CCSS.MATH.CONTENT.7.G.B.4 CCSS.MATH.CONTENT.HSG.GPE.B.7	• Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. • Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. • Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*	**2**

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1-9 Constructions

CCSS.MATH.CONTENT.HSG.CO.D.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.

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Unit 2 - Reasoning and Proof

Total Number of Instructional Days 10

	Common Core Standard Covered	Major Topics/Concepts	Number of days
2-1	**Inductive and Deductive Reasoning** CCSS.MATH.PRACTICE.MP2 CCSS.MATH.PRACTICE.MP3 CCSS.MATH.PRACTICE.MP8	• Reason abstractly and quantitatively. • Construct viable arguments and critique the reasoning of others. • Look for and express regularity in repeated reasoning.	**1**
2-2	**Logic** CCSS.MATH.PRACTICE.MP2 CCSS.MATH.PRACTICE.MP3 CCSS.MATH.PRACTICE.MP5	• Reason abstractly and quantitatively. • Construct viable arguments and critique the reasoning of others. • Use appropriate tools strategically.	**1**
2-3	**Proving Theorems** CCSS.MATH.PRACTICE.MP1 CCSS.MATH.PRACTICE.MP2 CCSS.MATH.PRACTICE.MP4 CCSS.MATH.PRACTICE.MP8 CCSS.MATH.CONTENT.HSG.CO.C.9 CCSS.MATH.CONTENT.HSG.CO.C.10 CCSS.MATH.CONTENT.HSG.CO.C.11	• Make sense of problems and persevere in solving them. • Reason abstractly and quantitatively. • Model with mathematics. • Look for and express regularity in repeated reasoning. • 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 about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are	**2**

		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. • 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.	
2-4	**Algebraic Proofs** CCSS.MATH.CONTENT.HSG.GPE.B.4 CCSS.MATH.CONTENT.HSG.GPE.B.5 CCSS.MATH.CONTENT.HSG.GPE.B.6 CCSS.MATH.CONTENT.HSG.GPE.B.7 CCSS.MATH.PRACTICE.MP4 CCSS.MATH.PRACTICE.MP8	• 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). • Find the point on a directed line segment between two given points that partitions the segment in a given ratio. • Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.* • Model with mathematics. • Look for and express regularity in repeated reasoning.	**2**
2-5	**Theorems about Angles and Perpendicular Lines** CCSS.MATH.CONTENT.HSG.CO.C.9 CCSS.MATH.CONTENT.HSG.GPE.B.5 CCSS.MATH.PRACTICE.MP4	• 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 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). • Model with mathematics.	**2**

2-6 Planning a Proof

CCSS.MATH.CONTENT.8.G.B.6
CCSS.MATH.PRACTICE.MP1
CCSS.MATH.PRACTICE.MP2
CCSS.MATH.PRACTICE.MP4

- Explain a proof of the Pythagorean Theorem and its converse.
- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Model with mathematics.

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Unit 3 - Parallel and Perpendicular Lines

Total Number of Instructional Days 12

	Common Core Standard Covered	Major Topics/Concepts	Number of days
3-1	**Identify Pairs of Lines and Angles** CCSS.MATH.CONTENT.8.G.A.5 CCSS.MATH.CONTENT.7.G.B.5 CCSS.MATH.CONTENT.HSG.CO.C.9 CCSS.MATH.CONTENT.HSG.GPE.B.5 CCSS.MATH.CONTENT.HSG.CO.B.6	• Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. • Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. • 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 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). • 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.	**2**

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3-2	**Use Parallel Lines and Transversals** CCSS.MATH.CONTENT.4.G.A.1 CCSS.MATH.CONTENT.4.G.A.2 CCSS.MATH.CONTENT.HSG.CO.C.9	• Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. • Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. • 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.	**2**
3-3	**Prove Lines Parallel** CCSS.MATH.CONTENT.HSG.CO.A.1 CCSS.MATH.CONTENT.HSG.CO.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. • 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.	**2**
3-4	**Find and Use Slopes of Lines** CCSS.MATH.CONTENT.8.EE.B.5	• Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.	**2**
3-5	**Right and Graph Equations of Lines** CCSS.MATH.CONTENT.8.EE.B.5 CCSS.MATH.CONTENT.8.EE.B.6	• Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. • Use similar triangles to explain why the slope m is the same between any two	**2**

		distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.	
3-6	**Prove Theorems about Perpendicular Lines** CCSS.MATH.CONTENT.HSG.CO.C.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.	**2**

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Unit 4 - Congruent Triangles

Total Number of Instructional Days 13

	Common Core Standard Covered	Major Topics/Concepts	Number of days
4-1	**Congruent Figures** CCSS.MATH.CONTENT.8.G.A.2 CCSS.MATH.CONTENT.8.G.A.4 CCSS.MATH.CONTENT.HSG.SRT.B.5	• Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. • Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. • Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**2**
4-2	**Triangle Congruence by SSS and SAS** CCSS.MATH.CONTENT.HSG.SRT.A.3 CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.HSG.CO.B.8	• Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. • Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions	**2**
4-3	**Triangle Congruence by ASA and AAS** CCSS.MATH.CONTENT.HSG.SRT.A.3 CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.HSG.CO.B.8	• Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. • Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions	**2**

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4-4	**Using Corresponding Parts of Congruent Triangles** CCSS.MATH.CONTENT.HSG.SRT.A.3 CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.HSG.CO.B.7	• Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. • Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • 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.	**2**
4-5	**Isosceles and Equilateral Triangles** CCSS.MATH.CONTENT.HSG.CO.C.10 CCSS.MATH.CONTENT.HSG.CO.D.13	• 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. • Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	**2**
4-6	**Congruence in Right Triangles** CCSS.MATH.CONTENT.HSG.SRT.B.4 CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.HSG.SRT.C.6	• 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 congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • 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	**2**
4-7	**Congruence in Overlapping Triangles** CCSS.MATH.CONTENT.HSG.SRT.A.3 CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.HSG.SRT.C.6	• Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. • Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • 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.	**1**

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Unit 5 - Relationships within Triangles

Total Number of Instructional Days 14

	Common Core Standard Covered	Major Topics/Concepts	Number of days
5-1	**Midsegments of Triangles** CCSS.MATH.CONTENT.HSG.CO.C.10 CCSS.MATH.CONTENT.8.G.A.5 CCSS.MATH.CONTENT.HSG.CO.C.9 CCSS.MATH.CONTENT.HSG.CO.C.10 CCSS.MATH.PRACTICE.MP2	• 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. • Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so. • 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 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. • Reason abstractly and quantitatively.	**2**
5-2	**Perpendicular and Angle Bisectors**	• 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	**2**

	CCSS.MATH.CONTENT.HSG.CO.C.9 CCSS.MATH.CONTENT.HSG.CO.C.10 CCSS.MATH.PRACTICE.MP2	the segment's endpoints. • 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. • Reason abstractly and quantitatively.	
5-3	**Bisectors in Triangles** CCSS.MATH.CONTENT.HSG.CO.C.9 CCSS.MATH.CONTENT.HSG.CO.C.10 CCSS.MATH.PRACTICE.MP2	• 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 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. • Reason abstractly and quantitatively.	**2**
5-4	**Medians and Altitudes** CCSS.MATH.CONTENT.HSG.CO.C.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.	**2**
5-5	**Indirect Proof** CCSS.MATH.CONTENT.HSG.SRT.B.4 CCSS.MATH.PRACTICE.MP1 CCSS.MATH.PRACTICE.MP3 CCSS.MATH.PRACTICE.MP4	• 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. • Make sense of problems and persevere in solving them. • Construct viable arguments and critique the reasoning of others. • Model with mathematics.	**2**

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5-6	**Inequalities in One Triangle** CCSS.MATH.CONTENT.HSG.SRT.B.4 CCSS.MATH.PRACTICE.MP1 CCSS.MATH.PRACTICE.MP3 CCSS.MATH.PRACTICE.MP4	• 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. • Make sense of problems and persevere in solving them. • Construct viable arguments and critique the reasoning of others. • Model with mathematics.	**2**
5-7	**Inequalities in Two Triangles** CCSS.MATH.CONTENT.HSG.SRT.B.4 CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.PRACTICE.MP1 CCSS.MATH.PRACTICE.MP3 CCSS.MATH.PRACTICE.MP4	• 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 congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • Make sense of problems and persevere in solving them. • Construct viable arguments and critique the reasoning of others. • Model with mathematics.	**2**

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Unit 6 - The Polygon and Angle Sum Theorems

Total Number of Instructional Days 16

	Common Core Standard Covered	Major Topics/Concepts	Number of days
6-1	**The Polygon-Angle Sum Theorems** CCSS.MATH.CONTENT.HSG.CO.C.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.	**1**
6-2	**Properties of Parallelograms** CCSS.MATH.CONTENT.5.G.B.3 CCSS.MATH.CONTENT.5.G.B.4 CCSS.MATH.CONTENT.HSG.CO.C.11	• Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. • Classify two-dimensional figures in a hierarchy based on properties. • 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.	**1**
6-3	**Proving That a Quadrilateral is a Parallelogram** CCSS.MATH.CONTENT.5.G.B.3 CCSS.MATH.CONTENT.5.G.B.4 CCSS.MATH.CONTENT.HSG.CO.C.11	• Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. • Classify two-dimensional figures in a hierarchy based on properties. • 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.	**2**

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6-4	**Properties of Rhombuses Rectangles and Squares** CCSS.MATH.CONTENT.5.G.B.3 CCSS.MATH.CONTENT.5.G.B.4 CCSS.MATH.CONTENT.HSG.CO.C.11	• Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. • Classify two-dimensional figures in a hierarchy based on properties. • 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.	**2**
6-5	**Conditions of Rhombuses Rectangles and Squares** CCSS.MATH.CONTENT.3.G.A.1 CCSS.MATH.CONTENT.4.G.A.2 CCSS.MATH.CONTENT.4.G.A.3 CCSS.MATH.CONTENT.5.G.B.3 CCSS.MATH.CONTENT.5.G.B.4	• Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories. • Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. • Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. • Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. • Classify two-dimensional figures in a hierarchy based on properties.	**2**

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6-6	**Trapezoids and Kites** CCSS.MATH.CONTENT.HSG.CO.C.11 CCSS.MATH.CONTENT.5.G.B.3 CCSS.MATH.CONTENT.5.G.B.4	• 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. • Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. • Classify two-dimensional figures in a hierarchy based on properties.	**2**
6-7	**Polygons in the Coordinate Plane** CCSS.MATH.CONTENT.HSG.CO.C.11 CCSS.MATH.CONTENT.HSG.GPE.B.7 CCSS.MATH.CONTENT.HSG.MG.A.1	• 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. • Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. • Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	**2**
6-8	**Applying Coordinate Geometry** CCSS.MATH.CONTENT.6.G.A.3 CCSS.MATH.CONTENT.8.G.A.3 CCSS.MATH.CONTENT.8.G.B.8	• Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. • Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. • Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	**2**

6-9 Proofs Using Coordinate Geometry

CCSS.MATH.CONTENT.HSG.GPE.B.7
CCSS.MATH.CONTENT.HSG.GPE.B.4

- Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
- 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).

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Unit 7 - Similarity

Total Number of Instructional Days 12

	Common Core Standard Covered	Major Topics/Concepts	Number of days
7-1	**Ratios and Proportions** CCSS.MATH.CONTENT.6.RP.A.1 CCSS.MATH.CONTENT.6.RP.A.2 CCSS.MATH.CONTENT.6.RP.A.3 CCSS.MATH.CONTENT.6.RP.A.3.A CCSS.MATH.CONTENT.6.RP.A.3.B CCSS.MATH.CONTENT.6.RP.A.3.C CCSS.MATH.CONTENT.6.RP.A.3.D CCSS.MATH.CONTENT.7.RP.A.1 CCSS.MATH.CONTENT.7.RP.A.2 CCSS.MATH.CONTENT.7.RP.A.2.A CCSS.MATH.CONTENT.7.RP.A.2.B CCSS.MATH.CONTENT.7.RP.A.2.C CCSS.MATH.CONTENT.7.RP.A.2.D CCSS.MATH.CONTENT.7.RP.A.3 CCSS.MATH.CONTENT.HSG.GPE.B.6 CCSS.MATH.CONTENT.8.EE.B.5	• Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes." • Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." • Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. • Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. • Solve unit rate problems including those involving unit pricing and constant speed • Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. • Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. • Compute unit rates associated with ratios of fractions, including ratios of	**3**

lengths, areas and other quantities measured in like or different units.

- Recognize and represent proportional relationships between quantities.
- Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
- Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.
- Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
- Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.
- Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
- Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

7-2 Similar Polygons **3**

CCSS.MATH.CONTENT.HSG.SRT.A.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.

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7-3	**Proving Triangles Similar** CCSS.MATH.CONTENT.HSG.SRT.A.2 CCSS.MATH.CONTENT.HSG.SRT.A.3 CCSS.MATH.CONTENT.HSG.SRT.B.4 CCSS.MATH.CONTENT.HSG.SRT.B.5	• 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. • Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. • 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 congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**2**
7-4	**Similarity in Right Triangles** CCSS.MATH.CONTENT.HSG.SRT.A.2 CCSS.MATH.CONTENT.HSG.SRT.A.3 CCSS.MATH.CONTENT.HSG.SRT.B.4 CCSS.MATH.CONTENT.HSG.SRT.B.5	• 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. • Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. • 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 congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**2**

7-5 Proportions in Triangles

CCSS.MATH.CONTENT.HSG.SRT.A.2
CCSS.MATH.CONTENT.HSG.SRT.A.3

- 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.
- Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

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Unit 8 - Right Triangles and Trigonometry

Total Number of Instructional Days 12

	Common Core Standard Covered	Major Topics/Concepts	Number of days
8-1	**The Pythagorean Theorem and Its Converse** CCSS.MATH.CONTENT.8.G.B.6 CCSS.MATH.CONTENT.8.G.B.7 CCSS.MATH.CONTENT.8.G.B.8 CCSS.MATH.CONTENT.HSG.SRT.C.8	• Explain a proof of the Pythagorean Theorem and its converse. • Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. • Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. • Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	**2**
8-2	**Special Right Triangles** CCSS.MATH.CONTENT.HSG.SRT.B.4 CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.HSG.SRT.C.8	• 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 congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	**2**
8-3	**Trigonometry** CCSS.MATH.CONTENT.HSG.SRT.D.9 CCSS.MATH.CONTENT.HSG.SRT.D.10 CCSS.MATH.CONTENT.HSG.SRT.D.11	• (+) 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. • (+) Prove the Laws of Sines and Cosines and use them to solve problems. • (+) 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).	**3**

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8-4	**Angles of Elevation and Depression** CCSS.MATH.CONTENT.HSG.SRT.D.9 CCSS.MATH.CONTENT.HSG.SRT.D.10 CCSS.MATH.CONTENT.HSG.SRT.D.11	• (+) 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. • (+) Prove the Laws of Sines and Cosines and use them to solve problems. • (+) 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).	**1**
8-5	**Law of Cosines** CCSS.MATH.CONTENT.HSG.SRT.D.10 CCSS.MATH.CONTENT.HSG.SRT.D.11	• (+) Prove the Laws of Sines and Cosines and use them to solve problems. • (+) 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).	**2**
8-6	**Law of Sines** CCSS.MATH.CONTENT.HSG.SRT.D.10 CCSS.MATH.CONTENT.HSG.SRT.D.11	• (+) Prove the Laws of Sines and Cosines and use them to solve problems. • (+) 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).	**2**

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Unit 9 - Transformations

Total Number of Instructional Days 14

	Common Core Standard Covered	Major Topics/Concepts	Number of days
9-1	**Translations** CCSS.MATH.CONTENT.8.G.A.2 CCSS.MATH.CONTENT.8.G.A.3 CCSS.MATH.CONTENT.8.G.A.4 CCSS.MATH.CONTENT.HSG.CO.A.3 CCSS.MATH.CONTENT.HSG.CO.A.4 CCSS.MATH.CONTENT.HSG.CO.A.5	• Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. • Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. • Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. • Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. • Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. • 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.	**2**
9-2	**Reflections** CCSS.MATH.CONTENT.8.G.A.2 CCSS.MATH.CONTENT.8.G.A.3 CCSS.MATH.CONTENT.8.G.A.4	• Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. • Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	**2**

	CCSS.MATH.CONTENT.HSG.CO.A.3 CCSS.MATH.CONTENT.HSG.CO.A.4 CCSS.MATH.CONTENT.HSG.CO.A.5	• Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. • Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. • Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. • 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.	
9-3	**Rotations** CCSS.MATH.CONTENT.8.G.A.2 CCSS.MATH.CONTENT.8.G.A.3 CCSS.MATH.CONTENT.8.G.A.4 CCSS.MATH.CONTENT.HSG.CO.A.3 CCSS.MATH.CONTENT.HSG.CO.A.4 CCSS.MATH.CONTENT.HSG.CO.A.5	• Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. • Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. • Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. • Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. • Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. • Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry	**2**

		software. Specify a sequence of transformations that will carry a given figure onto another.	
9-4	**Congruence Transformations** CCSS.MATH.CONTENT.8.G.A.2 CCSS.MATH.CONTENT.HSG.CO.A.3 CCSS.MATH.CONTENT.HSG.CO.A.4 CCSS.MATH.CONTENT.HSG.CO.A.5	• Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. • Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. • Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. • 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.	**2**
9-5	**Dilations** CCSS.MATH.CONTENT.8.G.A.2 CCSS.MATH.CONTENT.8.G.A.3 CCSS.MATH.CONTENT.8.G.A.4 CCSS.MATH.CONTENT.HSG.CO.A.3 CCSS.MATH.CONTENT.HSG.CO.A.4 CCSS.MATH.CONTENT.HSG.CO.A.5 CCSS.MATH.CONTENT.HSG.SRT.A.1 CCSS.MATH.CONTENT.HSG.SRT.A.1.A CCSS.MATH.CONTENT.HSG.SRT.A.1.B	• Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. • Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. • Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. • Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. • Develop definitions of rotations, reflections, and translations in terms of angles,	**2**

		circles, perpendicular lines, parallel lines, and line segments. • 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. • Verify experimentally the properties of dilations given by a center and a scale factor. • 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. • The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	
9-6	**Solving Rational Equations** CCSS.MATH.CONTENT.HSA.REI.A.2	• Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	**2**
9-7	**Similarity Transformations** CCSS.MATH.CONTENT.HSG.SRT.C.6 CCSS.MATH.CONTENT.HSG.SRT.A.1.B CCSS.MATH.CONTENT.HSG.SRT.A.2 CCSS.MATH.CONTENT.HSG.SRT.A.3	• 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. • The dilation of a line segment is longer or shorter in the ratio given by the scale factor. • 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. • Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	**2**

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Unit 10 - Area

Total Number of Instructional Days 16

	Common Core Standard Covered	Major Topics/Concepts	Number of days
10-1	**Areas of Parallelograms and Triangles** CCSS.MATH.CONTENT.6.G.A.1 CCSS.MATH.CONTENT.7.G.B.6 CCSS.MATH.CONTENT.HSG.GPE.B.7	• Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. • Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. • Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	**2**
10-2	**Areas of Trapezoids, Rhombuses, and Kites** CCSS.MATH.CONTENT.7.G.B.6 CCSS.MATH.CONTENT.HSG.GPE.B.7	• Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. • Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	**2**
10-3	**Areas of Regular Polygons** CCSS.MATH.CONTENT.6.G.A.1 CCSS.MATH.CONTENT.7.G.B.6	• Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. • Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	**2**

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10-4	**Perimeters and Areas of Similar Figures** CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.7.G.B.6	• Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	**2**
10-5	**Trigonometry and Area** CCSS.MATH.CONTENT.HSG.SRT.B.5 CCSS.MATH.CONTENT.7.G.B.6	• Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. • Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	**2**
10-6	**Circles and Arcs** CCSS.MATH.CONTENT.HSG.C.B.5	• Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius.	**2**
10-7	**Areas of Circles and Sectors** CCSS.MATH.CONTENT.HSG.C.B.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.	**2**
10-8	**Geometric Probability** CCSS.MATH.CONTENT.7.SP.C.5	• Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	**2**

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Unit 11 - Surface Area and Volume

Number of Instructional Days 12

	Common Core Standard Covered	Major Topics/Concepts	Number of days
11-1	**Space Figures and Cross Sections** CCSS.MATH.CONTENT.HSG.GMD.B.4 CCSS.MATH.CONTENT.7.G.A.3 CCSS.MATH.CONTENT.HSG.MG.A.1 CCSS.MATH.CONTENT.HSG.MG.A.2 CCSS.MATH.CONTENT.HSG.MG.A.3	• Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. • Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. • Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* • Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* • 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).*	**2**
11-2	**Surface Areas of Prisms and Cylinders** CCSS.MATH.CONTENT.6.G.A.4 CCSS.MATH.CONTENT.7.G.B.6 CCSS.MATH.CONTENT.7.G.A.3 CCSS.MATH.CONTENT.HSG.MG.A.1 CCSS.MATH.CONTENT.HSG.MG.A.2	• Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems. • Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. • Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	**2**

	CCSS.MATH.CONTENT.HSG.MG.A.3	• Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* • Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* • 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).*	
11-3	**Surface Areas of Pyramids and Cones** CCSS.MATH.CONTENT.6.G.A.4 CCSS.MATH.CONTENT.7.G.B.6 CCSS.MATH.CONTENT.7.G.A.3 CCSS.MATH.CONTENT.HSG.MG.A.1 CCSS.MATH.CONTENT.HSG.MG.A.2 CCSS.MATH.CONTENT.HSG.MG.A.3	• Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems. • Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. • Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. • Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* • Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* • 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).*	**2**
11-4	**Volumes of Prisms and Cylinders** CCSS.MATH.CONTENT.7.G.B.6 CCSS.MATH.CONTENT.7.G.A.3	• Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. • Describe the two-dimensional figures that result from slicing three-dimensional	**2**

	CCSS.MATH.CONTENT.HSG.GMD.A.1 CCSS.MATH.CONTENT.HSG.GMD.A.2 CCSS.MATH.CONTENT.HSG.GMD.A.3 CCSS.MATH.CONTENT.HSG.MG.A.1 CCSS.MATH.CONTENT.HSG.MG.A.2 CCSS.MATH.CONTENT.HSG.MG.A.3	figures, as in plane sections of right rectangular prisms and right rectangular pyramids. • 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. • (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. • Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.* • Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* • Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* • 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).*	
11-5	**Volumes of Pyramids and Cones**	• Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. • Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. • 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. • (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. • Use volume formulas for cylinders, pyramids, cones, and spheres to solve	**2**
	CCSS.MATH.CONTENT.7.G.B.6 CCSS.MATH.CONTENT.7.G.A.3 CCSS.MATH.CONTENT.HSG.GMD.A.1 CCSS.MATH.CONTENT.HSG.GMD.A.2 CCSS.MATH.CONTENT.HSG.GMD.A.3 CCSS.MATH.CONTENT.HSG.MG.A.1 CCSS.MATH.CONTENT.HSG.MG.A.2 CCSS.MATH.CONTENT.HSG.MG.A.3		

		problems.* • Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* • Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* • 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).*	
11-6	**Surface Area and Volumes of Spheres** CCSS.MATH.CONTENT.HSG.GMD.A.1 CCSS.MATH.CONTENT.HSG.GMD.A.2 CCSS.MATH.CONTENT.HSG.GMD.A.3 CCSS.MATH.CONTENT.HSG.MG.A.1 CCSS.MATH.CONTENT.HSG.MG.A.2 CCSS.MATH.CONTENT.HSG.MG.A.3	• 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. • (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. • Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.* • Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* • Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* • 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).*	**2**

11-7 Areas and Volumes of Similar Solids

CCSS.MATH.CONTENT.6.G.A.4
CCSS.MATH.CONTENT.6.G.A.2
CCSS.MATH.CONTENT.8.G.C.9

- Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.
- Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
- Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

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Unit 12 - Circles

Total Number of Instructional Days 12

	Common Core Standard Covered	Major Topics/Concepts	Number of days
12-1	**Tangent Lines** CCSS.MATH.CONTENT.HSG.C.A.4 CCSS.MATH.CONTENT.HSG.C.A.2	• (+) Construct a tangent line from a point outside a given circle to the circle. • 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.	**2**
12-2	**Chords and Arcs** CCSS.MATH.CONTENT.HSG.C.A.2 CCSS.MATH.CONTENT.HSG.C.B.5	• 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. • 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.	**2**
12-3	**Inscribed Angles** CCSS.MATH.CONTENT.HSG.C.A.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.	**2**
12-4	**Angle Measures and Segment Lengths** CCSS.MATH.CONTENT.4.MD.C.5 CCSS.MATH.CONTENT.4.MD.C.5.A CCSS.MATH.CONTENT.4.MD.C.5.B	• Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: • An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure	**2**

	CCSS.MATH.CONTENT.4.MD.C.6 CCSS.MATH.CONTENT.4.MD.C.7 CCSS.MATH.CONTENT.HSG.GPE.B.6 CCSS.MATH.CONTENT.HSG.CO.A.1	angles. • An angle that turns through n one-degree angles is said to have an angle measure of n degrees. • Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. • Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure. • Find the point on a directed line segment between two given points that partitions the segment in a given ratio. • 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.	
12-5	**Circles in the Coordinate Plane** CCSS.MATH.CONTENT.5.G.A.1 CCSS.MATH.CONTENT.5.G.A.2 CCSS.MATH.CONTENT.HSG.GPE.A.1 CCSS.MATH.CONTENT.HSA.REI.D.10 CCSS.MATH.CONTENT.HSG.GPE.B.4	• Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate). • Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. • 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	**2**

an equation.

- Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- Use coordinates to prove simple geometric theorems algebraically.
- 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)

12-6 Locus A Set of Points

CCSS.MATH.CONTENT.HSG.CO.A.2
CCSS.MATH.PRACTICE.MP1
CCSS.MATH.PRACTICE.MP3
CCSS.MATH.PRACTICE.MP4
CCSS.MATH.PRACTICE.MP6

- 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).
- Make sense of problems and persevere in solving them.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Attend to precision.

2

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Unit 13 - Probability

Total Number of Instructional Days 14

	Common Core Standard Covered	Major Topics/Concepts	Number of days
13-1	**Experimental and Theoretical Probability** CCSS.MATH.CONTENT.7.SP.A.2 CCSS.MATH.CONTENT.7.SP.C.5 CCSS.MATH.CONTENT.7.SP.C.6 CCSS.MATH.CONTENT.7.SP.C.8.A	• Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. • Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. • Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times. • Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.	**2**
13-2	**Probability Distributions and Frequency Tables** CCSS.MATH.CONTENT.6.SP.B.5.C CCSS.MATH.CONTENT.7.SP.C.8.B CCSS.MATH.CONTENT.HSS.MD.A.1 CCSS.MATH.CONTENT.HSS.MD.A.2	• Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. • Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.	**2**

		• (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. • (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	
13-3	**Permutations and Combinations** CCSS.MATH.CONTENT.HSS.CP.B.9	• Use permutations and combinations to compute probabilities of compound events and solve problems.	**2**
13-4	**Compound Probability** CCSS.MATH.CONTENT.7.SP.C.8 CCSS.MATH.CONTENT.7.SP.C.8.A CCSS.MATH.CONTENT.7.SP.C.8.B CCSS.MATH.CONTENT.7.SP.C.8.C	• Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. • Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. • Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. • Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?	**2**
13-5	**Probability Models** CCSS.MATH.CONTENT.7.SP.C.7 CCSS.MATH.CONTENT.7.SP.C.7.A CCSS.MATH.CONTENT.7.SP.C.7.B	• Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. • Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For	**2**

example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

- Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?

13-6	**Conditional Probability Formulas** CCSS.MATH.CONTENT.HSS.CP.A.3 CCSS.MATH.CONTENT.HSS.CP.B.6 CCSS.MATH.CONTENT.HSS.CP.B.7 CCSS.MATH.CONTENT.HSS.CP.B.8	• Understand the conditional probability of A given B as P(A 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. • 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. • Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model. • (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.	**2**
13-7	**Modeling Randomness** CCSS.MATH.CONTENT.HSS.MD.B.6 CCSS.MATH.CONTENT.HSS.MD.B.7 CCSS.MATH.PRACTICE.MP1 CCSS.MATH.PRACTICE.MP3 CCSS.MATH.PRACTICE.MP4	• (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). • (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). • Make sense of problems and persevere in solving them. • Construct viable arguments and critique the reasoning of others. • Model with mathematics.	**2**