



Park Hill School District

Building Successful Futures • Each Student • Every Day

High School Topics Geometry Curriculum

Course Description: This course involves the integration of logical reasoning and spatial visualization skills. It includes a study of deductive proofs and applications from Algebra, an intense study of polygons, and an introduction to Trigonometry. Students will be required to “think visually” while transferring information to real life problems.

Scope and Sequence:

Timeframe	Unit	Instructional Topics
3 weeks 7 weeks	Unit 1: Basics of Geometry	Topic 1: Foundations of Geometry Topic 2: Perpendicular Lines
3 ½ weeks 5 weeks	Unit 2: Properties of 2-Dimensional Figures	Topic 1: Properties of Triangles Topic 2: Properties of Polygons
1 ½ weeks 3 ½ weeks	Unit 3: Similarity	Topic 1: Similarity
1 ½ weeks 2 weeks	Unit 4: Transformations of Symmetry	Topic 1: Transformations of Symmetry
2 weeks	Unit 5: Trigonometric Ratios and Pythagorean Theorem	Topic 1: Trigonometric Ratios and Pythagorean Theorem
1 ½ weeks	Unit 6: Measurements of 2-Dimensional and 3-Dimensional Figures	Topic 1: Perimeter and Area of 2-Dimensional Figures Topic 2: Properties of 3-Dimensional Figures
2 weeks	Unit 7: Properties of Circles	Topic 1: Properties of Circles
1 week	Unit 8: Probability	Topic 1: Probability

**This document contains the entire High School Geometry curriculum that is taught in a regular education setting. Items that are highlighted in yellow have been designated as priority information that should be taught in the High School Geometry Topics class.*

Curriculum Revision Tracking

Spring, 2018

Changed order of units from

- Unit 1: Basic Geometry
- Unit 2: Properties of 2-Dimensional Figures
- Unit 3: Properties of Circles
- Unit 4: Similarity
- Unit 5: Measurements of 2-Dimensional and 3-Dimensional Figures
- Unit 6: Transformations of Symmetry
- Unit 7: Trigonometric Ratios and Pythagorean Theorem
- Unit 8: Probability

to

- Unit 1: Basic Geometry
- Unit 2: Properties of 2-Dimensional Figures
- Unit 3: Similarity
- Unit 4: Transformations of Symmetry
- Unit 5: Trigonometric Ratios and Pythagorean Theorem
- Unit 6: Measurements of 2-Dimensional and 3-Dimensional Figures
- Unit 7: Properties of Circles
- Unit 8: Probability

Unit 2

- Changed “Topic 3: Perimeter and Area of Polygons” to “Perimeter and Area of 2-D Figures” and moved it to Topic 1 of Unit 6: Measurements of 2-Dimensional and 3-Dimensional Figures

Unit 4

- Added priority standard Geo.GPE.B.3

Unit 6

- Changed title from “Properties of 3-Dimensional Figures” to “Measurements of 2-Dimensional and 3-Dimensional Figures”

Unit 1: Basics of Geometry

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Basics of Geometry

Length of Unit: 3 weeks **RESOURCE MODIFICATION:** 7 weeks

Overview of Unit: This unit will explore the defined and undefined terms associated with Geometry. This unit will also include theorems dealing with parallel and perpendicular lines.

RESOURCE MODIFICATION: Additional time will be given to providing background work and hands-on construction work to prepare students. Extended time should be provided to each area in the basics unit to develop geometry skills.

Priority Standards for unit:

- Geo.CO.A.1: Define angle, circle, perpendicular line, parallel line, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc.

Supporting Standards for unit:

- Geo.GPE.B.3: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
- Geo.CO.C.1: Prove theorems about lines and angles.
- Geo.CO.D.1: Construct geometric figures using various tools and methods.
- Geo.GPE.B.2: Prove the slope criteria for parallel and perpendicular lines and use them to solve problems.
- Geo.GPE.A.2: Derive the equation of a parabola given a focus and directrix.
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- ISTE-KNOWLEDGE COLLECTOR.3.D - build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
angle, circle, perpendicular line, parallel line, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc.	Define	Understand	1

Essential Questions:

1. Why are points, lines, and planes important?

2. What are the different types of angles in plane Geometry and how can you use them to find missing angle measures?
3. How do you construct the following: copy an angle, copy a segment, midpoint, perpendicular bisector, angle bisector, and a parallel line to another line?

Enduring Understanding/Big Ideas:

1. Two points determine a line. Segments and rays are parts of lines. Segments have 2 endpoints. Rays have one endpoint. These figures can all be contained in a plane. You name a plane using 3 noncollinear points. You name a line, segment, and ray with 2 points.
2. There are acute, right, obtuse, straight, and reflex angles that can be measured using a protractor. When finding an angle measure, any of the angles you find must be one of the types mentioned previously. Linear pairs are supplementary so you can be given one of the angles and find the other angle measure. Vertical Angles are congruent, so if you are given one angle, you can find the angle measure of its vertical angle. When you have parallel lines cut by a transversal, you get AEA that are congruent, you get AIA that are congruent, you get CA that are congruent, and CIA or SSIA are supplementary.
3. You can construct each of these items following a specific set of instructions. You can use a compass and straightedge to construct them, you can use software to construct them, or you can use paper folding to construct them.

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
<p style="text-align: center;">Rays Plane Distance Formula</p>	<p style="text-align: center;">Point Line Segment Opposite Rays Angle Midpoint Directed Line Segment Vertical Angles Linear Pairs Segment Bisector Angle Bisector Congruent Right Angle Acute Angle Obtuse Angle Straight Angle</p>

	Reflex Angle Polygon Constructions Midpoint Formula
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Resources for Vocabulary Development: Textbook Resources

Unit Postulates and Theorems:

Segment Addition Postulate Angle Addition Postulate Linear Pair Property Vertical Angles Theorem Alternate Exterior Angles Theorem Alternate Interior Angles Theorem Corresponding Angles Postulate Consecutive Interior Angles Theorem (Same Side Interior Angles Theorem)
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Topic 1: Foundations of Geometry

Engaging Experience 1

Title: Constructions Practice

Suggested Length of Time: 2 class periods

Standards Addressed

Priority:

- Geo.CO.A.1: Define **angle**, **circle**, perpendicular line, parallel line, **line segment** and **ray** based on the undefined notions of **point**, **line**, **distance along a line** and distance around a circular arc.

Supporting:

- Geo.CO.D.1: Construct geometric figures using various tools and methods.
- ISTE-CREATIVE COMMUNICATOR.6.A - choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

Detailed Description/Instructions: Students will be given a task, and following teacher modeling, students will recreate those constructions (for example, midpoint of a segment, vertical angles, copy a segment, copy an angle, angle bisector, circle) using paper folding, computer software, or straightedge and compass. Students will then develop their own constructions.

Bloom's Levels: Understand

Webb's DOK: 1

Engaging Experience 2

Title: Coordinate Plane Practice

Suggested Length of Time: 1 class period; RESOURCE MODIFICATION: 2 class periods

Standards Addressed

Priority:

- Geo.CO.A.1: Define **angle**, **circle**, perpendicular line, parallel line, **line segment** and **ray** based on the undefined notions of **point**, **line**, **distance along a line** and distance around a circular arc.

Supporting:

- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Detailed Description/Instructions: Students will be given two ordered pairs to represent two points in the coordinate plane. They will be expected to find the length of the segment (use distance formula) and the midpoint coordinates of the segment.

Bloom's Levels: Understand

Webb's DOK: 1

Topic 2: Parallel and Perpendicular Lines

Engaging Experience 1

Title: Constructions Practice

Suggested Length of Time: 1 class period; RESOURCE MODIFICATION: 2 class periods

Standards Addressed

Priority:

- Geo.CO.A.1: Define angle, circle, **perpendicular line, parallel line**, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc.

Supporting:

- Geo.CO.D.1: Construct geometric figures using various tools and methods.
- ISTE-INNOVATIVE DESIGNER.4.A - know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

Detailed Description/Instructions: Students will be given a task, and following teacher modeling, students will recreate those constructions (for example, parallel and perpendicular lines) using paper folding, computer software, or straightedge and compass. Students will then develop their own constructions.

Bloom's Levels: Understand

Webb's DOK: 1

Engaging Experience 2

Title: Coordinate Plane Practice

Suggested Length of Time: 1 class period; RESOURCE MODIFICATION: 2 class periods

Standards Addressed

Priority:

- Geo.CO.A.1: Define angle, circle, **perpendicular line, parallel line**, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc.

Supporting:

- Geo.CO.D.1: Construct geometric figures using various tools and methods.

Detailed Description/Instructions: Students will be given a coordinate plane to work with. They will be given two ordered pairs to represent two points in the coordinate plane. They will be expected to find the length of the segment (use distance formula) and the midpoint coordinates of the segment.

Bloom's Levels: Understand

Webb's DOK: 1

Engaging Experience 3

Title: Special Angle Pair Practice

Suggested Length of Time: 30 minutes; **RESOURCE MODIFICATION:** 1 class period

Standards Addressed

Priority:

- Geo.CO.A.1: Define angle, circle, perpendicular line, parallel line, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc.

Supporting:

- Geo.CO.C.1: Prove theorems about lines and angles.

Detailed Description/Instructions: The teacher will construct two parallel lines and a transversal with tape on the floor. Students will be in pairs. The teacher will give each pair of students an angle pair relationship and they have to stand in the correct spots on the tape diagram. Example: "Show me corresponding angles." The students will stand in two angles that are corresponding.

Bloom's Levels: Understand

Webb's DOK: 1

Engaging Scenario

Engaging Scenario: *Students will be given the problem at the start of Topic 2 Parallel & Perpendicular Lines*

This worksheet can be found in the district Geometry Shell Course.

- Safe Crossings Project: Students will work on building a model bridge to a school over a busy road - the bridge must be perpendicular to the existing sidewalk and then create a parallel sidewalk on other side of road.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Foundations of Geometry	Constructions Practice	Students will be given a task, and following teacher modeling, students will recreate those constructions (for example, midpoint of a segment, vertical angles, copy a segment, copy an angle, angle bisector, circle) using paper folding, computer software, or straightedge and compass. Students will then develop their own constructions.	2 class periods
Foundations of Geometry	Coordinate Plane Practice	Students will be given two ordered pairs to represent two points in the coordinate plane. They will be expected to find the length of the segment (use distance formula) and the midpoint coordinates of the segment.	1 class period
Parallel and Perpendicular Lines	Constructions Practice	Students will be given a task, and following teacher modeling, students will recreate those constructions (for example, parallel and perpendicular lines) using paper folding, computer software, or straightedge and compass. Students will then develop their own constructions.	1 class period
Parallel and Perpendicular Lines	Coordinate Plane Practice	Students will be given a coordinate plane to work with. They will be given two ordered pairs to represent two points in the coordinate plane. They will be expected to find the length of the segment (use distance formula) and the midpoint.	1 class period
Parallel and Perpendicular Lines	Special Angle Pair Practice	The teacher will construct two parallel lines and a transversal with tape on the floor. Students will be in pairs. The teacher will give each pair of students an angle pair relationship and they have to stand in the correct spots on the tape diagram. Example: "Show me corresponding angles." The students will stand in two angles that are corresponding.	30 minutes

Unit 2: Properties of 2-Dimensional Figures

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Properties of 2-Dimensional Figures

Length of Unit: 3 ½ weeks; **RESOURCE MODIFICATION:** 5 weeks

Overview of Unit: This unit explores the properties of triangles and how to prove triangles are congruent. Students will also learn about the different types of 2-dimensional figures and the formulas associated with the area and perimeter of such figures.

Priority Standards for unit:

- Geo.MG.A.1: Use geometric shapes, their measures and their properties to describe objects.

Supporting Standards for unit:

- Geo.GPE.B.4: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles.
- Geo.CO.C.3: Prove theorems about polygons.
- Geo.CO.C.2: Prove theorems about triangles.
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- Geo.MG.A.3: Apply geometric methods to solve design mathematical modeling problems.
- Geo.SRT.B.1: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- Geo.CO.B.2: Develop the criteria for triangle congruence from the definition of congruence in terms of rigid motions.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
geometric shapes, their measures and their properties	Use	Apply	2
objects	Describe	Analyze	1

Essential Questions:

1. How do you prove triangles are congruent?
2. How do you prove in the coordinate plane what type of quadrilateral or triangle is represented?

- How do you use the area and perimeter formulas of parallelograms, triangles, trapezoids, regular polygons, and composite figures to solve for a missing value (area, length, width, etc.)?

Enduring Understanding/Big Ideas:

- Side-Side-Side (SSS) can be used to prove 2 triangles are congruent by having 3 pairs of corresponding sides in a triangle that are congruent. Side-Angle-Side (SAS) can be used to prove triangles are congruent by having 2 pairs of congruent corresponding sides and the included angle pair is congruent. Angle-Side-Angle (ASA) can be used to prove triangles are congruent by having 2 pairs of congruent corresponding angles and their included sides are congruent. Angle-Angle-Side (AAS) can be used to prove triangles are congruent by having 2 pairs of congruent corresponding angles and a non-included set of corresponding sides is congruent. Hypotenuse-Leg (HL) can be used to prove 2 triangles are congruent by having a right triangle with the pair of hypotenuses congruent and a pair of corresponding legs is congruent.
- To prove a quadrilateral is a parallelogram, you need to show that opposite sides are parallel. To prove a parallelogram is a rectangle, you must show one angle is a right angle. To prove a parallelogram is a rhombus, you must show that the diagonals are perpendicular or 2 adjacent sides are congruent. To prove a parallelogram is a square, you must show it has one right angle and the diagonals are perpendicular. To prove a quadrilateral is a trapezoid, show that you only have one pair of opposite sides that are parallel. To decide if a triangle is scalene, isosceles, or equilateral, you have to find the side lengths and then use the definition of each to decide what type is shown.
- For a single polygon, you must first decide what formula to use for area or perimeter. Then you have to plug in the given sides where they belong. Then perform the necessary operations to solve for the one variable that is unknown (area, length, width, etc.). For finding the area of composite figures, you must first decide what formulas to use for the area of the figures. Then you plug in the given values for the appropriate variables. Once you have the 2 areas, you decide whether you need to add the areas (everything shaded) or you need to subtract the areas (one shape is cut out of another).

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
<p style="text-align: center;">Triangle Altitude (Height) of a Triangle</p>	<p style="text-align: center;">Scalene Triangle Isosceles Triangle Equilateral Triangle Right Triangle Acute Triangle Obtuse Triangle</p>

	<p>Equiangular Triangle</p> <p>Midsegment of a Triangle</p> <p>Centroid of a Triangle</p> <p>Midsegment of a Trapezoid</p> <p>Sum of Interior Angles Formula</p> <p>Sum of Exterior Angles of Polygon</p> <p>Parallelogram</p> <p>Rectangle</p> <p>Rhombus</p> <p>Square</p> <p>Kite</p> <p>Pentagon</p> <p>Hexagon</p> <p>Heptagon</p> <p>Octagon</p> <p>Nonagon</p> <p>Decagon</p> <p>Dodecagon</p> <p>Area Formula of a Parallelogram</p> <p>Area Formula of a Triangle</p> <p>Area Formula of a Trapezoid</p> <p>Area Formula of a Regular Polygon</p>
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Resources for Vocabulary Development: Textbook resources

Unit Postulates and Theorems:

	<p>Triangle Sum Theorem</p> <p>Exterior Angle Theorem</p> <p>SSS</p> <p>SAS</p> <p>ASA</p> <p>AAS</p> <p>HL</p>
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Topic 1: Properties of Triangles

Engaging Experience 1:

Title: Coordinate Plane Practice

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.MG.A.1: Use geometric shapes, their measures and their properties to describe objects.

Supporting:

- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- Geo.MG.A.3: Apply geometric methods to solve design mathematical modeling problems.

Detailed Description/Instructions: Students will be given 3 ordered pairs that represent a triangle in the coordinate plane. The students will graph the points and decide if the triangle is scalene, isosceles, or equilateral using algebraic proof (distance formula to find the side lengths). Students will also have to prove algebraically if a triangle is a right triangle or not.

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Experience 2:

Title: Proving Triangles Are Congruent Whiteboard Practice

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.MG.A.1: Use geometric shapes, their measures and their properties to describe objects.

Supporting:

- Geo.CO.C.2: Prove theorems about triangles.
- Geo.CO.B.2: **Develop the criteria for triangle congruence** from the definition of congruence in terms of rigid motions.
- Geo.SRT.B.1: **Use congruence** and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Detailed Description/Instructions: Once students have learned the 5 ways to prove triangles are congruent, the students can do whiteboard practice. Each student gets a whiteboard and a marker. The teacher will project different triangles with different given pieces of information. The students will then have to decide if the triangle is congruent and if so, state the reason. They write that on their whiteboard and they show the teacher their answer when prompted to do so. This can also be extended to problems where the students are given that the triangles are congruent, and there is a missing side length or angle measure that must be found (can include variables) and the students need to work it out on their whiteboard and show the teacher the whiteboard when prompted to do so.

Bloom's Levels: Apply

Webb's DOK: 2

Topic 2: Properties of Polygons

Engaging Experience 1:

Title: Angles in a Polygon Exploration Activity

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.MG.A.1: Use geometric shapes, their measures and their properties to describe objects.

Supporting:

- Geo.CO.C.3: Prove theorems about polygons.

Detailed Description/Instructions: Students will work in partners on the following activity.

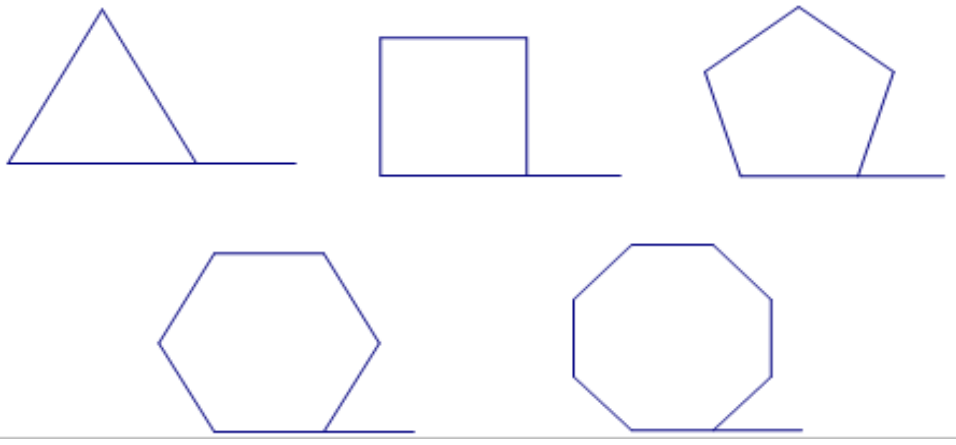
They will fill in the table as they go. The end result is for them to derive the formulas needed for angle relationships in polygons.

Formulas:

- Sum of interior angles of a convex polygon = $180(n - 2)$
- Sum of the exterior angles of a convex polygon = 360
- One interior angle measure of a regular polygon = $\frac{180(n-2)}{n}$
- One exterior angle measure of a regular polygon = $\frac{360}{n}$

For each polygon below, choose one vertex and draw in all diagonals from that vertex to determine the number of triangles in that polygon. Then fill in the table using that information and the vocabulary previously learned.

Polygon	Number of Sides	Number of Triangles after you draw in the diagonals from one vertex of the polygon	Sum of all Interior Angles (Use the # of triangles)	Measure of ONE interior angle of Regular Polygon	Measure of ONE exterior angle of Regular Polygon	Sum of all Exterior Angles
Triangle						
Quadrilateral						
Pentagon						
Hexagon						
Octagon						
n-gon						



Bloom's Levels: Apply

Webb's DOK: 2

Engaging Experience 2:

Title: Coordinate Plane Practice

Suggested Length of Time: 2 class periods; **RESOURCE MODIFICATION:** 3 class periods

Standards Addressed

Priority:

- Geo.MG.A.1: Use geometric shapes, their measures and their properties to describe objects.

Supporting:

- Geo.CO.C.3: Prove theorems about polygons.

Detailed Description/Instructions: The students are given 4 ordered pairs in the coordinate plane that represent a quadrilateral. The students are to graph the quadrilateral and prove algebraically if it is a parallelogram, trapezoid, or neither using slopes. If they can prove it is a parallelogram, then they have to see if they can further classify it as a rectangle, rhombus, square, or none of these. In order to prove this, they will need to know the properties of each. For example, if they can prove that the parallelogram has one right angle using slopes of 2 adjacent sides, then that would prove it is a rectangle (and possibly a square).

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Scenario

Engaging Scenario: *This project can be assigned to the students at the beginning of the Perimeter & Area topic. It will be due by the end of the topic. Students will select a room to remodel. They will give the dimensions of the room. The students will calculate the costs for the remodel based on price of materials for paint, wallpaper, carpet, etc.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Properties of Triangles	Properties of Triangles	Students will be given 3 ordered pairs that represent a triangle in the coordinate plane. The students will graph the points and decide if the triangle is scalene, isosceles, or equilateral using algebraic proof (distance formula to find the side lengths). Students will also have to prove algebraically if a triangle is a right triangle or not.	1 class period
Properties of Triangles	Proving Triangles are Congruent Whiteboard Practice	Once students have learned the 5 ways to prove triangles are congruent, the students can do whiteboard practice. Each student gets a whiteboard and a marker. The teacher will project different triangles with different given pieces of information. The students will then have to decide if the triangle is congruent and if so, state the reason. They write that on their whiteboard and they show the teacher their answer when prompted to do so. This can also be extended to problems where the students are given that the triangles are congruent, and there is a missing side length or angle measure that must be found (can include variables) and the students need to work it out on their whiteboard and show the teacher the whiteboard when prompted to do so.	1 class period
Properties of Polygons	Angles in a Polygon Exploration Activity	Students will work in partners on the following activity. They will fill in the table as they go. The end result is for them to derive the formulas needed for angle relationships in polygons.	1 class period
Properties of Polygons	Coordinate Plane Practice	The students are given 4 ordered pairs in the coordinate plane that represent a quadrilateral. The students are to graph the quadrilateral and prove algebraically if it is a parallelogram, trapezoid, or	2 class periods

		neither using slopes. If they can prove it is a parallelogram, then they have to see if they can further classify it as a rectangle, rhombus, square, or none of these. In order to prove this, they will need to know the properties of each. For example, if they can prove that the parallelogram has one right angle using slopes of 2 adjacent sides, then that would prove it is a rectangle (and possibly a square).	
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Unit 3: Similarity

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Similarity

Length of Unit: 1 ½ weeks; **RESOURCE MODIFICATION:** 3 ½ weeks

Overview of Unit: In this unit, students will learn about similar figures and how scale factors relate to those figures. Students will use the relationship between similarity and congruence to solve problems and show their understanding of the two concepts.

Priority Standards for unit:

- Geo.SRT.A.1: Construct and analyze scale changes of geometric figures.
- Geo.GPE.B.3: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

Supporting Standards for unit:

- Geo.SRT.A.2: Use the definition of similarity to decide if figures are similar and to solve problems involving similar figures.
- Geo.SRT.A.3: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
- Geo.SRT.B.1: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- Geo.C.A.1: Prove that all circles are similar using similarity transformations.
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
scale changes of geometric figures	Construct	Apply	2
scale changes of geometric figures	Analyze	Analyze	3

Essential Questions:

1. How can you determine if figures are similar?
2. How does a scale factor relate to the ratios of perimeter and area between similar figures?
3. How does the scale factor affect the preimage to image?

Enduring Understanding/Big Ideas:

1. Similar figures have corresponding congruent angles and corresponding proportional side lengths.
2. The ratio of the perimeters is the same as the scale factor. The ratio of the areas is the square of the scale factor.
3. If the scale factor is less than one, the image will be a reduction of the preimage. If the scale factor is one, the image will be congruent to the preimage. If the scale factor is greater than one, the image will be an enlargement of the preimage.

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
Similar Ratio Proportion Scale Factor	Similar Polygons Similar Circles Ratio of Perimeters Ratio of Areas Properties of Proportions <ul style="list-style-type: none">● Cross-Multiplication Property● Reciprocal Property● Exchange Property● Add-One Property

Resources for Vocabulary Development: Textbook Resources

Unit Postulates and Theorems:

AA similarity postulate SSS similarity theorem SAS similarity theorem Triangle Proportionality Theorem Angle Bisector of a Triangle Proportionality Theorem

Topic 1: Similarity

Engaging Experience 1

Title: Student Created Examples of Similarity

Suggested Length of Time: 1 class period; RESOURCE MODIFICATION: 2-3 class periods

Standards Addressed

Priority:

- Geo.SRT.A.1: Construct and analyze scale changes of geometric figures.
- Geo.GPE.B.3: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

Supporting:

- Geo.SRT.A.2: Use the definition of similarity to decide if figures are similar and to solve problems involving similar figures.
- Geo.SRT.B.1: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- Geo.SRT.B.1: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Detailed Description/Instructions: The teacher will give students graph paper. Students will take out a blank piece of lined paper and pencil. The teacher will tell the students that they are to come up with the examples listed below for similar polygons to show their understanding of the concept of similar polygons and scale factors both in plane geometry and coordinate plane geometry. You could have students trade papers for one or all of these at the end for peer check to see if it is correct.

Tasks for the lined paper:

- Draw a pair of similar triangles. Label the corresponding sides and corresponding angles appropriately so someone else would be able to prove it is similar by the definition of similarity.
- Draw a pair of similar quadrilaterals. Label the corresponding sides and corresponding angles appropriately so someone else would be able to prove it is similar by the definition of similarity.
- Draw a pair of triangles that have a 1:1 scale factor and label all the corresponding sides and corresponding angles appropriately so someone else would be able to tell that it has a 1:1 scale factor.

Task for the graph paper:

- Draw a pair of triangles in the coordinate plane that are similar. You must check that the sides are all proportional to each other by checking against the distance formula to show by SSS Similarity Postulate that these triangles are indeed similar.

Bloom's Levels: Analyze

Webb's DOK: 3

Engaging Scenario

Engaging Scenario: Students will create a scale model (mini-me or bedroom model) or students could measure a doll's legs, arms, head circumference, etc. Then the students would measure their own legs, arms, head circumference, etc. and then they would come up with the ratio of the two measurements.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Similarity	Student Created Examples of Similarity	<p>The teacher will give students graph paper. Students will take out a blank piece of lined paper and pencil. The teacher will tell the students that they are to come up with the examples listed below for similar polygons to show their understanding of the concept of similar polygons and scale factors both in plane geometry and coordinate plane geometry. You could have students trade papers for one or all of these at the end for peer check to see if it is correct.</p>	1 class period

Unit 4: Transformations and Symmetry

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Transformations and Symmetry

Length of Unit: 1 ½ weeks; **RESOURCE MODIFICATION:** 2 weeks

Overview of Unit: This unit consists of the following transformations: translation, rotation, reflection, and dilation. This includes transformations with two-dimensional objects as well as three-dimensional objects.

Priority Standards for unit:

- Geo.CO.A.4: Develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.
- Geo.CO.A.3: Describe the rotational symmetry and lines of symmetry of two-dimensional figures.

Supporting Standards for unit:

- Geo.CO.A.2: Represent transformations in the plane, and describe them as functions that take points in the plane as inputs and give other points as outputs.
- Geo.CO.A.5: Demonstrate the ability to rotate, reflect or translate a figure, and determine a possible sequence of transformations between two congruent figures.
- Geo.CO.B.1: Develop the definition of congruence in terms of rigid motions.
- Geo.CO.B.2: Develop the criteria for triangle congruence from the definition of congruence in terms of rigid motions.
- Geo.GMD.B.2: Identify three-dimensional objects generated by transformations of two-dimensional objects.
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- ISTE - INNOVATIVE DESIGNER.4.B - select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.	Develop	Understand	3
rotational symmetry and lines of symmetry of two-dimensional figures.	Describe	Analyze	1

Essential Questions:

1. How do rigid and non-rigid transformations affect a preimage?
2. How do you determine the type of symmetry of a figure?

Enduring Understanding/Big Ideas:

1. Rigid transformations maintain the size and shape of the preimage, creating an image that is congruent to the preimage. These transformations include rotations, reflections and translations. Non-rigid transformations reduce or dilate the preimage using a scale factor, creating an image that is similar to the preimage. This transformation includes dilations.
2. A figure has rotational symmetry if the preimage and the image are the same after a rotation. A figure has line (reflectional) symmetry if one half of the image is a reflection of the other half. A figure with line symmetry will have a line over which half of the figure is reflected.

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
Transformation Rotation Reflection Translation	Line symmetry Transformation notation Rotational symmetry Rigid transformation Non-rigid transformation

Resources for Vocabulary Development: Textbook resources

Topic 1: Transformations and Symmetry

Engaging Experience 1

Title: Coordinate Plane Practice

Suggested Length of Time: 1 class period; RESOURCE MODIFICATION: 2 class periods

Standards Addressed

Priority:

- Geo.CO.A.4: Develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.
- Geo.CO.A.3: Describe the rotational symmetry and lines of symmetry of two-dimensional figures.

Supporting:

- Geo.CO.A.2: Represent transformations in the plane, and describe them as functions that take points in the plane as inputs and give other points as outputs.
- Geo.CO.A.5: Demonstrate the ability to rotate, reflect or translate a figure, and determine a possible sequence of transformations between two congruent figures.
- Geo.CO.B.1: Develop the definition of congruence in terms of rigid motions.
- Geo.CO.B.2: Develop the criteria for triangle congruence from the definition of **congruence in terms of rigid motions.**
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.

Detailed Description/Instructions: The teacher will give students graph paper. First students are to come up with their own triangle in the coordinate plane. They are to label the vertices A, B, and C. The students also need to write down the coordinates of each point on a separate piece of paper. This triangle will be used for each of the transformations listed below.

- a) Students will come up with their own translation to perform on their triangle. On the graph paper they are to graph their image and then need to write the transformation notation (function) for that translation on their other sheet of lined paper.
- b) Students are to reflect their original triangle across the y-axis. On the graph paper they are to graph their image and then need to write the transformation notation (function) for that reflection on their other sheet of lined paper.
- c) Students are to reflect their original triangle over the vertical line $x = 2$ and then they are to reflect that image over the $y = x$ line. On the graph paper they are to graph both of their images. They are to label the first image $\Delta A'B'C'$ and their second image $\Delta A''B''C''$ since it is the image of $\Delta A'B'C'$.
- d) Students are to rotate their original triangle 180 degrees about the origin. On the graph paper they are to graph their image and then need to write the transformation notation (function) for that translation on their other sheet of lined paper.
- e) Students are to dilate their triangle through the origin with a scale factor of their choosing. On the graph paper they are to graph their image and then need to write the transformation notation (function) for that translation on their other sheet of lined paper.

Bloom's Levels: Understand

Webb's DOK: 3

Engaging Experience 2

Title: 3-D figures from 2-D transformations

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.CO.A.4: Develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.
- Geo.CO.A.3: Describe the rotational symmetry and lines of symmetry of two-dimensional figures.

Supporting:

- Geo.GMD.B.2: Identify three-dimensional objects generated by transformations of two-dimensional objects.

Detailed Description/Instructions: The teacher shows the following 3-dimensional figures on the board: rectangular prism, cone, and square pyramid. Students then work in groups of 2-3 to decide what 2-dimensional figure would be used and what transformation would be performed to get you that 3-dimensional figure.

Bloom's Levels: Understand

Webb's DOK: 3

Engaging Scenario

Engaging Scenario: Students will be given parameters of a shape and will create a picture by rotating and transforming the shape (using Geogebra).

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Transformations and Symmetry	Coordinate Plane Practice	<p>The teacher will give students graph paper. First students are to come up with their own triangle in the coordinate plane. They are to label the vertices A, B, and C. The students also need to write down the coordinates of each point on a separate piece of paper.</p> <p style="text-align: center;">This triangle will be used for transformations.</p>	1 class period
Transformations and Symmetry	3-D figures from 2-D transformations	<p>The teacher shows the following 3-dimensional figures on the board: rectangular prism, cone, and square pyramid. Students then work in groups of 2-3 to decide what 2-dimensional figure would be used and what transformation would be performed to get you that 3-dimensional figure.</p>	1 class period

Unit 5: Trigonometric Ratios and Pythagorean Theorem

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Trigonometric Ratios and Pythagorean Theorem

Length of Unit: 2 weeks

Overview of Unit: This unit uses Trigonometric Ratios (sine, cosine, and tangent) as well as Pythagorean Theorem to solve problems with right triangles.

Priority Standards for unit:

- Geo.SRT.C.3: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles.

Supporting Standards for unit:

- Geo.SRT.C.2: Explain and use the relationship between the sine and cosine of complementary angles.
- Geo.SRT.C.4: Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle.
- Geo.SRT.C.1: Understand that side ratios in right triangles define the trigonometric ratios for acute angles.
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.
- Geo.MG.A.3: Apply geometric methods to solve design mathematical modeling problems.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
trigonometric ratios and the Pythagorean Theorem	Use	Apply	2
right triangles	Solve	Apply	2

Essential Questions:

1. How do you use Sine, Cosine, or Tangent to solve a problem?
2. Why do we use the inverses of Sine, Cosine, or Tangent?
3. Why do we use the Pythagorean Theorem?

Enduring Understanding/Big Ideas:

1. When trying to find a missing side length of a right triangle, if you are given one side length and an angle, the ratio of the side you have and the side you are solving for determines which Trigonometric Ratio you use.
2. In a right triangle, the inverses of Sine, Cosine, and Tangent are used when solving for an angle measure when given two side lengths.
3. Pythagorean Theorem is used in a right triangle to find the missing side length when given two sides.

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
Pythagorean Theorem	Sine Cosine Tangent Inverse sine Inverse cosine Inverse tangent Law of Sines Pythagorean inequalities

Resources for Vocabulary Development: Textbook resources

Topic 1: Trigonometric Ratios and Pythagorean Theorem

Engaging Experience 1

Title: Cross Number Puzzle Worksheet

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.SRT.C.3: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles.

Supporting:

- Geo.SRT.C.2: Explain and use the relationship between the sine and cosine of complementary angles.
- Geo.SRT.C.1: Understand that side ratios in right triangles define the trigonometric ratios for acute angles.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Detailed Description/Instructions: Once students have learned the Pythagorean Theorem and how to use the Trigonometric Ratios have them solve the problems on the following worksheet and fill in the Cross Number Puzzle. This worksheet can be found in the district Geometry shell course.

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Scenario

Engaging Scenario: Students will create a trigonometric story problem. (For example, a 10-foot ladder is leaning against a wall and makes a 46-degree angle with the ground. How far up the wall does the ladder reach?)

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Trigonometric Ratios and Pythagorean Theorem	Cross Number Puzzle Worksheet	Once students have learned the Pythagorean Theorem and how to use the Trigonometric Ratios have them solve the problems on the following worksheet and fill in the Cross Number Puzzle. This worksheet can be found in the district Geometry shell course.	1 class period

Unit 6: Measurement of 2-Dimensional and 3-Dimensional Figures

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Measurement of 2-Dimensional and 3-Dimensional Figures

Length of Unit: 1 ½ weeks

Overview of Unit: This unit consists of using the volume formulas for cylinders, pyramids, cones, spheres, and composite figures.

Priority Standards for unit:

- Geo.GMD.A.2: Use volume formulas for cylinders, pyramids, cones, spheres and composite figures to solve problems.
- Geo.MG.A.2: Apply concepts of density based on area and volume in modeling situations.

Supporting Standards for unit:

- Geo.GMD.A.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.**
- Geo.GMD.B.1: Identify the shapes of two-dimensional cross-sections of three-dimensional objects.
- Geo.MG.A.3: Apply geometric methods to solve design mathematical modeling problems.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.
- ISTE-KNOWLEDGE COLLECTOR.3.D - build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
volume formulas for cylinders, pyramids, cones, spheres and composite figures.	Use	Apply	2
problems	Solve	Apply	2
concepts of density based on area and volume in modeling situations.	Apply	Apply	3

Essential Questions:

1. How do you use volume formulas for three-dimensional figures (prisms, pyramids, cones, spheres, cylinders and composite solids)?
2. How do you use surface area formulas for three-dimensional figures (prisms, pyramids, cones, spheres, and cylinders)?

Enduring Understanding/Big Ideas:

1. For a single solid, you must first decide what formula to use for volume. Then you have to plug in the given measurements where they belong. Then perform the necessary operations to solve for the one variable that is unknown (volume, height, slant height, etc.). For finding the volume of composite solids, you must first decide what formulas to use for the volume of the solids. Then you plug in the given values for the appropriate variables. Once you have the 2 volumes, you decide whether you need to add them or you need to subtract them (one solid is cut out of another).
2. For a single solid, you must first decide what formula to use for surface area. Then you have to plug in the given measurements where they belong. Then perform the necessary operations to solve for the one variable that is unknown (surface area, height, slant height etc.).

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
Density Volume Cross section Prism Pyramid Cone Sphere Cylinder	Surface area Composite figure

Resources for Vocabulary Development: Textbook resources

Topic 1: Perimeter and Area of 2-Dimensional Figures

Engaging Experience 1

Title: Coordinate Plane Practice

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.MG.A.1: Use geometric shapes, their measures and their properties to describe objects.

Supporting:

- Geo.GPE.B.4: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles.
- Geo.MG.A.3: Apply geometric methods to solve design mathematical modeling problems.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Detailed Description/Instructions: Students will be given ordered pairs that represent points in the coordinate plane. Using distance formula and area formulas, students will find the perimeter and area of each figure represented in the coordinate plane.

Bloom's Levels: Apply

Webb's DOK: 2

Topic 2: Properties of 3-Dimensional Figures

Engaging Experience 1

Title: Volume of Everyday Objects

Suggested Length of Time: ½ of a class period; **RESOURCE MODIFICATION:** 1-2 class periods

Standards Addressed

Priority:

- Geo.GMD.A.2: Use volume formulas for cylinders, pyramids, cones, spheres and composite figures to solve problems.

Supporting:

- Geo.GMD.A.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.**
- Geo.GMD.B.1: Identify the shapes of two-dimensional cross-sections of three-dimensional objects.
- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Detailed Description/Instructions: The teacher needs to collect various real world examples of cylinders, pyramids, and cones. You can also have the students bring in items of their own. Items such as a Pringles can, a pop can, a cone party hat, a traffic cone, a toy pyramid, a pyramid Rubik's Cube, etc. Try to find pyramids with different polygon bases. You may bring in more than one of each object. Put students into group of 4-5 and give each group a few of the items. They will also need rulers and measuring tapes. As a group they will need to find the volume of each of their items. At the end, if possible, you can cut cross sections in some of the items to show the two-dimensional cross-sections of three-dimensional objects.

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Experience 2

Title: How Much is Too Much?

Suggested Length of Time: ½ of a class period

Standards Addressed

Priority:

- Geo.MG.A.2: Apply concepts of density based on area and volume in modeling situations.

Supporting:

- Geo.MG.A.3: Apply geometric methods to solve design mathematical modeling problems.

- ISTE-COMPUTATIONAL THINKER.5.A - formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.
- ISTE-KNOWLEDGE COLLECTOR.3.D - build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

Detailed Description/Instructions: Before the lesson, pick random numbers and write them (enough for one per student) on a piece of paper. You will want to pick large numbers that can represent a population. Then put the papers in a bag for the students to randomly select later in the lesson. Each student needs to research how many living things can comfortably live in a given space. They can choose to research people in a city, chickens in a coop, dogs in a kennel, etc. Once they have their information, then each student draws a number out of the bag. This is how many of their researched item they need to find a space large enough to hold comfortably. On a piece of paper, they will figure out (using proportions) how large of a space they need.

RESOURCE MODIFICATION: consider providing students with the number of living things that can live comfortably in a given space.

Bloom's Levels: Apply and solve

Webb's DOK: 2

Engaging Scenario

Engaging Scenario: Students will select a product and determine the best shape and size for packaging to maximize volume and minimize cost.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Perimeter and Area of 2-Dimensional Figures	Coordinate Plane Practice	Students will be given ordered pairs that represent points in the coordinate plane. Using distance formula and area formulas, students will find the perimeter and area of each figure represented in the coordinate plane.	1 class period
Properties of 3-Dimensional Figures	Volume of Everyday Objects	The teacher needs to collect various real-world examples of cylinders, pyramids, and cones. You can also have the students bring in items of their own. Items such as a Pringles can, a pop can, a cone party hat, a traffic cone, a toy pyramid, a pyramid Rubik's Cube, etc. Try to find pyramids with different polygon bases. You may bring in more than one of each object. Put students into group of 4-5 and give each group a few of the items. They will also need rulers and measuring tapes. As a group they will need to find the volume of each of their items. At the end, if possible, you can cut cross sections in some of the items to show the two-dimensional cross-sections of three-dimensional objects.	½ of a class period
Properties of 3-Dimensional Figures	How Much is Too Much?	Before the lesson, pick random numbers and write them (enough for one per student) on a piece of paper. You will want to pick large numbers that can represent a population. Then put the papers in a bag for the students to randomly select later in the lesson. Each student needs to research how many living things can comfortably live in a given space. They can choose to research people in a city, chickens in a coop, dogs in a kennel, etc. Once they have their information, then each student draws a number	½ of a class period

		out of the bag. This is how many of their researched item they need to find a space large enough to hold comfortably. On a piece of paper, they will figure out (using proportions) how large of a space they need.	
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Unit 7: Properties of Circles

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Properties of Circles

Length of Unit: 2 weeks

Overview of Unit: In this unit, students will apply the equation of a circle and the formulas for circumference and area of circles in order to solve problems. Students will also learn about inscribed and circumscribed circles and use the coordinate plane to explore these concepts.

Priority Standards for unit:

- Geo.C.A.2: Identify and describe relationships among inscribed angles, radii and chords of circles.

Supporting Standards for unit:

- Geo.GPE.A.1: Derive the equation of a circle.
- Geo.C.B.1: Derive the formula for the length of an arc of a circle.
- Geo.C.B.2: Derive the formula for the area of a sector of a circle.
- Geo.C.A.3: Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
- Geo.GMD.A.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.
- Geo.GPE.B.1: Use coordinates to prove geometric theorems algebraically.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
relationships among inscribed angles, radii and chords of circles	Identify	Understand	2
relationships among inscribed angles, radii and chords of circles	Describe	Analyze	2

Essential Questions:

1. How does the equation of a circle relate to the distance formula?
2. How do you find the circumference and area of a circle?
3. How does the length of an arc of a circle relate to the circumference of the circle?
4. How does the area of a sector of a circle relate to the area of the circle?

Enduring Understanding/Big Ideas:

1. Since the equation of a circle shows how far each of the points on the circle are from the center of the circle, it is derived from the distance formula.
2. Circumference of a circle can be found by multiplying pi by the diameter of the circle.
Area of a circle can be found by multiplying pi by the square of the radius.
3. The length of an arc of a circle is a fraction of the circumference of the circle.
4. The area of a sector of a circle is a fraction of the area of the circle.

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
Circle Circumference Angles	Equation of a Circle Area of Circle Area of Sector Arc Length Radius Diameter Chords Tangent Line Secant Line Sector Arc Circumscribed Circles Inscribed Circles Inscribed Angles Central Angles Interior Angles of a Circle Exterior Angles of a Circle Major Arc Minor Arc Semicircle

Resources for Vocabulary Development: Textbook Resources

Unit Postulates and Theorems:

Tangent Line Theorem
Radius-Tangent Theorem
Congruent Tangent Theorem
Arc Addition Postulate
Congruent Chords Theorem
Radius-Chord Theorem
Measure of Inscribed Angle Theorem
Inscribed Quadrilateral Theorem
Angles Inside a Circle Theorem
Angles Outside a Circle Theorem
Segments of Chords Theorem
Segments of Secants Theorem
Segments of Secants & Tangent Theorem

Topic 1: Properties of Circles

Engaging Experience 1

Title: Construction of Circle with Inscribed and Circumscribed Polygons

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.C.A.2: Identify and describe relationships among inscribed angles, radii and chords of circles.

Supporting:

- Geo.C.A.3: Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

Detailed Description/Instructions: Given an equation of a circle and a coordinate plane, students will draw the circle on the coordinate plane. Using tools, students will then draw the inscribed triangle and circumscribed triangle then discuss the similarities/differences with a partner. Given another equation of a circle and coordinate plane students will draw the circle on the coordinate plane, then correctly inscribe a given quadrilateral. Once they have their inscribed quadrilateral they will be given time to discover the different properties of the inscribed quadrilaterals angles.

Bloom's Levels: Understand and analyze

Webb's DOK: 2

Engaging Experience 2

Title: Arc and Sector Whiteboard Races

Suggested Length of Time: ½ of a class period

Standards Addressed

Priority:

- Geo.C.A.2: Identify and describe relationships among inscribed angles, radii and chords of circles.

Supporting:

- Geo.C.B.1: Derive the formula for the length of an arc of a circle.
- Geo.C.B.2: Derive the formula for the area of a sector of a circle.

Detailed Description/Instructions: Teachers will put students in groups of 3-4. Each group gets one whiteboard and one marker. They may have their notes with them to reference the formulas for length of an arc of a circle and area of a sector of a circle. The teacher will give one problem on the board. The students will be asked to solve the problem. They will need to decide which formula to use before starting to solve. For each new problem the teacher gives, a new student is using the whiteboard and marker to find the answer. Once the student is done working, he or she holds up their white board for the teacher to check the answer. The first group with the correct answer gets eight points (if there are eight groups), second group with correct answer gets seven

points (if there are eight groups) and so on. Points awarded to each group in descending value so that each group has a chance to get points and will find more value in completing the answer even if they are last.

Bloom's Levels: Understand and analyze

Webb's DOK: 2

Engaging Experience 3

Title: Area and Circumference of a Circle Quiz Trading

Suggested Length of Time: ½ of a class period

Standards Addressed

Priority:

- Geo.C.A.2: Identify and describe relationships among inscribed angles, radii and chords of circles.

Supporting:

- Geo.GMD.A.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.
- ISTE-EMPOWERED LEARNER1.D - understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

Detailed Description/Instructions: Students will create five original problems to find the circumference and area of a circle. Encourage students to come up with problems where they are given the circumference or area and need to find the radius or diameter. They will then solve their own problems to create an answer key. The teacher will give each student time to create their own quiz (using these five problems) on an approved site, or they can create their own worksheet quiz with the problems. The students will then trade their quiz with another student and solve their new problems. Once they are done, they trade quizzes back and grade them. While grading, if there was a mistake, they need to try to find the mistake and show (on the paper) how to correct it.

Bloom's Levels: Understand and analyze

Webb's DOK: 2

Engaging Scenario

Engaging Scenario: Students will be given ordered pairs that represent several plants on a coordinate plane. They will be tasked with placing the sprinkler at a specific point in order to water all of the plants. The students then will have to find the area of the patch of grass that is being watered.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Properties of Circles	Construction of Circle with Inscribed and Circumscribed Polygons	Given an equation of a circle and a coordinate plane, students will draw the circle on the coordinate plane. Using tools, students will then draw the inscribed triangle and circumscribed triangle then discuss the similarities/differences with a partner. Given another equation of a circle and coordinate plane students will draw the circle on the coordinate plane, then correctly inscribe a given quadrilateral. Once they have their inscribed quadrilateral they will be given time to discover the different properties of the inscribed quadrilaterals angles.	1 class period
Properties of Circles	Arc and Sector Whiteboard Races	Teachers will put students in groups of 3-4. Each group gets one whiteboard and one marker. They may have their notes with them to reference the formulas for length of an arc of a circle and area of a sector of a circle. The teacher will give one problem on the board. The students will be asked to solve the problem. They will need to decide which formula to use before starting to solve. For each new problem the teacher gives, a new student is using the whiteboard and marker to find the answer. Once the student is done working he or she holds up their white board for the teacher to check the answer. The first group with the correct answer gets eight points (if there are eight groups), second group with correct answer gets seven points (if there are eight groups) and so on. Points awarded to each group in descending value so that each group has a chance to get points and will find more value in completing the answer even if they are last.	½ of a class period

<p>Properties of Circles</p>	<p>Area and Circumference of a Circle Quiz Trading</p>	<p>Students will create five original problems to find the circumference and area of a circle. Encourage students to come up with problems where they are given the circumference or area and need to find the radius or diameter. They will then solve their own problems to create an answer key. The teacher will give each student time to create their own quiz (using these five problems) on an approved site, or they can create their own worksheet quiz with the problems. The students will then trade their quiz with another student and solve their new problems. Once they are done, they trade quizzes back and grade them. While grading, if there was a mistake, they need to try to find the mistake and show (on the paper) how to correct it.</p>	<p>½ of a class period</p>
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Unit 8: Probability

Subject: Geometry

Grade: 9, 10, 11, 12

Name of Unit: Probability

Length of Unit: 1 week

Overview of Unit: This unit focuses on probability of events. This includes being able to use union and intersection as well as permutations and combinations.

Priority Standards for unit:

- Geo.CP.A.3: Calculate conditional probabilities of events.

Supporting Standards for unit:

- Geo.CP.A.1: Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections or complements of other events.
- Geo.CP.A.2: Understand the definition of independent events and use it to solve problems.
- Geo.CP.A.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.
- Geo.CP.A.5: Recognize and explain the concepts of conditional probability and independence in a context.
- Geo.CP.A.6: Apply and interpret the Addition Rule for calculating probabilities.
- Geo.CP.A.7: Apply and interpret the general Multiplication Rule in a uniform probability model.
- Geo.CP.A.8: Use permutations and combinations to solve problems.
- ISTE-COMPUTATIONAL THINKER.5.B - collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
conditional probabilities of events	Calculate	Apply	1

Essential Questions:

1. How do you determine whether to use permutations or combinations?
2. What is sample space and why do you need it?
3. What is the difference between a union and an intersection and how do you know which one to use?

Enduring Understanding/Big Ideas:

1. Permutations are used when order matters (lists) and combinations are used when the order does not matter (groups).
2. The sample space is the set of all possible outcomes. In order to talk about probabilities, you need to know all of the possible outcomes. It also gives you a representation of a greater population.
3. The union of two sample spaces is the set of all members included in both groups (the entire Venn Diagram) and the intersection of two samples spaces is the set of repeated members in both groups (the middle of the Venn Diagram). When asked for the entire group, you use union. When asked for a specific group, you use intersection.

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
Probability Sample space	Union Intersection Permutation Combination Two-way frequency table

Resources for Vocabulary Development: Textbook resources

Topic 1: Probability

Engaging Experience 1

Title: Marble Game Worksheet

Suggested Length of Time: 1 class period

Standards Addressed

Priority:

- Geo.CP.A.3: Calculate conditional probabilities of events.

Supporting:

- Geo.CP.A.1: Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections or complements of other events.
- Geo.CP.A.2: Understand the definition of independent events and use it to solve problems.
- Geo.CP.A.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.
- Geo.CP.A.5: Recognize and explain the concepts of conditional probability and independence in a context.
- Geo.CP.A.6: Apply and interpret the Addition Rule for calculating probabilities.
- Geo.CP.A.7: Apply and interpret the general Multiplication Rule in a uniform probability model.
- Geo.CP.A.8: Use permutations and combinations to solve problems.
- ISTE-COMPUTATIONAL THINKER.5.B - collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.

Detailed Description/Instructions: This worksheet can be found in the district Geometry Shell Course. To add more to this activity, you could include combinations with how many different types of Sonic drinks are possible given the number of flavors offered and you could add finding probability that you pick red or blue from the marble bag.

Bloom's Levels: Apply

Webb's DOK: 1

Engaging Scenario

Engaging Scenario: Students will collect data from their class or via social media and determine probabilities using that data.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Probability	Marble Game Worksheet	This worksheet can be found in the district Geometry Shell Course. To add more to this activity, you could include combinations with how many different types of Sonic drinks are possible given the number of flavors offered and you could add finding probability that you pick red or blue from the marble bag.	1 class period

Unit of Study Terminology

Appendices: All Appendices and supporting material can be found in this course's shell course in the District's Learning Management System.

Assessment Leveling Guide: A tool to use when writing assessments in order to maintain the appropriate level of rigor that matches the standard.

Big Ideas/Enduring Understandings: Foundational understandings teachers want students to be able to discover and state in their own words by the end of the unit of study. These are answers to the essential questions.

Engaging Experience: Each topic is broken into a list of engaging experiences for students. These experiences are aligned to priority and supporting standards, thus stating what students should be able to do. An example of an engaging experience is provided in the description, but a teacher has the autonomy to substitute one of their own that aligns to the level of rigor stated in the standards.

Engaging Scenario: This is a culminating activity in which students are given a role, situation, challenge, audience, and a product or performance is specified. Each unit contains an example of an engaging scenario, but a teacher has the ability to substitute with the same intent in mind.

Essential Questions: Engaging, open-ended questions that teachers can use to engage students in the learning.

Priority Standards: What every student should know and be able to do. These were chosen because of their necessity for success in the next course, the state assessment, and life.

Supporting Standards: Additional standards that support the learning within the unit.

Topic: These are the main teaching points for the unit. Units can have anywhere from one topic to many, depending on the depth of the unit.

Unit of Study: Series of learning experiences/related assessments based on designated priority standards and related supporting standards.

Unit Vocabulary: Words students will encounter within the unit that are essential to understanding. Academic Cross-Curricular words (also called Tier 2 words) are those that can be found in multiple content areas, not just this one. Content/Domain Specific vocabulary words are those found specifically within the content.