Southern York County School District Instructional Plan

Name:	**Dates: September**
Course/Subject: Geometry	**Unit 1: Shapes and Transformations**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

- **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).**
- **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.**
- **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).**

Understanding(s): ***Students will understand . . .*** 1. Transformations of shapes using Reflection, Rotation, and Translation. 2. Basic shapes and how to describe them by the following attributes. a. number of signs b. parallel sides c. perpendicular sides d. equal sides	**Essential Question(s):** ▪ What is geometry? ▪ How can I describe this shape? ▪ How can I move it? ▪ Is the shape symmetrical? ▪ How can I communicate my ideas clearly?
Learning Objectives: ***Students will know . . .*** ▪ Each other's names and will become more personally connected to the classroom environment ▪ How to ask mathematical questions. ▪ How to make an argument convincing ▪ How to recognize how algebra can be used in the study of geometry	***Students will be able to:*** ▪ Investigate quilts, rug designs and kaleidoscopes, which introduce some basic building blocks of geometry. ▪ Flip, turn, and slide shapes, while learning about transformations and how to use these motions to build new shapes and describe symmetry. ▪ Describe, classify, and name according to their attributes.

Name:	**Dates: October**
Course/Subject: Geometry	**Unit 2: Angles and Measurement**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

- **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.**
- **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.**
- **Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees.**
- **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.**

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. The relationship between angles formed by intersecting lines. 2. The relationship between angles formed by parallel lines and a transversal are alternate interior, corresponding, same side interior. 3. The proper tools and units to use to measure a figure. 4. How to use the Pythagorean Theorem to find missing sides of a right triangle.	▪ What is the relationship between different pairs of angles? ▪ How do you find different measurements related to a figure? ▪ Are there multiple ways to solve the same problem?
Learning Objectives: ***Students will know . . .***	***Students will be able to:***
▪ How to name angles, and the 3 main relationships for angle measures. ▪ When a transversal intersects parallel lines, corresponding angles are equal. ▪ The relationship between alternate interior angles and consecutive interior angles. ▪ The angles in a triangle add up to 180 degrees. ▪ The measurement of an object depends on the units of measure that are being used. ▪ How to find the area of simple and complex figures. ▪ How to use Pythagorean Theorem to find the missing side of a right triangle. ▪ The triangle inequality.	▪ Use angle relationships to find missing measurements in figures. ▪ Determine the best unit of measure needed to find the needed measurement. ▪ Find the area of figures. ▪ Find missing sides of right triangles.
Name:	**Dates: October**
Course/Subject: Geometry	**Unit 3: Justification and Similarity**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

- **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 islonger or shorter in he 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.**
- **Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.**

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. The methods used to determine if 2 figures are similar. 2. The use of proportions to find missing information about 2 similar figures. 3. How to document facts to support a conclusion	▪ Is it still the same shape? ▪ How did the shape shrink? ▪ What do I need to show for 2 figures to be similar? ▪ How can I justify that? ▪ What evidence can I state?
Learning Objectives: ***Students will know . . .***	***Students will be able to:***
▪ The vocabulary associated with lines, angles, and transversals. ▪ Different angle relationships. ▪ The sum of the interior angles of a triangle equals 180.	▪ Develop problem solving skills of looking for patterns, making tables and systematic lists of data and drawing diagrams ▪ Build the fundamental vocabulary for angles and angle relationships ▪ Develop conjectures for corresponding and alternate interior angle relationships formed by parallel lines ▪ Explore adjacent angles and develop a conjecture for vertical angles ▪ Confirm that the sum of the interior angles of any triangle is 180° ▪ Explore exterior angles of triangles and develop a conjecture ▪ Graph solutions to linear inequalities ▪ Extend their knowledge of slope to parallel lines
Name:	**Dates: November**
Course/Subject: Geometry	**Unit 4: Trigonometry and Probility**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

- **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.**
- **Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.**

Understanding(s):	**Essential Question(s):**

Students will understand . . . 1. The Tangent Ratio in Right Triangles is opposite/adjacent. 2. Experimental probability is found from actual data gathered and theoretical probability is calculated using mathematical formulas. 3. The slope of a line and the tangent ratio are the same value.	▪ Are the figures similar? ▪ What ratios are represented in the figure? ▪ What is the probability of the event occurring? ▪ How can I represent probability using a graphic organizer?
Learning Objectives: ***Students will know . . .*** ▪ How the tangent ratio is connected to the slope of a line. ▪ The trigonometric ratio of tangent. ▪ How to apply trigonometric ratios to find missing measurements in right triangles. ▪ How to model real world situations with right triangles and use trigonometric ratios to solve problems. ▪ Several ways to model probability situations, such as tree diagrams and area models.	***Students will be able to:*** ▪ Use the Tangent ratio to find missing sides of Right Triangles. ▪ Use probability models to solve more complex probability problems. ▪ Discuss the difference between experimental and theoretical probability.
Name:	**Dates: December**
Course/Subject: Geometry	**Unit 5: Triangle Toolkit**
Stage 1 – Desired Results	
PA Standard(s)/Assessment Anchors Addressed: **Common Core State Standards** ▪ **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.** ▪ **Explain and use the relationship between the sine and cosine of complementary angles** ▪ **Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.** ▪ **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)** ▪ **Explain and use the relationship between the sine and cosine of complementary angles.** ▪ **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.**	
Understanding(s): ***Students will understand . . .*** 1. That trig ratios – an extension of similar triangles and proportions can be used when solving. 2. Patterns in triangle (angles, sides) can lead to useful shortcuts. 3. A number of tools are available to analyze triangles and solve for missing sides or angles which are law of sines,	**Essential Question(s):** ▪ How are the trig ratios related to similar triangles? ▪ Which tool (of triangles and trigonometry) is appropriate to use in *this* problem? ▪ When is it appropriate to use the inverse of a trigonometric function?

law of cosines, sine, cosine, and tangent.	
Learning Objectives: ***Students will know . . .*** ▪ Definitions for sine and cosine ratios ▪ How to apply the inverse trig functions in certain situations ▪ Shortcuts, like Pythagorean triples, 30-60-90 and 45-45-90 triangles ▪ The formulas for Law of Sines and Law of Cosines	***Students will be able to:*** ▪ Use sine and cosine ratios to find missing sides of right triangles ▪ Use inverse trig ratios to find missing angles of right triangles ▪ Recognize 30-60-90 and 45-45-90 triangles and use appropriate shortcuts ▪ Recognize simpler Pythagorean triples and use them as shortcuts ▪ Use the Law of Sines and Law of Cosines to find missing sides and/or angles of non-right triangles
Name:	**Dates: January**
Course/Subject: Geometry	**Unit 6: Congruent Triangles**

Stage 1 – Desired Results

PA Standard(s)/Assessment Anchors Addressed:
Common Core State Standards

- Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
- Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures
- Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. The ways to determine if two triangles are congruent. ▪ ASA, SAS, SSS, AAS, HL 2. What a converse of a conditional statement is and how to recognize whether or not the converse is true 3. How to organize a flowchart that helps conclude that two triangles are congruent	▪ How are the triangles related? ▪ What information do I need? ▪ What is the connection ▪ How can I justify that? ▪ What do I need to show for triangles to be congruent?

Learning Objectives:

Students will know . . .	***Students will be able to:***
▪ How to support a mathematical statement using flowcharts and conditional statements ▪ About the special relationships between shapes that are similar or congruent ▪ How to determine if triangles are similar or congruent ▪ The different between a statement and its converse and what makes that converse true or false	▪ Through exploration generate congruent figures ▪ Determine what common qualities congruent shapes have ▪ Discover the conditions that cause triangles to be similar or congruent ▪ Use a flowchart to organize facts and support their conclusions ▪ How to write and/or identify the converse of a statement

Name:	**Dates: February**
Course/Subject: Geometry	**Unit 7: Proof and Quadrilaterals**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

- **Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.**
- **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 coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).**
- **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.**
- **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.**

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. The relationships between sides and angles of quadrilaterals such as but not limited to, squares, rectangles, parallelograms, and trapezoids 2. What the midpoint of a line segment is and how to find it given two points 3. How to write a convincing proof that helps prove something about two shapes, angles, or sides	▪ What is the connection? ▪ How can I determine the midpoint of a line segment? ▪ What tools can I use? ▪ How do I know what shape it is?

Learning Objectives: ***Students will know . . .***	***Students will be able to:***
▪ How to support a mathematical statement using flowcharts and proofs ▪ About the special relationships between shapes that are similar or congruent ▪ How to prove if two shapes are similar	▪ Through exploration, generate quadrilaterals that are similar and/or congruent ▪ Determine what common qualities congruent quadrilaterals have

or congruent ▪ The formula for finding the midpoint of a line segment	▪ Discover the conditions that cause quadrilaterals to be similar or congruent ▪ Use a proof to organize facts, support their conclusions, and ultimately prove their conjectures ▪ Use the midpoint formula to find the midpoint of a line segment
Name:	**Dates: February**
Course/Subject: Geometry	**Unit 8: Polygons and Circles**
Stage 1 – Desired Results	
PA Core Standard(s)/Assessment Anchors Addressed: ▪ **Prove theorems about lines and angles.** ▪ **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.** ▪ **Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.**	
Understanding(s): ***Students will understand . . .*** 1. The differences between special types of polygons. 2. The measure of the interior and exterior angles of a regular polygon are related to the number of sides of the polygon. 3. The measure of the area of similar figures are related. 4. How to find the area and circumference of a circle and parts of circles.	**Essential Question(s):** ▪ How can I measure a polygon? ▪ How does the area change? ▪ Is there another method? ▪ What if the polygon has infinite sides? ▪ What is the connection?
Learning Objectives: ***Students will know . . .*** ▪ How to find the area of regular polygons. ▪ The relationship between the areas of similar figures. ▪ How to find the area and circumference of circles.	***Students will be able to:*** ▪ Find the sum of the interior angles of a polygon. ▪ Determine the measure of an interior and exterior angle of a regular polygon. ▪ Find the area of any regular polygon. ▪ Use the ratio of similarity to find the ratio of areas for similar figures. ▪ Find the area and circumference of a circle.
Name:	**Dates: March**
Course/Subject: Geometry	**Unit 9: Solids and Constructions**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

- **Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).**
- **Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.**
- **Construct a tangent line from a point outside a given circle to the circle.**
- **Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).★**

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. How to find volume and surface area of 3-dimensional solids. 2. How to create isometric drawings, mat plans and front, side, top view drawings of 3-dimensional shapes.	▪ How does it change? ▪ How can I represent it? ▪ How can I construct it? ▪ Is there another way?
Learning Objectives: ***Students will know . . .***	***Students will be able to:***
▪ How to find volume and surface area for 3-dimensional solids. ▪ How to represent 3-dimensional solids using mat plans, nets, side and top views. ▪ How to construct geometric shapes using a compass and straightedge.	▪ Find the volume and surface area of 3-dimensional solids using cubes and formulas. ▪ Use mat plans, nets, and side/top views to represent 3-dimensional solids. ▪ Use ratio of similarity to find the volume of a similar 3-dimensional object. ▪ Construct simple geometric figures using basic tools of a compass and straightedge.

Name:	**Dates: April**
Course/Subject: Geometry Connections and Geometry Enrichment	**Unit 10: Circles**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

- **Identify and describe relationships among inscribed angles, radii, and chords.**
- **Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.**
- **Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.**
- **Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).**
- **Prove that all circles are similar**.

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. The relationships between angles, arcs, and line segments in a circle.	▪ What is the relationship?
Learning Objectives:	

Students will know . . . ▪ How to use relationships between parts of a circle to solve problems. ▪ How to find a circle inscribed in a triangle.	***Students will be able to:*** ▪ Use angles, arcs, and segments within a circle to solve problems.
Name:	**Dates: May**
Course/Subject: Geometry	**Unit 11 Solids**
Stage 1 – Desired Results	
PA Core Standard(s)/Assessment Anchors Addressed: ▪ **Identify the shapes of two-dimensional cross-sections of three- dimensional objects, and identify threedimensional objects generated by rotations of two dimensional objects.** ▪ **Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.**	
Understanding(s): ***Students will understand . . .*** 1. The properties of Platonic Solids. 2. The formulas used to find volume and surface area of cones and pyramids.	**Essential Question(s):** ▪ How can I build it? ▪ What is a platonic solid?
Learning Objectives: ***Students will know . . .*** ▪ How to find the volume and surface area of a pyramid, cone, and sphere. ▪ How to find the cross-section of a solid.	***Students will be able to:*** ▪ Determine what shape is formed by taking a cross-section of various solids. ▪ Find the volume of various solids. ▪ Find the surface area of various solids.