Title: Identifying shared attributes of shapes

Grade: 3

PA Core Standard: CC.2.3.3.A.1 Identify, compare, and classify shapes and their attributes.

PA Connector:		Identify shared attributes of shapes.

Strand: Geometry | **Family:** Recognizing, Describing, Naming and Classifying

Progress Indicator: *E.GM.1h Describing, analyzing, comparing, and classifying two-dimensional figures (triangles, quadrilaterals) using shared attributes*

Big Idea(s): Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.

Essential Question(s): How are spatial relationships, including shape and dimension, used to draw, construct, model, and represent real situations or solve problems?
How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?

Foundational Knowledge:

- Understand same, match, and different (e.g., match same, sort by same and different).
- Name and discriminate basic shapes (e.g., count the number of sides of a shape, sort into categories of shapes).
- Identify tools necessary to create and measure shapes (e.g., ruler).

Key Vocabulary, Concepts and Symbols:

- Triangle, Quadrilateral, Rhombus, Square, Rectangle, Pentagon, Polygon
- Identifying different basic shapes and sizes

Suggested Instructional Strategies:

- Sorting plane and solid shapes across different materials and with increasing difficulty (e.g., create a game involving sorting)
    - Sort identical figures, then similar figures
        - Start with a model for groups and move to student-generated categories
    - Sort into an increasing numbers of categories
    - Move from blocks to cards cut into shapes to images on cards
    - Provide discrimination opportunities with varying distracting features such as colors and size
    - Sort novel items
- Use a graphic organizer to show the hierarchy among shapes (e.g., triangle, rectangle, square are all different kinds of polygons. Squares are a particular kind of rectangle. A rectangle is a kind of quadrilateral).
- Match a definition to a shape (e.g., I am a closed figure with 3 sides. What am I?)
- Label or match the shapes to the name
- Observe the school environment and find real world objects that are a designated shape.
    - Play “I Spy” in areas such as the cafeteria or playground to identify shapes.

Supports and Scaffolds Considerations:

- Shape blocks, cut outs, or cards with shapes
- Objects for creating shapes (e.g., popsicle sticks, pipe cleaners)
- Tangram Sets
- Computer-related activities
- Assistive Technology (e.g., interactive whiteboard or other software, calculator , communication device)
- Visual support to represent the rules

Key Word Search:

Triangle, Quadrilateral, Rhombus, Square, Rectangle, Pentagon, Polygon, Shapes

Title: Partitioning rectangles and circles into equal parts with equal area.

Grade: 3

PA Core Standard: CC.2.3.3.A.2 Use the understanding of fractions to partition shapes into parts with equal areas and express the area of each part as a unit fraction of the whole.

PA Connector:		Partition rectangles and circles into equal parts with equal area.

Strand: Geometry | **Family:** Geometric Problems

Progress Indicator: *E.GM.1i Partitioning shapes into equal parts with equal areas and recognizing that each part is a unit fraction of the whole*

Big Idea(s): Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.
Mathematical relationships among numbers can be represented, compared, and communicated.

Essential Question(s): How are spatial relationships, including shape and dimension, used to draw, construct, model, and represent real situations or solve problems?
How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?
How is mathematics used to quantify, compare, represent, and model numbers?

Foundational Knowledge:

- Understand the concept of equal parts (e.g., fold rectangular pieces of paper into 2 or 4 equal pieces).
- Which shape represents a fractional amount (e.g., a piece of a candy bar divided into thirds)
- Partition with concrete objects.
- Partition rectangles into two, three, or four equal parts.

Key Vocabulary, Concepts and Symbols:

- Understand the following concepts and vocabulary: equal, partition, area, rectangle, halves, thirds, fourths, fraction

Suggested Instructional Strategies:

- Explicitly teach connections between portioning rectangles and the location of fractions on the number line between 0 and 1.
- Match to same
- Tiling
- Task analysis (measure length, divide by number of parts, mark each equal part)
- Multiple exemplars for equal and not equal*
- Model-Lead-Test*
    - Use physical models and a trial and error approach (e.g., give student the “whole” rectangle, then give student various fractional pieces; students use trial and error with fractional pieces to determine the equal pieces that fit on the “whole”).

Supports and Scaffolds Considerations:

- Computer software
- Ruler
- Assistive Technology (e.g., interactive whiteboard or other software, calculator , communication device)
- Paper with pre-determined lines (e.g., black lines, perforated lines)
- Real-world objects (graham crackers, 2 square-game that can be drawn with chalk on the hard top)
- Fraction bars
- Geo Boards

Key Word Search:
partition, area, rectangle, fraction

Title: Classifying two-dimensional shapes based on attributes

Grade: 4

PA Core Standard: CC.2.3.4.A.2 Classify two-dimensional figures by properties of their lines and angles.

PA Connector:		Classify two-dimensional shapes based on attributes (e.g., type or # of angles or # of sides).

Strand: Geometry	**Family:** Recognizing, Describing and Naming and Classifying

Progress Indicator: *E.GM.1h Describing, analyzing, comparing, and classifying two-dimensional figures (triangles, quadrilaterals) using shared attributes*

Big Idea(s): Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.

Essential Question(s): How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?

Foundational Knowledge:

- Identify attributes of a 2-D figure (e.g., a square has 4 equal sides and 4 right angles).
- Identify parallel and perpendicular lines within 2-D shapes.
- Recognize and identify right angles.

Key Vocabulary, Concepts and Symbols:

- Understand the following concepts and vocabulary: side, angle, right angle, parallel, perpendicular

Suggested Instructional Strategies:

- Explicit instruction on the attributes & definitions of the attributes.
- Multiple exemplar (e.g., shapes, angles, polygons)*
- Using criteria for classifying each shape as a self check
- Have students use a graphic organizer (T-chart, paper with picture of shape you want them to find, etc.) to sort the shapes by classification.
- Use a Geoboard to make a 2-dimensional shape (rectangle, square, triangle, rhombus, diamond, etc.). Have students count the number of angles (points where the sides meet) and decide what shape it could be.
- Use objects to construct 2-dimensional shapes (toothpicks, paper, wiki-sticks). Have students count the number of angles in each.
- Have students complete an interactive whiteboard activity on 2-dimensional shapes that includes coloring or marking the angles of each shape. They could also place a “highlighter” mark over each angle in a shape and then count the angles.
    - Have students find examples of angles throughout the classroom (paper corners, doors, file cabinets, tables, etc.). Have them take pictures of these real object angles and create a PowerPoint or a book (with iPad you can use “Little Storymaker”) about the angles and shapes.

Supports and Scaffolds Considerations:

- Manipulatives
- Objects to construct quadrilaterals (toothpicks, paper, wiki-sticks)
- Geoboard
- Graphic organizer for classification
- Assistive Technology (e.g., interactive whiteboard or other software, calculator , communication device)
- Computer software (e.g., sorting or matching games)
- 2-D shapes, laminated

Key Word Search:

side, angle, right angle, parallel, perpendicular, shape

Title: Recognizing a point, line, line segment, and rays in two-dimensional figures		
Grade: 4		
PA Core Standard: CC.2.3.4.A.1 Draw lines and angles and identify these in two-dimensional figures.		
PA Connector:		Recognize a point, line, line segment, and rays in two-dimensional figures.
Strand: Geometry	**Family:** Recognizing, Describing and Naming and Classifying	
Progress Indicator: *E.GM.1j Recognizing and drawing points, lines, line segments, rays, angles, and perpendicular and parallel lines and identifying these in plane figures*		
Big Idea(s): Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.		
Essential Question(s): How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?		
Foundational Knowledge: • Recognize a 2-D shape from other shapes or non-shapes. • Know characteristics of 2-D shapes. • Identify points, line segments, perpendicular lines, and parallel lines in shapes.		
Key Vocabulary, Concepts and Symbols: • Given a picture of a point, line or line segment not in a shape, correctly name the object. • Accurately draw pictures of points, lines and line segments (not in shapes).		
Suggested Instructional Strategies: • Build models for points, line segments, and rays. • Use models of line segments to construct shapes • Use models of rays to construct angles. • Use graph paper to draw points, rays, line segments, parallel lines, and perpendicular lines.		
Supports and Scaffolds Considerations: • Wikistix • Graph paper • Manipulative shapes • Assistive Technology (e.g., interactive whiteboard or other software, calculator , communication device)		
Key Word Search: Line, segment, parallel, perpendicular, ray		

Title: Categorizing angles as right, acute, or obtuse

Grade: 4

PA Core Standard: CC.2.3.4.A.2 Classify two-dimensional figures by properties of their lines and angles.

PA Connector:		Categorize angles as right, acute, or obtuse.

Strand: Geometry | **Family:** Recognizing, Describing and Naming and Classifying

Progress Indicator: *E.GM.1j Recognizing and drawing points, lines, line segments, rays, angles, and perpendicular and parallel lines and identifying these in plane figures*

Big Idea(s): Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.

Essential Question(s): How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?

Foundational Knowledge:

- Recognize that sides of a 2-D shape form angles where they intersect.
- Recognize that angles can be measured
- Understand how to measure an angle
- Recognize that angles can be classified as acute, obtuse, or right based on their measure
  - may use a protractor to measure the angle and define acute/obtuse/right
  - may define angles as acute or obtuse based on an understanding of right angles
- Given a picture of an angle (not in a shape) identify if the angle is acute, obtuse, or right.

Key Vocabulary, Concepts and Symbols:

- Know the following vocabulary: angle, right angle, obtuse angle, acute angle, degrees

Suggested Instructional Strategies:

- Students will review parallel lines and perpendicular lines using a prior strategy (make T with arms, hold arms straight above heads, etc.). Ask students what they notice when a partner makes a T with their arms, and they "trace" from the fingertip to a fingertip and down (they should notice that this makes a "corner"). Ask if they have seen this shape before, or can find it somewhere else in the classroom-paper edge, file cabinet edge, whiteboard edge, etc. All of these are angles, specifically right angles, made by perpendicular lines. Ask students what shape they can make in the corner of these right triangles (should be a square). Tell students that in a right angle, you can find a square in the corner. Have them find other right angles in the classroom by using a square from a manipulative pack to test out their ideas.
- Review right angles (angles you can make a square in the corner). Ask students to draw a right angle on graph paper. Have them close the angle by adding a line segment. Ask what shape they have made (a triangle). Explain that this triangle is a right triangle because it has a right angle as one of the 3 angles. Ask students to try to make another right triangle on their paper with sides of different lengths. Discuss what had to stay the same and what could change.
- After students demonstrate an understanding of right angles, have them compare other angles to the right angle to determine if they are acute or obtuse.
- Have students use a protractor to measure a set of angles, with each angle on its own index card. Students will then sort the angles based on whether the angle measure is greater than 90˚, less than 90˚, or equal to 90˚ and classify these groups as sets of acute, obtuse, and right angles.

Supports and Scaffolds Considerations:

- Manipulatives that include squares
- Graph paper
- Highlighters or crayons
- Wikistix
- Assistive Technology (e.g., interactive whiteboard or other software, calculator , communication device)
- Computer software
- Protractor

Key Word Search:
angle, right, obtuse, acute, degrees

Title: Recognizing a line of symmetry in a two-dimensional figure

Grade: 4

PA Core Standard: CC.2.3.4.A.3 Recognize symmetric shapes and draw lines of symmetry.

PA Connector:		Recognize a line of symmetry in a two-dimensional figure.

Strand: Geometry **Family:** Transforming and Graphing

Progress Indicator: *E.GM.1k Recognizing and drawing lines of symmetry in a variety of figures*

Big Idea(s): Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.

Essential Question(s): How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?

Foundational Knowledge:

- Distinguish 2-D figures from other figures.
- Fold paper so all the sides/angles match up to test whether it has a line of symmetry.
- Given a picture, select shapes that have a line of symmetry already drawn.
- Given a picture, select shapes that are symmetrical.

Key Vocabulary, Concepts and Symbols:

- Know the following vocabulary: symmetry, symmetrical, line of symmetry

Suggested Instructional Strategies:

- Show students a picture of a happy face. Using paint or ink, mark one eye and half of the mouth, and then fold it length-wise in half. Ask the students if they think that the picture is the same on both sides of the fold. Unfold the picture and see what pattern the ink or paint made. Do the same thing, this time fold the picture width-wise. Ask the students again if they think that the picture is the same on both sides of the fold. Unfold the picture and see what pattern the ink or paint made. Tell students that when you can fold a picture and have both sides match up, that picture has symmetry, it matches. The line you can fold it on is called the line of symmetry. That line may NOT be in more than one place on this picture of a face. Hand out or try the same thing with several pictures. See if students can find a line of symmetry or more than one line of symmetry in the pictures.
- Using wikistix, have students try to find lines of symmetry on different shapes. Once they place the wikistix, have them fold the shape along the wikistix and see if the shape is the same along the fold. If not, they must replace the wikistix in a different area and try again. If it works, they can draw the line with pen or pencil.
    - Multiple exemplar training*

Supports and Scaffolds Considerations:

- Pictures of common symmetrical items (happy face, butterfly, button, etc.)
- Paint or ink
- Wikistix
- Assistive Technology (e.g., interactive whiteboard or other software, calculator , communication device)

Key Word Search:

symmetry, line of symmetry

Title: Using ordered pairs to graph given points

Grade: 5

PA Core Standard: CC.2.3.5.A.1 Graph points in the first quadrant on the coordinate plane and interpret these points when solving real world and mathematical problems.

PA Connector:		Use ordered pairs to graph given points.

Strand: Geometry | **Family:** Transforming and Graphing

Progress Indicator: *M.GM.1c Demonstrating the use of a coordinate system by locating/graphing a given point or polygon using ordered pairs*

Big Idea(s): Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.

Essential Question(s): How can data be organized and represented to provide insight into the relationship between quantities?

Foundational Knowledge:

- Locate the position of a number on a number line.
- Identify the x- and y- axis.
- Identify the origin (i.e., point of intersection).
- Complete concrete graphing of points (e.g., place a straw vertically up from 3 on the x-axis; place a straw horizontally from 2 on the y-axis. Put a chip at the point of intersection (3,2)).
- Identify that in an ordered pair the first coordinate is the horizontal shift (using the x-axis) and the second is the vertical shift (using the y-axis) from the origin.

Key Vocabulary, Concepts and Symbols:

- Understand the following concepts and vocabulary: coordinates, ordered pair, origin, x-axis, y-axis, point, vocabulary within the context of the problem

Suggested Instructional Strategies:

- Teach the coordinate system as two number lines.
- Task analysis:
  - Identify the x-values as the horizontal shift from the origin, and shift to that location. Then use the y-value to perform the vertical shift and determine the location of the ordered pair.
  - Find the point at (3,2) as the intersection of the vertical line x=2 and the horizontal line y=3.
- Use games such as *Battleship* to practice graphing.
- Use a grid on the floor and have students move to coordinates to model the horizontal and vertical shifts.
- Use a map overlaid on a coordinate system
  - Make a treasure hunt with ordered pairs.
- Use ordered pairs that create a picture when graphed.

Supports and Scaffolds Considerations:

- Raised graph paper
- Raised coordinate plane with raised x- and y-axis and raised horizontal and vertical lines
- Graphic organizer or visual representation of task analysis
- Maps of local and/or well-known cities
- Maps of school or classroom
- Assistive Technology (e.g., interactive whiteboard or other software, calculator , communication device)

Key Word Search:
coordinates, ordered pair