Geometry Unit

6th, 7th and 8th grade

Tates Creek Middle School

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Approximate Timeline: Jan. - Feb., 2003; 4 ½ weeks for alternating block, 2-3 weeks for double-blocked classes
School Level: Middle School
Area(s) of Core Content: Mathematics

Organizers:
Why and how do we use geometry in our lives?

Academic Expectations, Demonstrators and Core Content: *(These are the standards that will be taught and formally assessed in the Culminating Assessments.)*

Academic Expectation 1--Apply Communication and Math Skills:

- 1.5 - 1.9 Students use mathematical ideas and procedures to communicate, reason, and solve problems.

  Demonstrators for Academic Expectation 1.5-1.9
  Communicate the meanings of number, space, change, data, and measurement verbally, pictorially, symbolically, and concretely.
- 1.10 Students organize information through development and use of classification rules and systems.

  Demonstrators for Academic Expectation 1.10
  Apply a classification system based upon multiple criteria to organize objects, information, and/or ideas.

Academic Expectation 2--Mathematics:

- 2.9 Students understand space and dimensionality concepts and use them appropriately and accurately.

  Demonstrators for Academic Expectation 2.9
  - Use attributes to classify and analyze regular and irregular figures in 2 and 3 dimensions.
  - Investigate symmetry, similarity, and congruence using concrete models and drawing.
  - Explore, describe, and draw transformations.
  - Visualize different representations of 2 and 3-dimensional geometric figures.
- 2.10 Students understand measurement concepts and use measurements appropriately and accurately.

  Demonstrators for Academic Expectation 2.10
  - Extend the concepts of length, area, volume, mass, weight, capacity, time, angle, perimeter, money, circumference, and temperature using measurement tools and models.
  - Develop, through investigation, the formulas for perimeter, area, and volume.

Middle School Core Content--Mathematics:

- MA-M-2.1.1 Basic geometric elements that include points, segments, rays, lines, angles, and planes
- MA-M-2.1.2 Two-dimensional shapes including circles, regular polygons, quadrilaterals (square, rectangle, rhombus, parallelogram, trapezoid), and triangles (acute, obtuse, right, equilateral, scalene, isosceles)
- MA-M-2.1.4 Congruence, symmetry, and similarity
- MA-M-2.2.1 Identify characteristics (e.g., sides, vertices, angles, faces, edges, congruent parts) of two-dimensional and three-dimensional shapes
- MA-M-2.2.3 Move shapes in a coordinate plane: translate (slide), rotate (turn), reflect (flip), and dilate (magnify, reduce)
- MA-M-2.2.5 Use formulas to find area and perimeter of triangles and quadrilaterals, area and circumference of circles, and surface area and volume of rectangular prisms
- MA-M-2.3.2 How two-dimensional and three-dimensional figures are related as seen in different orientations (e.g., top view, side view, three-dimensional shapes drawn on isometric dot paper)

Secondary Standards: *(These standards will be taught and informally assessed throughout the unit, but not formally assessed in the culminating assessments.)*

Academic Expectation 1--Apply Communication and Math Skills:

- 1.16 Students use computers and other kinds of technology to collect, organize, and communicate information and ideas.

  Demonstrators for Academic Expectation 1.16
  - Express information and ideas creatively using technology.
  - Analyze relationships/patterns to draw inferences using technology.

Essential Questions:

- Compare and contrast the characteristics of 2- and 3-dimensional objects we see in the world around us.
- How do transformations relate to the real world?
- Find perimeter and area of objects in the real world.

Culminating Performance:

I. Create a visual representation of 2- and 3-dimensional objects (such as PowerPoint, Brochure, poster, mobile, sculpture, diorama, stories, songs, dramatic representation, or other approved by teacher), describing and classifying each object using appropriate characteristics.
Characteristics should include (but are not limited to):

2-dimensional
- # of Sides
- # of Angles
- Angle sums
- Lines of symmetry
- Real world example

3-dimensional
- # of Edges
- # of Faces
- # of Vertices
- Nets (8^{th} grade)
- Real world example

II. Open Response - Transformations

A. Draw a 2-dimensional object on a coordinate grid. List the coordinates. Show an example of all the transformations.
B. Choose one of the transformations and compare and contrast the original shape with its transformation.
C. Using the transformation you chose in part B describe how it might occur in the real world.

III. Comprehensive objective skills test

6th Grade Visual Representation Scoring Rubric				
	4	3	2	1
Organization	▪ Attractive and well organized ▪ Clearly communicates concepts and ideas	▪ Well organized ▪ Communicates concepts and ideas	▪ Somewhat organized ▪ Communicates some concepts and ideas	▪ Not organized ▪ Does not communicate concepts and ideas
Product	▪ Product is expressed in a creative, colorful medium ▪ Product is pre-approved.	▪ Product is expressed in a creative or colorful medium ▪ Product is pre-approved.	▪ Product is expressed with some creativity or color ▪ Product is not pre-approved, but shows some thought or effort.	▪ Product is expressed with no creativity or color ▪ Shows lack of thought or effort
Number of Components	Must include at least 3 different triangles, 3 different quadrilaterals, 3 different geometric solids and a circle.	Product contains 7-9 required components.	Product contains 4-6 required components.	Product contains 3 or fewer required components
Concept Accuracy	Each shape is correctly classified.	Most shapes are accurately classified.	Some shapes are accurately classified.	Few shapes are accurately classified
Notes:				

7th Grade Visual Representation Scoring Rubric				
	4	3	2	1
Organization	▪ Attractive and well organized ▪ Clearly communicates concepts and ideas	▪ Well organized ▪ Communicates concepts and ideas	▪ Somewhat organized ▪ Communicates some concepts and ideas	▪ Not organized ▪ Does not communicate concepts and ideas
Product	▪ Product is expressed in a creative, colorful medium ▪ Product is pre-approved.	▪ Product is expressed in a creative or colorful medium ▪ Product is pre-approved.	▪ Product is expressed with some creativity or color ▪ Product is not pre-approved, but shows some thought or effort.	▪ Product is expressed with no creativity or color ▪ Shows lack of thought or effort
Number of Components	Must include at least 3 different triangles, 3 different quadrilaterals, 3 different geometric solids and a circle.	Product contains 7-9 required components.	Product contains 4-6 required components.	Product contains 3 or fewer required components
Concept Accuracy	Each shape is correctly classified.	Most shapes are accurately classified.	Some shapes are accurately classified.	Few shapes are accurately classified
Notes:				

8th Grade Visual Representation Scoring Rubric				
	4	3	2	1
Organization	▪ Attractive and well organized ▪ Clearly communicates concepts and ideas	▪ Well organized ▪ Communicates concepts and ideas	▪ Somewhat organized ▪ Communicates some concepts and ideas	▪ Not organized ▪ Does not communicate concepts and ideas
Product	▪ Product is expressed in a creative, colorful medium ▪ Product is pre-approved.	▪ Product is expressed in a creative or colorful medium ▪ Product is pre-approved.	▪ Product is expressed with some creativity or color ▪ Product is not pre-approved, but shows some thought or effort.	▪ Product is expressed with no creativity or color ▪ Shows lack of thought or effort
Number of Components	Must include at least 3 different triangles, 3 different quadrilaterals, 3 different geometric solids, 5 different platonic solids and a circle.	Product contains 12-14 required components.	Product contains 9-11 required components.	Product contains 8 or fewer required components.
Concept Accuracy	Each shape is correctly classified.	Most shapes are accurately classified.	Some shapes are accurately classified.	Few shapes are accurately classified
Notes:				

Open Response Scoring Rubric					
	4	3	2	1	0
Terminology and Representations	Correctly plots the drawing and transformations	Correct procedure shown for plotting the drawing or transformations	Unsuccessful attempt to plot drawings or transformations	Attempted drawing does not relate to the task or recopied data as given	Blank
Skills, Concepts and Relationships	Compares and contrasts with no errors	Compares and contrasts with few errors	Compares and contrasts with some errors	Compares and contrasts with many errors	Blank
Real World Connection	Correctly describes appropriate real world example of transformation	Vaguely describes appropriate real world example	Lists but doesn't describe appropriate real world example	Gives an inappropriate example	Blank
Notes:					

Evaluation Component:
The comprehensive objective skills test will be given as both a pre-test and post test for the unit.

Knowledge:

Parallel lines
Transversal
Perpendicular
Lines
Rays
Segments
Point
Intersect/intersection
Angles
Vertex
Acute
Obtuse
Straight angle
Adjacent
Corresponding
Vertical
Interior
Exterior
Complementary
Supplementary
Polygon
Base
Regular and irregular
Closed
Curve
Quadrilateral
Square
Rhombus
Triangle
Equilateral
Right
Scalene
Isosceles
Trapezoid
Parallelogram
Prisms
Pyramids
Sphere
Cylinder
Cone
Platonic Solids
Tetrahedron
Icosahedron
Dodecahedron
Hexahedron
Decahedron
Edge
Faces
Diameter
Circumference
Pi
Area
Perimeter
Radius
Arc
Center point
Axes (horizontal and vertical)
Coordinate grid and plane
Base
Altitude
Degree
Symmetry
Translation
Rotation
Reflection

Technology Standards:

- T3 Use or Present Information/Ethical and Real World Use
- T5.7.2 Enter, manipulate and create visual representation of data.
- T6.1 Select appropriate software for a task.
- T6.4 Use a Word Processor to present information.
- T6.6.1 Determine appropriate use for presentation

Skills/Abilities:

Classify
Organize
Construct
Geometer's Sketchpad
Compare
Contrast
Apply
PowerPoint
Publisher or Word
Add
Subtract
Multiply
Divide
Measure angles and lengths

Instructional/Assessment Activities:

6th Grade Activities

	Objectives	Activities	Assessment	Critical Resources
Lesson 1	Introduce Geometer's Sketchpad: Review basic vocabulary: point, line, ray, perpendicular, parallel, intersect	Guide through basic tools of Sketchpad. Student will perform simple tasks using Arrow Tool, Point Tool, Compass Tool, Straightedge Tool, and Text Tool. Create parallel and perpendicular lines using Select Arrow and Construct menu.	Observations of task performance: parallel and perpendicular line creation. Development of vocabulary cards for Word Wall. "Lots of Lines" Activity and (p.12-Math Minders Geometry) **Homework**: Students will list examples of parallel and perpendicular lines found at home or in their community. "Parallel and Perpendicular Park" Activity (p. 13-Math Minders Geometry)	Geometer's Sketchpad
Lesson 2	Review right, obtuse, and acute angles. Measure angles with protractors.	Draw various angles using Sketchpad. Record angle measurement (use Measure menu). Introduce how to use protractor to measure angles and to draw angles of various degrees.	Glencoe Practice Worksheets 9-1 and 9-2. "Angle Word Search Activity" (p. 5 – Pre-Geometry)	Geometer's Sketchpad Glencoe Practice Worksheets

Lesson 3	Classify triangles by angles and sides.	Construct various triangles using Sketchpad. Measure their angles and sides. (Calculate and Tabulate measurements.) Discuss findings. Name different types of triangles created and discuss their characteristics. Develop a graphic organizer for the different types of triangles. Discuss where triangles are found in everyday life.	Saved files with triangle constructions. Graphic organizer to compare and contrast different types of triangles. Development of vocabulary words for Word Wall.	Geometer's Sketchpad
Lesson 4	Classify quadrilaterals	After discussing quadrilaterals (square, rhombus, rectangle, parallelogram, trapezoid) and their characteristics, have students create one quadrilateral and manipulate it to become each of the others. Develop a graphic organizer for the different types of quadrilaterals. Find examples of quadrilaterals around the classroom and school.	Saved files of quadrilaterals. Graphic organizer to compare and contrast different types of quadrilaterals. Word wall.	

Lesson 5	Review circles and appropriate vocabulary.			
Lesson 6	Develop a formula for the perimeter of a rectangle, followed by calculations for the perimeter for other polygons.	Discuss real life examples of when perimeter would be used (building a fence, fertilizing the grass, etc.) Use geoboards or graph paper to find perimeters of rectangles. Measure the sides of rectangular objects in the room to find their perimeters.		
Lesson 7	Finding the area of rectangles and triangles.			
Lesson 8	Transform an object using reflections, translations, and rotations.			

8th Grade Activities

	Objectives	Activities	Assessment	Critical Resources
Lesson 1	Identify and analyze/classify types of angles	1. Make classification matrix 2. Protractor activity	1. Matrix 2. Protractor activity page	http://home.xnet.com/~fidler/triton/math/review/mat075/angle/type1.htm
Lesson 2	Review of polygons: identify/classify triangles and quadrilaterals	1. Make classification matrix (Use dot and graph paper)	1. Matrix	http://mathforum.org/alejandre/frisbie/quad.html http://mathforum.org/alejandre/escot/folding.html
Lesson 3	Area and perimeter: triangles and quadrilaterals	1. Dog pen problem (Use Geoboards, graph paper)	1. Dog pen problem solution	
Lesson 4	Review of polygons: identify/classify n-gons	1. Classification matrix (use dot and graph paper)	1. Matrix	
Lesson 5	Review of Circles	1. Classification matrix 2. Compass, patty paper activity	1. Matrix 2. Compass activity	http://mathforum.org/alejandre/geometrylist.html
Lesson 6	Constructions (congruent lines and angles, angle bisectors, perpendicular bisectors, circles, perpendicular lines through a point on/off given line, construct regular polygons)	1. Geometer's Sketchpad activity: Constructing a Square	1. Sketchpad drawings	http://mathforum.org/workshops/radnor/june14.2002.html http://www.math.byu.edu/~lfrancis/readings302/GSP/GSPLessonPlans/GSPGrade8LP.html#Lesson2
Lesson 7	Constructions (cont.)			
Lesson 8	Intro to transformations: types and examples	MIRA, patty paper, dot and graph paper		http://math.rice.edu/~lanius/misc/index.html
Lesson 9	Translations and reflections	MIRA, patty paper, dot and graph paper		
Lesson 10	Rotations and dilations	Geometer's Sketchpad, graph paper		http://mathforum.org/alejandre/workshops/unit14.html
Lesson 11	Intro to 3-D figures	Multilink cubes, isometric dot paper drawings		http://mathforum.org/alejandre/workshops/unit14.html http://mathforum.org/alejandre/applet.polyhedra.html
Lesson 12	Review of geometric solids: terminology and identification/classification; Euler's formula	Classification matrix		http://math.rice.edu/~lanius/frac/koch.html http://www.kn.pacbell.com/wired/bluewebn/content/Cat_9_App_3.html http://www.georgehart.com/virtual-polyhedra/vp.html
Lesson 13	Platonic solids: terminology and identification/classification	Classification matrix		
Lesson 14	Platonic solids: nets	Geometer's Sketchpad, hexominoes		
Lesson 15	Platonic solids: nets (cont.)			