7th CCSS D4 <u>Geometry</u> Conceptual Foundation (4-5 weeks)

Domain 4: Geometry 7.G **D4 Cluster 1: Draw, construct, and describe geometrical figures and describe the relationships between them.** 1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. 2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. 3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
4.1.1 I can solve problems with scale drawings of geometric figures, compute actual lengths and area from a scale drawing, and reproduce a scale drawing using a different scale. 4.1.2 I can draw (freehand, with ruler and protractor, with technology) geometric shapes with given conditions (focus on triangles). 4.1.3 I can describe the two-dimensional figures that result from slicing three-dimensional figures.
D4 Cluster 2: **Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** 4. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. 5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. 6. Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
4.2.1 I can give an informal derivation of the relationship between the circumference and area of a circle. 4.2.2 I can solve real-world and mathematical problems involving 2-dimensional area (triangles, quadrilaterals, polygons) and 3-dimensional volume and surface area (cubes, right prisms). 4.2.3 I can use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

*Please note: The following conceptual foundation highlights important concepts &instructional support, but is not all inclusive. Please refer to "I Can" statements for a more complete picture of content.

Solve problems w scale drawings

(For example, if given a map of Utah with the scale of 1 inch=40 miles, reproduce that map at the scale of 1 inch = 10 miles or 1 inch = 60 miles.)

- For sample problems, please examine the corresponding assessment and answer sheet

Draw shapes w/given conditions

(For example: "Can you draw a triangle with sides lengths 5 and 7, and a 30 degree angle? If so, is there only one triangle, more than 1? Are the triangles acute, right, or obtuse?)

- For sample problems, please examine the corresponding assessment and answer sheet

Solve real world problems involving 2-D area (triangles, quadrilaterals, polygons) and 3-D volume and surface area (cubes, right prisms).

There are many real-life problems that involve finding areas buying carpet, laying a hard-wood floor, painting or wallpapering a room, to name a few.

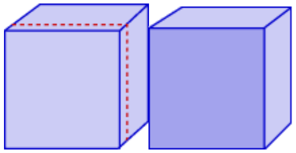
- For sample problems, please examine the corresponding assessment and answer sheet

Angles (supplementary, complementary, vertical, adjacent)—write and solve equations to find unknown angles.

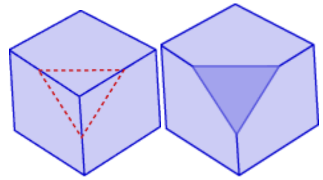
- For sample problems, please examine the corresponding assessment and answer sheet

Describe 2D Figures from slicing 3D figures and explain the result

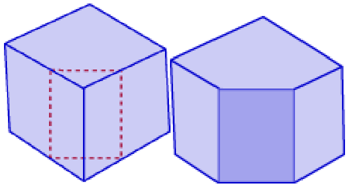
Examples:



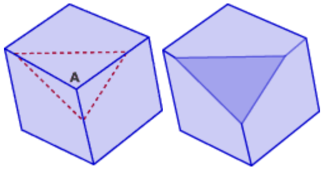
Create 4 points (equidistant from 4 vertexes)—slice.



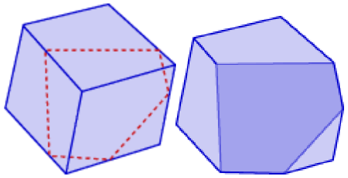
Create 3 points (equidistant from one vertex)—slice



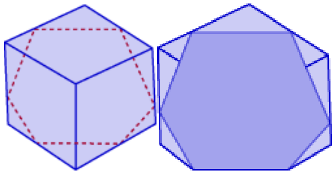
Create 4 points (equidistant from 2 vertexes)—slice.



Create 3 points (NOT equidistant from a vertex)—slice.



Create 5 points on 5 adjacent edges
(if the points are the midpoints of the edges,
the pentagon will be regular)



Create 6 points on 6 adjacent edges
(if the points are the midpoints of the edges,
the hexagon will be regular)

http://www.learner.org/courses/learningmath/geometry/session9/part_c/index.html#c4

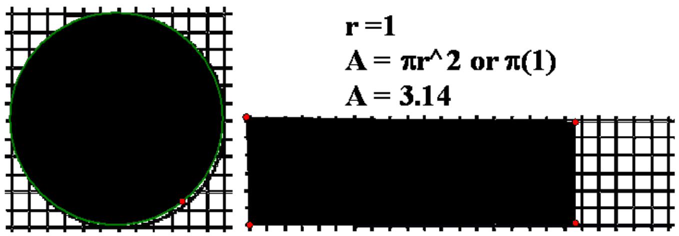
Show relationship between Circumference and Area of a circle

Both circumference and area of a circle involve a ratio relationship (Pi) between the radius and the Circumference or the radius and the Area. You can show this relationship using drawings or by rewriting the formulas in terms of Pi

Area relationship to Pi

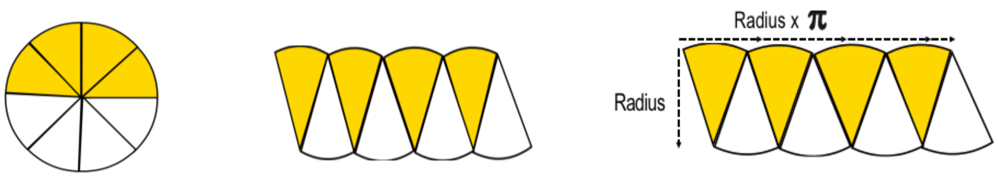
1. A good way for students to develop a conceptual understanding of pi is to:
   - Draw a circle with a radius of one unit on grid paper (you may have to explain to students that we can create "one unit" from 10 sub-units, for example). If the circle has a radius of 1 unit, then the area of the square in which it is inscribed is 4 square units. (See picture.)
   - If you fill the circle with beans (rice or something else being sure not to overlap items) and then move the beans into the rectangle with its height equal to one unit (see below), students can see that it is a little more than 3 sq units.

   You can see that $A = \prod r^2$ or $A = \prod(1)$ or 3.14 sq units



   - You can also look at the rectangle as having a height (or width) of 1, length of 3.14. Extend the idea to a circle with a radius of 2 units.

2. Another representation—transferring circle area to a rectangle area: The radius becomes the height—the radius x Pi becomes the length.



The idea is that we are "squaring" the circle. In other words, we are decomposing the circle and creating a square (actually rectangle) out of it. We are doing this, because we know that the area of a rectangular region is length times width.

The top (or bottom) length is half the circumpherence. In other words it is 1/2 of 2πr or πr. The height of the rectangle created is the radius of the circle or r. Hence, the area is height times base or πr times r or πr^2.

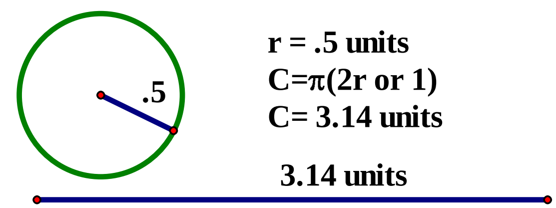
Note: The rearranged slices do not exactly form a rectangle (the top and bottom are not straight lines). However, the greater the number of wedges created from the circle, the closer the approximation of a rectangle.

Circumference relationship to Pi

A good way for students explore the idea of pi and its relationship to circumference is to have them measure the diameter of circular objects in the class room and then use that length as a unit length to find the circumference of the object. For this type of exercise, it is important to use a thread/yarn that is as non-elastic as possible. Collect data from students and ask them to make a conjecture based on the data.

Another activity:

- Draw a circle with a radius of .5 units
- Use a string to measure the circumference. Stretch the string to measure it.
- The string will be 3.14 units in length
- You can see that $C = \prod 2r$ or
  $C = \prod(1)$ or 3.14 units



Rewriting the equations reveals the Pi relationship in both circumference and area. Π is the constant. Circumference and area are dependent variables—dependent on the radius length. Radius is the input and circumference or area are the outputs.

$$C = \prod 2r \quad rewrite: \frac{C}{2r} = \Pi \qquad\qquad A = \prod r^2 \quad rewrite: \frac{A}{r^2} = \Pi$$