UNIT NINE: GEOMETRY

Filling and Wrapping

Big Idea

Geometric figures can be compared by their relative values.

Enduring Understandings

- Recognize that all other dimensions of a circle may be determined given any other dimension.
- Understand how changing the diameter or radius will affect the area and or circumference.
- Understand how a semi-circle relates to a circle.
- Understand volume as a measure of filling an object and surface area as a measure of wrapping or covering an object.
- Understand that three-dimensional figures may have the same volume but quite different surface areas or they may have the same surface areas but different shapes and volumes.
- Understand how changes in one or more dimensions of a rectangular prism or cylinder will affect the prism's volume.
- Understand the effect on surface area and volume of applying a scale factor to a rectangular prism.

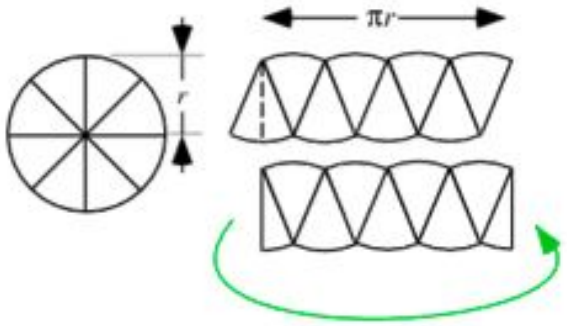
Essential Questions

- How can one part of a circle help determine the measure of another part?
- How are area and circumference connected?
- How can we determine area, given circumference?
- Can we determine diameter or radius, given area or circumference?

Common Core Standards: Content & Skills

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

7.G.4 Visit: U9L1 Khan Academy	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. Examples: Students understand the relationship between radius and diameter. Students also understand the ratio of circumference to diameter can be expressed as π. Building on these understandings, students generate the formulas for circumference and area.



http://mathworld.wolfram.com/Circle.html

The illustration shows the relationship between the circumference and area. If a circle is cut into wedges and laid out as shown, a parallelogram results. Half of an end wedge can be moved to the other end and a rectangle results. The height of the rectangle is the same as the radius of the circle. The base length is ½ the circumference ($2\pi r$). The area of the rectangle (and therefore the circle) is found by the following calculations:

Area Rect. = Base x Height A r e a = $(2\pi r)$ x r A r e a = πr x r Area = πr^2

7.G.4

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Students solve problems (mathematical and real-world) involving circles or semi-circles.

Note: Because π is an irrational number that neither repeats nor terminates, the measurements are approximate when 3.14 is used in place of Π.

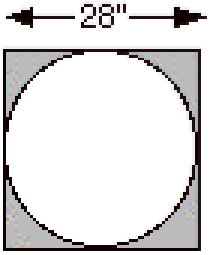
Example 1: The seventh grade class is building a mini-golf game for the school carnival. The end of the putting green will be a circle. If the circle is 10 feet in diameter, how many square feet of grass carpet will they need to buy to cover the circle? How might someone communicate this information to the salesperson to make sure he receives a piece of carpet that is the correct size? Use 3.14 for π.

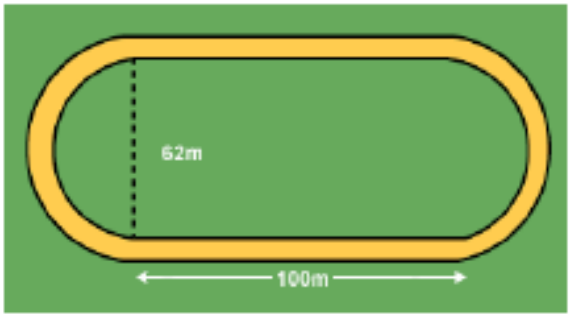
Solution: Area = πr^2 Area = 3.14 $(5)^2$ Area = 78.5 ft^2

To communicate this information, ask for a 9 ft by 9 ft square of carpet. A circle of that size could be cut out of a square measuring 81 square feet in area.

Students build on their understanding of area from 6th grade to find the area of leftover materials when circles are cut from squares and triangles or when squares and triangles are cut from circles.

Example 2: If a circle is cut from a square piece of plywood, how much plywood would be left over?



7.G.4 Visit: U9L1 Khan Academy	*Solution:* The area of the square is 28 x 28 or 784 in^2. The diameter of the circle is equal to the length of the side of the square, or 28", so the radius would be 14". The area of the circle would be approximately 615.44 in^2. The difference in the amounts (plywood left over) would be 168.56 in^2 (784 – 615.44).  **Example 3**:□What is the perimeter of the inside of the track above? *Solution:* The ends of the track are two semicircles, which would form one circle with a diameter of 62m. The circumference of this part would be 194.68 m. Add this to the two lengths of the rectangle and the perimeter is 394.68 m.
7.G.6 Visit: U9L2 U9L3 Khan Academy	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. Students continue work from 5^{th} and 6^{th} grade to work with area, volume, and surface area of two-dimensional and three-dimensional objects (composite shapes). Students will not work with cylinders, as circles are not polygons. At this level, students determine the dimensions of the figures given the area or volume. Example: The surface area of a cube is 96 in^2. What is the volume of the cube? Student: A cube has 6 faces that are all squares. All the squares are the same size. Dividing 96 by 6 gives me 16. So now I know each square has an area of 16 in^2. To find the volume of the cube, I need to know the length of each edge of the cube. Each edge is the same as the side length of one of the squares. 4 × 4 is 16, so, the side of the square is 4 inches. Because all of the edge lengths are the same in a cube, I can do 4 × 4 × 4 = 64 in^3