Vertical Progression:

7th Grade	**7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems.** o **7.RP.A.3** Use proportional relationships to solve multistep ratio and percent problems. **7.G.B Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** o **7.G.B.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.
8th Grade	**8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.** o **8.G.C.9** Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
Geometry	**ELG.MA.HS.G.10 Find arc lengths and areas of sectors of circles** o **G-C.B.5** 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.

Students will demonstrate command of the ELG by:

- Deriving the formula to find lengths of arcs intercepted by angles and using it to solve problems.
- Deriving the formula to find the area of a sector and using it to solve problems.

Vocabulary:

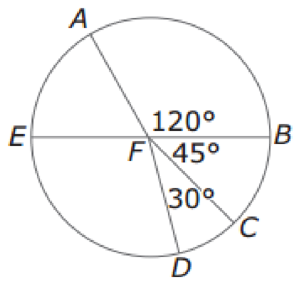
- arc
- arc length
- central angle
- circle
- circumscribed angle
- inscribed angle
- radius
- sector

Sample Instructional/Assessment Tasks:

1) **Standard(s): G-C.B.5**
Source: http://parcc.pearson.com/resources/practice-tests/math/geometry/eoy/PC194890-001_GEOMTB_PT.pdf

Item Prompt:

The circle with center F is divided into sectors. In circle F, $\overline{EB}$ is a diameter. The length of $\overline{FB}$ is 3 units.



Select the correct expression that represents the arc length of $\overset{\frown}{AED}$.

Ⓐ π

Ⓑ $\frac{11\pi}{4}$

Ⓒ $\frac{13\pi}{4}$

Ⓓ $\frac{7\pi}{4}$

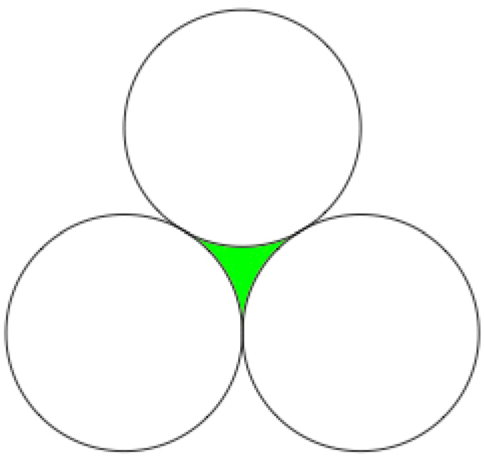
Correct Answer: B

2) **Standard(s): G-C.B.5**

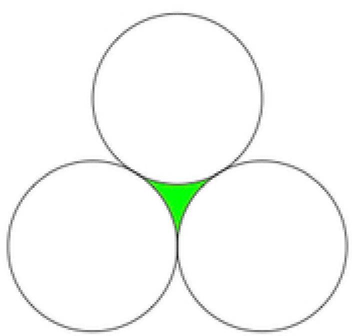
Source: https://www.illustrativemathematics.org/content-standards/HSG/C/B/5/tasks/1006

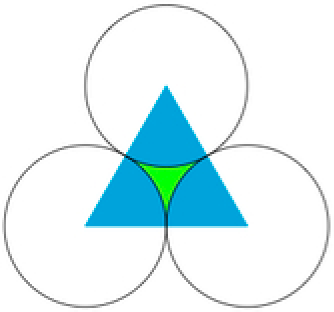
Item Prompt:

Three circles, each having radius 2, are mutually tangent as pictured below:



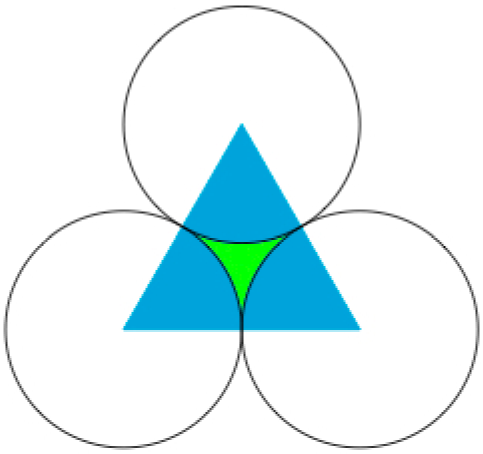
What is the total area of the circles together with the shaded region?





Solution:

The shaded shape is highly irregular with three different arcs of circles as its boundary. The key to calculating the area is to add into the picture the sectors of the three circles swept out by those arcs:



The vertices of the blue shape are the centers of the three circles. Since each pair of circles is tangent, the centers of the circles are all 4 units apart. The sides of the blue shape are each made up out of two circle radii each measuring 2 units. This means that these radii are collinear and so the blue shape is a triangle. It is equilateral because each side has length 4 units. The area of an equilateral triangle with side length 4 units is $4\sqrt{3}$units^2.

The blue sectors are each 60 degrees since these are angles in an equilateral triangle. Together they form a 180 degree sector or half of a circle of radius 2. So the area of the green section is

$4\sqrt{3} - 2\pi$ units^2.

Each circle has area 4π units2. So this means that the sum of the area of the three circles and the green shaded portion is $10\pi + 4\sqrt{3}$.