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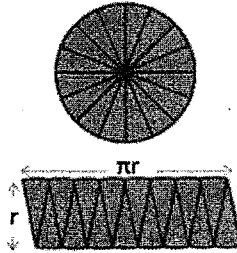
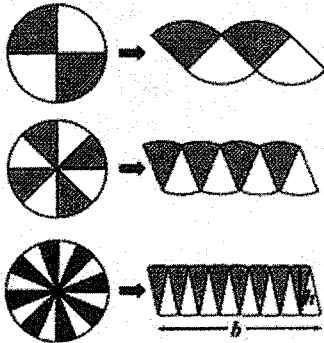
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CC GEOMETRY

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LESSON #2: PROVING THE AREA OF A CIRCLE

<https://www.youtube.com/watch?v=YokKp3pwVFc#t=16>



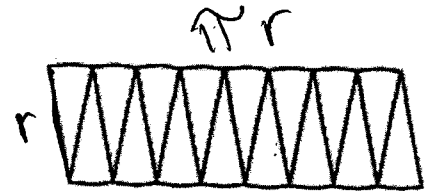
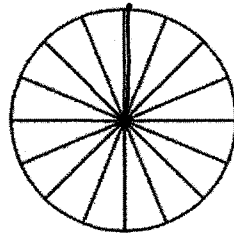
h approaches the radius of the circle as the number of sectors approaches infinity

b approaches the circumference of the semicircle as the number of sectors approaches infinity

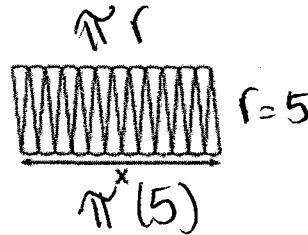
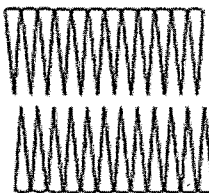
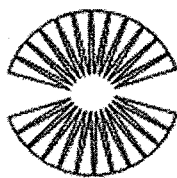
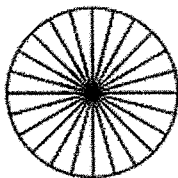
As a result, Area of Rectangle = Area of Circle
 $(\pi r) r = \pi r^2$

1. One method for calculating area of a circle is to dissect it into a number of wedges. The circle below has a radius r and has been evenly dissecting into 16 wedges. If the wedges are rearranged alternately to create a shape resembling a rectangle, as shown below, what is the approximate length of the rectangle?

- a. π
- b. πr
- c. r
- d. πr^2



2. A circle with a radius of 5 was divided into 24 congruent sectors. The sectors were rearranged, as shown in the diagram below. To the nearest integer, the value of x is...



$5\pi = 15.7079$
 $x=16$

- $d=20$ 3. A designer needs to create perfectly circular necklaces. The necklaces each need to have a radius of 10 cm. What is the largest number of necklaces that can be made from 1000 cm of wire?

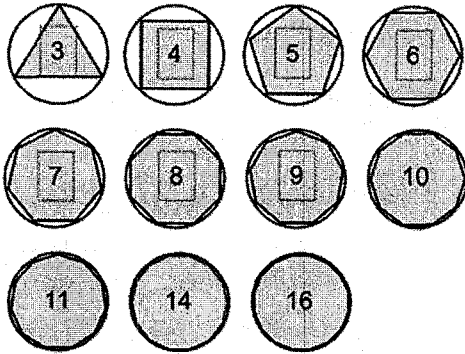
circumference!
 $c = \pi d$
 $c = 20\pi$

$\frac{1000}{20\pi} = 15.9154$

15 necklaces

Given the diagram below

What happens to h_n and perimeter P_n as n approaches infinity ($n \rightarrow \infty$) in terms of the radius and circumference of the circle?

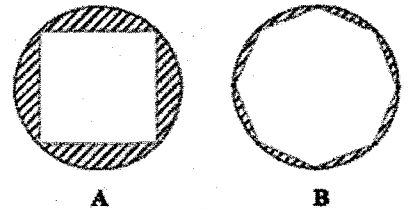


AREA OF A CIRCLE
 The area of a circle is the limit of the areas of the inscribed regular polygons as the number of sides of the polygons approaches infinity.

Theorem: As the number of sides of the polygon increases, the area of the polygon becomes a better estimate of the area of the circle.

4. Which of the figures below best approximates the area of the circle? Explain.

circle B b/c the # of sides of the shape within the circle is 7
 circle A



5. Each of the following shapes is inscribed in a circle with a radius of 5 cm. Which of the shapes has a perimeter closest in value to the circumference of the circle?

(1) a square

4

(2) a regular hexagon

6

(3) a regular octagon

8

(4) a regular dodecagon

12

6. A regular hexagon is inscribed in a circle with radius r . Name another regular polygon that, when inscribed in the same circle, has an area that better approximates the area of the circle than does the area of the regular hexagon. Explain how you know this is true.

Any reg. polygon w/ more than 6 sides.
 As the # of sides \uparrow , the area of the polygon is close r to the area of a circle

7. In the diagram below, circle O is inscribed in square $ABCD$. The square has an area of 36. What is the area of the circle in terms of π ?

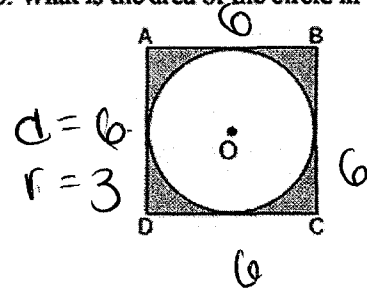
$$\sqrt{S^2} = \sqrt{36}$$

$$S = 6$$

$$A = \pi r^2$$

$$A = \pi (3)^2$$

$$A = 9\pi \text{ units}^2$$



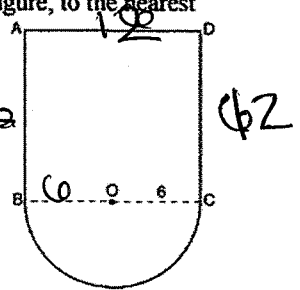
8. In the figure below, $ABCD$ is a square and semicircle O has a radius of 6. What is the area of the figure, to the nearest thousandths?

$$A \text{ square} = 12 \times 12 = 144$$

$$A \text{ circle} = \pi (6)^2 = 36\pi \div 2 = 18\pi$$

~~$$257.097$$~~

$$\boxed{200.549 \text{ un}^2}$$

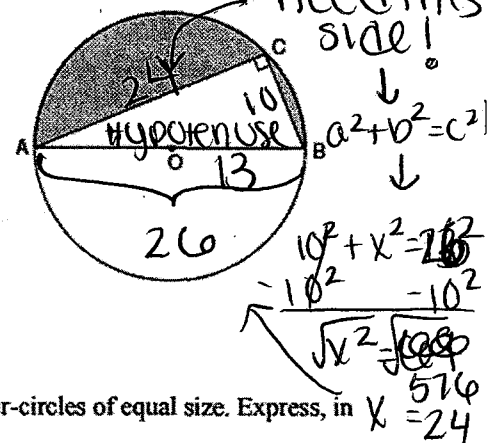


9. In the accompanying diagram, right triangle ABC is inscribed in circle O , diameter $AB = 26$, and $CB = 10$. Find, to the nearest square unit, the area of the shaded region.

Area $\frac{1}{2}$ circle - Area of triangle

$$\frac{1}{2} \pi r^2 - \frac{1}{2} bh$$

$$\frac{1}{2} \pi (13)^2 - \frac{1}{2} (10)(24) = \boxed{145 \text{ un}^2}$$



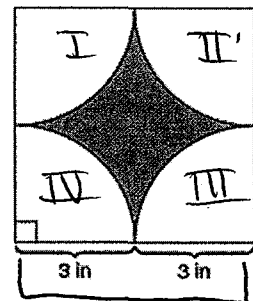
10. A designer created the logo shown below. The logo consists of a square and four quarter-circles of equal size. Express, in terms of π , the exact area, in square inches, of the shaded region.

A square - A circle

$$s^2 - \pi r^2$$

$$6^2 - \pi (3)^2$$

$$\boxed{36 - 9\pi \text{ un}^2}$$



6

11. The diagram shows a green piece of square carpeting. A hole is being cut out of the carpeting for a column 6' in diameter. How many square feet of carpeting are shown in this diagram? Round answer to the nearest tenth of a square foot.

A square - A circle

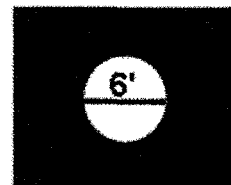
$$s^2 - \pi r^2$$

$$18^2 - \pi (3)^2$$

$$\boxed{295.7 \text{ ft}^2}$$

$$d = 6$$

$$r = 3$$



18'

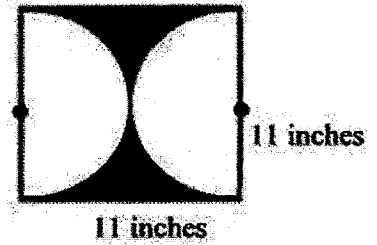
12. Find the number of square inches in the area of the shaded region of this square which is being intersected by two semicircles. Leave answer in terms of π .

$$A_{\text{square}} - A_{\text{circle}}$$

$$s^2 - \pi r^2$$

$$11^2 - \pi(5.5)^2$$

$$\boxed{121 - 30.25\pi \text{ in}^2}$$



$$d = 11$$

$$r = 5.5$$

13. Mr. Petri has a rectangular plot of land with length = 20 feet and width = 10 feet. He wants to design a flower garden in the shape of a circle with two semicircles at each end of the center circle, as shown in the accompanying diagram. He will fill in the shaded area with wood chips. If one bag of wood chips covers 5 square feet, how many bags must he buy?

$$A_{\text{rectangle}} - 2(A_{\text{circle}})$$

$$l \cdot w - 2(\pi r^2)$$

$$(20 \cdot 10) - 2(\pi(5)^2)$$

$$200 - 50\pi = \frac{42.9203 \text{ ft}^2}{5}$$

$$= 8.5840$$

$$= \boxed{9 \text{ bags}}$$

