

## Station 1—Regular Polygons & Area Relationships

1. **(Easy)** A regular decagon has side length of 9in and apothem of approximately 14in. Find the area of the decagon.
2. **(More Difficult)** Regular pentagon QRSTU with center A has a perimeter of 60 ft. and  $AR \approx 10.21$  ft. Find the area of the pentagon.
3. **(Most Difficult)** A regular nonagon has a side length of 16cm. Find its approximate area.  
(Hint: Use trigonometry.)
4. What should be the correct (exact) length of the apothem in problem #1?

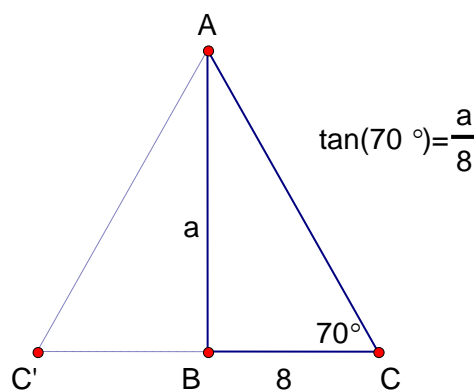
## Station 1 Answers

$$1. A = \frac{1}{2} Pa = \frac{(90)(14)}{2} = 630$$

2. If  $AR \approx 10.21$  ft., then the apothem can be found using the Pythagorean theorem. The apothem is approximately 8.26 ft.

$$\text{Thus } A = \frac{Pa}{2} = \frac{(60)(8.26)}{2} = 247.8$$

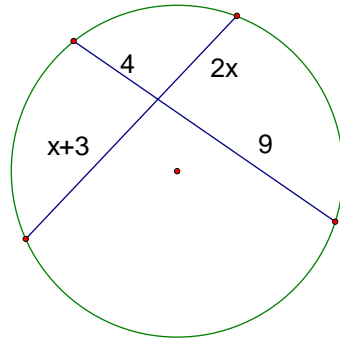
3. The interior angles of a regular nonagon each equal 140 degrees. As a result, the apothem is approximately 21 cm. Thus, the area of the nonagon is approximately 1512 cm.



4. According to the figure,  $\tan 72^\circ = \frac{a}{4.5}$ . So, the apothem is  $a = 4.5 \tan 72^\circ \approx 13.849575\dots$

## Station 2—Fun With Circles!

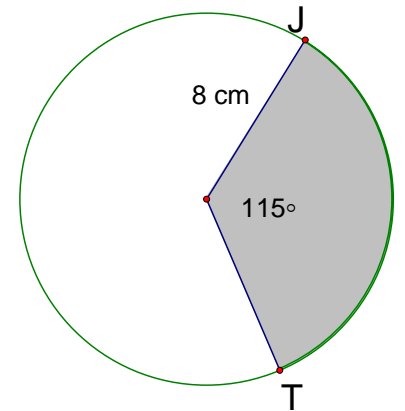
1. Find  $x$ .



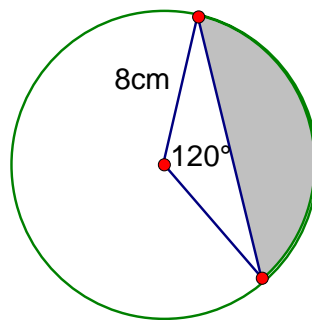
2. (Easy)

a) Find the area of the shaded region.  
(Leave answer in terms of  $\pi$ .)

b) Find the length of minor arc JT.  
(Leave answer in terms of  $\pi$ .)



3. (Difficult) Find the area of the shaded region.



## Station 2 Answers

1. The power of the point gives  $2x(x+3)=36$ .

$x = -6$  or  $x = 3$ . Since length cannot be negative,  $x = 3$ .

2. a) The shaded area is  $\frac{115}{360}$  of the circle. Thus, the area of the shaded sector is  $\frac{115}{360}(64)\pi = \frac{184}{9}\pi$  sq. cm.

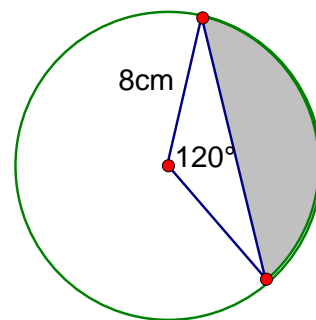
b) The length of minor arc JT is  $\frac{115}{360}(16)\pi = \frac{46}{9}\pi$  cm.

3. The sector's area is  $\frac{64\pi}{3}$ . The area of the triangle must be subtracted from the sector. Using the formula

$$A = \frac{1}{2}ab \sin C \quad A = \frac{1}{2}(8)(8) \sin 120^\circ \approx 27.7$$

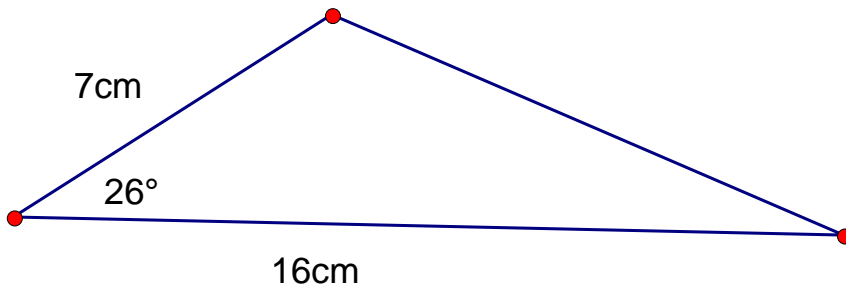
Thus, the area of the shaded region is

exactly  $\frac{64\pi}{3} - 32 \sin 120^\circ$  or approximately 39.3 sq. cm.



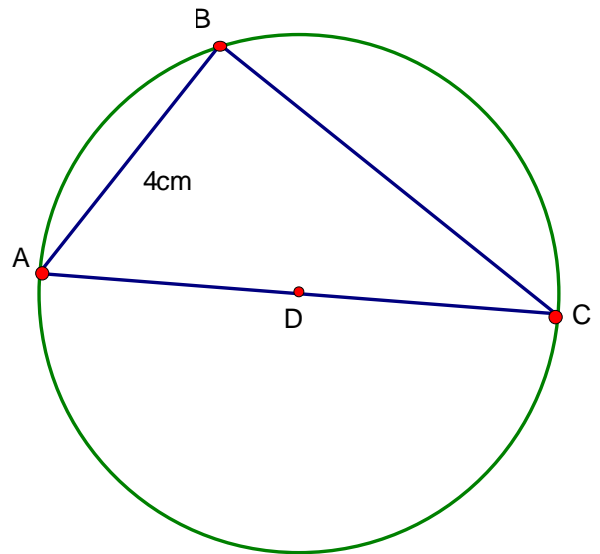
## Station 3—Right Triangle Trigonometry

1. Find the area of the triangle to the nearest 0.01



2. Given  $\triangle ABC$  with  $AB = 4\text{cm}$  and radius  $AD = 5\text{cm}$ .

- Explain why  $\triangle ABC$  is a right triangle.
- Find  $\cos A$
- Find  $\sin A$



3. Given an isosceles triangle with side lengths 9, 7, and 9, find the cosine of a one of the congruent angles.

## Station 3 Answers

1.  $A = \frac{1}{2}(7)(16)\sin 26^\circ \approx 24.5\text{cm}^2$

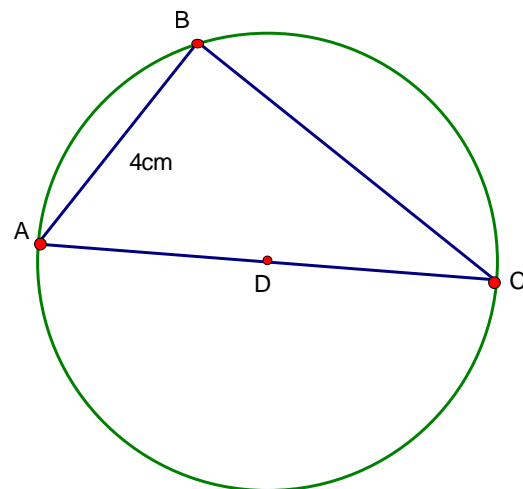
2.  $\triangle ABC$  is a right triangle with right angle B.

a) Angle ABC is an inscribed angle that intercepts an arc of  $180^\circ$ .

b)  $\cos A = \frac{4}{10} = \frac{2}{5}$

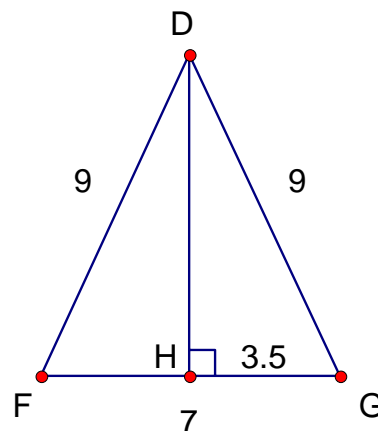
c) Using the Pythagorean theorem

$$BC = 2\sqrt{21}. \text{ Thus, } \sin A = \frac{\sqrt{21}}{5}$$



3. Make the two congruent angles the base angles and draw an altitude of the triangle to create right triangles.

$$\cos G = \frac{3.5}{9} = \frac{7}{18}$$

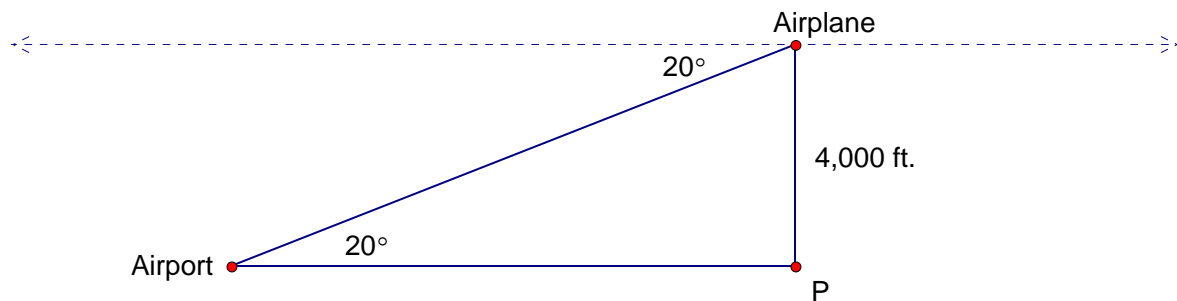


## Station 4—Trigonometry Applications

1. **(Easy)** If the thin-headed man below puts the ladder 6 ft from the wall so that the top of the ladder meets the top of the wall and the angle of elevation is 70 degrees, then how long is the ladder? *Round your answer to the nearest tenth of a foot.*



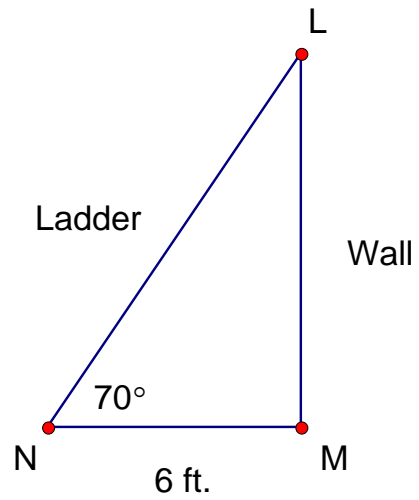
2. **(More difficult)** While flying her plane over the lake, a pilot sees the airport. She estimates that the angle of depression to the airport is 20 degrees. If her elevation is 4,000 feet what is the (horizontal) distance to the airport?



## Station 4—Answers

$$\cos 70^\circ = \frac{6}{x}$$

1.  $x = \frac{\cos 70^\circ}{6} \approx 17.5 \text{ ft}$



2.  $\tan 20^\circ = \frac{4000}{x}$

$$x = \frac{4000}{\tan 20^\circ} \approx 10,990 \text{ ft.}$$