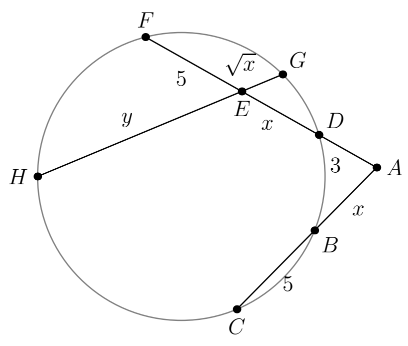
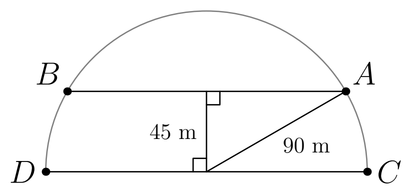
If you can solve nearly all of the following problems with little difficulty, then the class **Math 8: Introduction to Geometry** would only serve as a review for you.

1. Prove the Pythagorean Theorem.
2. Find y in the diagram below.

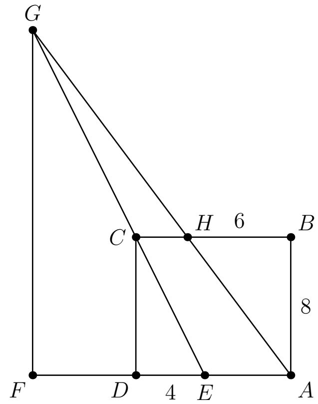


3. Marcia could walk from A to B along arc AB on the semicircular path, or she can walk along chord AB. Diameter CD has length $180m$. How much farther is it to walk along the arc as opposed to the chord?

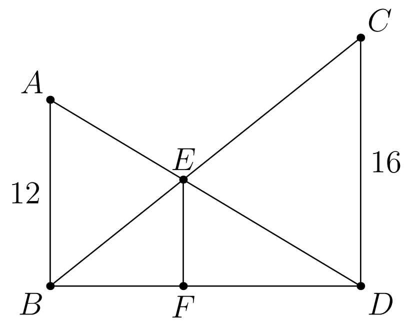


4. An ant starts at one vertex of a unit cube and walks to the opposite vertex along the surface of the cube. What is the minimum distance the ant can walk?
5. Spot's doghouse has a regular hexagonal base that measures one yard on each side. He is tethered to a vertex with a two-yard rope. What is the area, in square yards, of the region outside the doghouse that Spot can reach?

6. In rectangle $ABCD$, we have $AB = 8$, $BC = 9$, H is on BC with $BH = 6$, E is on AD with $DE = 4$, line EC intersects line AH at G, and F is on line AD with $GF \perp AF$. Find the length GF.



7. There are two flagpoles, one of height 12 and one of height 16. A rope is connected from the top of each flagpole to the bottom of the other. The ropes intersect at a point x units above the ground. Find x. In the accompanying diagram, this is equivalent to finding the length of EF.



8. Three spheres are tangent to a plane at the vertices of a triangle and are tangent to each other. Find the radii of these spheres if the sides of the triangle are 6, 8, and 10.

9. Derive a general formula for the volume of the frustum of a cone with bases of radius R and r and height h.

Don't look at the next page until you've attempted all the problems!

The answers are below. (The answers to problem sets and challenges given in the class will include full detailed solutions as opposed to the mere answers provided below.)

1. (Note that there are many acceptable proofs.) In right triangle ABC with right angle at A we wish to prove $AC^2 + AB^2 = BC^2$. Drop altitude AD to hypotenuse BC. $\triangle ABC \sim \triangle DAC \sim \triangle DBA$ giving us $\frac{DC}{AC} = \frac{AC}{BC}$ and $\frac{DB}{AB} = \frac{AB}{BC}$. Now $AC^2 = BC \cdot DC$ and $AB^2 = BC \cdot DB$, so $AC^2 + AB^2 = BC(DC + DB) = BC^2$.
2. 10
3. $60\pi - 90\sqrt{3}$
4. $\sqrt{5}$
5. 3π
6. 20
7. $\frac{48}{7}$
8. $r_1 = \frac{12}{5}, r_2 = \frac{15}{4}, r_3 = \frac{20}{3}$
9. $V = \frac{1}{3}\pi h(R^2 + Rr + r^2)$