

10-3 Think About a Plan

Areas of Regular Polygons

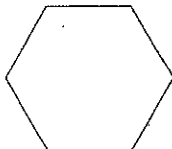
A regular hexagon has perimeter 120 m. Find its area.

Understanding the Problem

1. What is the formula for the area of a regular polygon?
2. What information is given? What information do you need?

Planning the Solution

3. Divide the hexagon into six congruent triangles. What type of triangle are these? Explain how you know.



4. What is the length of the radius? Explain.

5. Draw an apothem. What type of triangle is formed by one radius, half of one side, and the apothem? What are the angles in this polygon?

6. What relationships exist among the sides of this type of triangle?

7. How can you find the length of the apothem? Find its length.

Getting an Answer

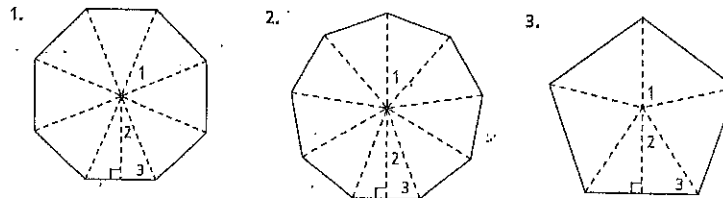
8. Substitute the values for the apothem and the perimeter into the formula and solve.

10-3 Practice

Areas of Regular Polygons

Form G

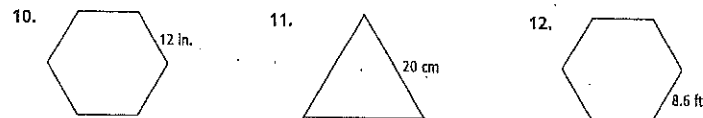
Each regular polygon has radii and apothem as shown. Find the measure of each numbered angle.



Find the area of each regular polygon with the given apothem a and side length s .

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|---|--|
| 4. pentagon, $a = 4.9$ in., $s = 7.1$ in. | 5. hexagon, $a = 12.1$ ft, $s = 14$ ft |
| 6. octagon, $a = 20.8$ m, $s = 17.2$ m | 7. nonagon, $a = 50.9$ m, $s = 37$ m |
| 8. decagon, $a = 31$ in., $s = 20.1$ in. | 9. dodecagon, $a = 40.6$ m, $s = 21.7$ m |

Find the area of each regular polygon. Round your answer to the nearest tenth.



13. Your math teacher draws a regular hexagon with a circle circumscribed around it. The radius of the circle is 5 m. To the nearest tenth, what is the area of the hexagon?

Find the measures of the angles formed by (a) two consecutive radii and (b) a radius and a side of the given regular polygon.

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|--------------|------------|-------------|
| 14. hexagon | 15. square | 16. octagon |
| 17. pentagon | 18. 15-gon | 19. 20-gon |

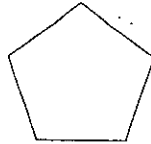
10-5 Think About a Plan

Trigonometry and Area

Architecture The Pentagon in Arlington, Virginia, is one of the world's largest office buildings. It is a regular pentagon, and the length of each of its sides is 921 ft. What is the area of land the Pentagon covers to the nearest thousand square feet?

Understanding the Problem

- The figure at the right is a regular pentagon. Label the side length with the information given in the problem.
- The formula for the area of a regular polygon is $A = \frac{1}{2}ap$. Which measures do you need to solve the problem?



Planning the Solution

- How can you find the perimeter?
- Draw an apothem and radius on the figure. Label the center A , and draw right $\triangle ABC$ formed by the apothem and radius, where \overline{AB} is the hypotenuse.
- How can you find $m\angle ABC$? Write this measure on the diagram.
- Which trigonometric ratio can you use to find the apothem? Explain.

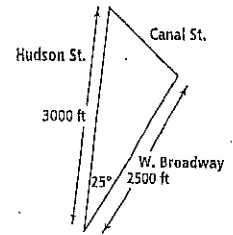
Getting an Answer

- Complete the equation below. Then solve for a , the apothem.
 $\frac{\text{Area}}{\text{Perimeter}} = \frac{a}{2}$; $a \approx \text{_____} \text{ ft}$
- Use the formula for the area of a regular polygon to find the area.

10-5 Practice (continued)

Trigonometry and Area

- The Tribeca neighborhood in New York City gets its name from its shape and location (a triangle below Canal Street). The triangular part of the neighborhood is formed by the intersection of Canal Street, Hudson Street, and West Broadway. This section of Hudson Street is about 3000 ft long, this section of West Broadway is about 2500 ft long, and the angle enclosed by the two streets is approximately 25° . What is the area of this part of Tribeca? Round your answer to the nearest thousand square feet.



Find the perimeter and area of each regular polygon to the nearest tenth.

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- The central angle of a regular polygon is 18° . The perimeter of the polygon is 144 ft. What is the area of the polygon to the nearest tenth?
- The cost for refinishing a floor is $\$2.50/\text{ft}^2$. What is the cost of refinishing a hexagonal floor that has a radius of 5.5 ft?

The polygons are regular polygons. Find the area of the shaded region.

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- Reasoning** Which has the greater area, a regular octagon or a regular nonagon, if both have the same length sides? Explain.
- Reasoning** Which has the greater perimeter, a regular pentagon, or a regular hexagon, if they have the same area? Explain.