Find the area of this regular hexagon with a side length of 5 inches.

\[ A = \frac{5 \times (2.55 \sqrt{3})}{2} = 10.8 \]

1. In the figure, regular hexagon \(JKLMNP\) is inscribed in \(\odot R\). Identify the center, a radius, an apothem, and a central angle of the polygon. Then find the measure of a central angle. **Guided Practice**

   **Center:** point \( R \), **radius:** \( \overline{RK} \), **apothem:** \( \overline{RS} \), **central angle:** \( m \angle KRL, 60 \)
Area of a Regular Polygon:

\[ A = \frac{aP}{2} \]

- \( A \) = area
- \( a \) = apothem
- \( P \) = perimeter

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

\[ P = 18 \quad a = 2.6 \]

\[ a = 1.5 \tan 60 = \frac{9}{\sqrt{3}} \approx 5.2 \]

\[ 1.5 \tan 60 = a \]

\[ 2.6 = a \]

\[ A = \frac{2.6(18)}{2} \]

\[ A = 23.4 \text{ in}^2 \]

---

3A. 6.9 ft²

- 30°
- 4 ft
- 2.6 ft

\[ h = 3.5 \]

\[ A = \frac{4(3.5)}{2} = 6.9 \]

3B. 98 cm²

- 7 cm
- 10

\[ \sin 45 = \frac{x}{7} \]

\[ x = \frac{7}{\sqrt{2}} \approx 5 \]

3C. 212.1 in²

- 8 in
- 22.5°

\[ \tan 22.5 = \frac{x}{8} \]

\[ x = 3.3 \]

\[ P = 5(8) \]

\[ a = 8 \]

\[ A = \frac{5(3.3)}{2} = 8.3 \text{ in}^2 \]
Composite Figure: figure that can be separated into multiple simple shapes

**MINIATURE GOLF** The dimensions of a putting green at a miniature golf course are shown. How many square feet of carpet are needed to cover this green?

\[ A_c = \pi r^2 = 50.2 \quad \frac{50.2}{2} = 25.1 \]

\[ A_T = \frac{4 \times 4}{2} = 8 \]

\[ A_r = \frac{4 \times 7}{2} = 14 \]

\[ 28 + 8 + 25.1 = 61.1 \text{ ft}^2 \]

---

Find the area of each figure. Round to the nearest tenth if necessary.

4A. \[
\begin{array}{c}
8 \text{ in.} \\
12 \text{ in.} \\
5 \text{ in.}
\end{array}
\]

\[ A = \frac{1}{2} (7)(12+5) \]

\[ A = 59.5 \]

\[ 59.5 + 96 = 155.5 \]

4B. \[
\begin{array}{c}
15 \text{ cm} \\
22 \text{ cm} \\
31 \text{ cm}
\end{array}
\]

\[ 9^2 + x^2 = 15^2 \]

\[ x = 12 \]

\[ A_c = \pi r^2 = 113 \quad \frac{113}{2} = 56.5 \]

\[ A_T = \frac{1}{2} (12)(22+31) = 318 \]

\[ 56.5 + 318 = 374.5 \]
11.5 Area of Similar Figures

**Theorem 11.1 Areas of Similar Polygons**

<table>
<thead>
<tr>
<th>Words</th>
<th>If two polygons are similar, then their areas are proportional to the square of the scale factor between them.</th>
</tr>
</thead>
</table>

**Example** If $ABCD \sim FGHJ$, then

\[
\frac{\text{area of } FGHJ}{\text{area of } ABCD} = \left(\frac{FG}{AB}\right)^2.
\]

For each pair of similar figures, find the area of the green figure.

1A. 
\[
\begin{align*}
8 \text{ cm} & \quad 12.5 \text{ cm}^2 \\
5 \text{ cm} & \\
S & = 32 \text{ cm}^2 \\
\frac{8}{5} & = \frac{4}{2.5} \\
\frac{6}{5} & = \frac{36}{2} \\
800 & = 64x \\
12.5 & = x
\end{align*}
\]

1B. 
\[
\begin{align*}
8 \text{ ft} & \quad 24 \text{ ft}^2 \\
A & = 13.5 \text{ ft}^2 \\
\frac{8}{6} & = \frac{36}{64} \\
64 & = 36x \\
2.4 & = x
\end{align*}
\]

For each pair of similar figures, use the given areas to find the scale factor of the blue to the green figure. Then find $x$.

2A. 
\[
\begin{align*}
x \text{ in.} & \quad \frac{5}{6} ; \frac{5}{6} \\
A & = 50 \text{ in}^2 \\
A & = 72 \text{ in}^2 \\
\frac{A}{50} & = \frac{25}{36} = \frac{5}{6} \\
\frac{x}{6} & = \frac{x}{6}
\end{align*}
\]

2B. 
\[
\begin{align*}
x \text{ mm} & \quad \frac{5}{2} \text{ or } 2.5 ; 16 \\
A & = 400 \text{ mm}^2 \\
A & = 64 \text{ mm}^2 \\
\frac{A}{100} & = \frac{100}{16} = \frac{5}{4} \\
\frac{10}{4} & = \frac{40}{x} \\
160 & = 10x \\
16 & = x
\end{align*}
\]
Homework:

p. 811 #9-17 odd
p. 821 #9-17 odd

In each figure, a regular polygon is inscribed in a circle. Identify the center, a radius, an apothem, and a central angle of each polygon. Then find the measure of a central angle.

8. center: point $X$, radius: $XY$, apothem: $XY$, central angle: $\angle VXT$, 72
9. center: point $R$, radius: $\overline{RL}$, apothem: $\overline{RS}$, central angle: $\angle KRL$, 60

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

10. 12 mm $62.4 \text{ mm}^2$
11. 5 cm $59.4 \text{ cm}^2$
12. 4 ft $55.4 \text{ ft}^2$
13. 11 in. $584.2 \text{ in}^2$
Find the area of each figure. Round to the nearest tenth if necessary.

16. \(2.5 \text{ ft} \times 1 \text{ ft} = 6 \text{ ft}^2\)

17. \(6 \text{ in.} \times 6 \text{ in.} = 36 \text{ in.}^2\)

18. \(3.5 \text{ mm} \times 5.5 \text{ mm} = 19.25 \text{ mm}^2\)

19. \(14 \text{ yd} \times 14 \text{ yd} = 196 \text{ yd}^2\)

20. \(13 \text{ m} \times 9 \text{ m} = 117 \text{ m}^2\)

Find the area of each shaded region formed by each circle and regular polygon. Round to the nearest tenth.

22. \(76.4 \text{ cm}^2\)

23. \(1.9 \text{ in.}^2\)

24. \(2.5 \text{ ft}^2\)

For each pair of similar figures, find the area of the green figure.

6. \(A = 25 \text{ mm}^2\)

7. \(A = 60 \text{ ft}^2\)

8. \(A = 500 \text{ in.}^2\)

9. \(A = 1050 \text{ cm}^2\)

10. \(A = \frac{12}{5} \text{ m}^2\)

11. \(A = \frac{4}{5} \times 17.5 \text{ in.}^2\)

12. \(A = \frac{3}{7} \times 6 \text{ ft}^2\)

13. \(A = \frac{3}{2} \times 36 \text{ cm}^2\)

For each pair of similar figures, use the given areas to find the scale factor of the blue to the green figure. Then find \(x\).

6. \(\frac{10}{5} = \frac{x}{10}\)

11. \(\frac{14}{x} = \frac{1}{x}\)

12. \(\frac{x}{14} = \frac{27}{147}\)

13. \(\frac{A}{24} = \frac{846}{378}\)
14. **CRAFTS**  Marina crafts unique trivets and other kitchenware. Each trivet is an equilateral triangle. The perimeter of the small trivet is 9 inches, and the perimeter of the large trivet is 12 inches. If the area of the small trivet is about 3.9 square inches, what is the approximate area of the large trivet? \( \text{6.9 in}^2 \)

15. **BAKING**  Kaitlyn wants to use one of two regular hexagonal cake pans for a recipe she is making. The side length of the larger pan is 4.5 inches, and the area of the base of the smaller pan is 4.6 square inches.

   a. What is the side length of the smaller pan? \( 4 \text{ in} \).
   
   b. The recipe that Kaitlyn is using calls for a circular cake pan with an 8-inch diameter. Which pan should she choose? Explain your reasoning.

15b. Larger, sample answer: The area of a circular pie pan with an 8 in. diameter is about 50 in\(^2\). The area of the larger pan is 52.6 in\(^2\), and the area of the smaller pan is 41.6 in\(^2\). The area of the larger pan is closer to the area of the circle, so Kaitlyn should choose the larger pan to make the recipe.

16. **CHANGING DIMENSIONS**  A polygon has an area of 144 square meters.

   a. If the area is doubled, how does each side length change?
   
   b. How does each side length change if the area is tripled?
   
   c. What is the change in each side length if the area is increased by a factor

17. **CHANGING DIMENSIONS**  A circle has a radius of 24 inches.

   a. If the area is doubled, how does the radius change?
   
   b. How does the radius change if the area is tripled?
   
   c. What is the change in the radius if the area is increased by a factor of \( x \)?

16a. If the area is doubled, each side length will increase by a factor of \( \sqrt{2} \).

16b. If the area is tripled, each side length will increase by a factor of \( \sqrt{3} \).

16c. If the area changes by a factor of \( x \), then each side length will change by a factor of \( \sqrt{x} \).

17a. If the area is doubled, the radius changes from 24 in. to 33.9 in.

17b. If the area is tripled, the radius changes from 24 in. to 41.6 in.

17c. If the area changes by a factor of \( x \), then the radius changes from 24 in. to \( 24\sqrt{x} \) in.