Chapter 13

A

Area of Triangles,

Quadrilateral,

and Similar Figures

Geometry PAP

Name _______________________

Period _______________

Teacher ____________

Timmy's Advanced Geometry class did come in handy at times.
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Heron’s Formula Practice

Find the area of each triangle, leave answer as a simplified radical. \( a, b, c \) represent side lengths.

\[
s = \frac{1}{2} (a + b + c) \quad \quad A = \sqrt{s(s-a)(s-b)(s-c)}
\]

1) \( \begin{array}{ccc}
5 & 7 & 4 \\
\end{array} \) 

2) \( \begin{array}{ccc}
10 & 5 & \\
\end{array} \) 

3) \( \begin{array}{ccc}
9 & 4 & 11 \\
\end{array} \)

4) \( \begin{array}{ccc}
7 & 11 & 6 \\
\end{array} \)

5) \( \begin{array}{ccc}
10 & 8 & 14 \\
\end{array} \)

6) \( \begin{array}{ccc}
6 & 5 & \\
\end{array} \)

7) \( \begin{array}{ccc}
12 & 7 & 9 \\
\end{array} \)

8) \( \begin{array}{ccc}
8 & 4 & 8 \\
\end{array} \)

9) \( \begin{array}{ccc}
7 & 9 & 10 \\
\end{array} \)

10) \( \begin{array}{ccc}
6 & 7 & 5 \\
\end{array} \)

11) \( \begin{array}{ccc}
9 & 14 & 7 \\
\end{array} \)

12) \( \begin{array}{ccc}
5 & 8 & 7 \\
\end{array} \)

13) \( \begin{array}{ccc}
16 & 8 & 10 \\
\end{array} \)

14) \( \begin{array}{ccc}
6 & 9 & 7 \\
\end{array} \)

15) \( \begin{array}{ccc}
8 & 9 & 7 \\
\end{array} \)
13-1 Practice for Area of Triangles, Rectangles, Parallelograms

Find the area of the polygon.

1)*

\[
\begin{array}{cc}
\text{2 2}\frac{2}{3} \text{ m.} \\
\frac{5}{6} \text{ m.}
\end{array}
\]

2)

\[
\begin{array}{cc}
12 \\
24
\end{array}
\]

3)

\[
\begin{array}{cc}
8 \\
13
\end{array}
\]

Find the value of \(x\).

4)

\[
\text{Area} = 70 \text{ cm}^2
\]

5)

\[
\text{Area} = 104 \text{ m}^2
\]

6)

\[
\text{Area} = 576 \text{ in.}^2
\]

The lengths of the hypotenuse and one leg of a right triangle are given. Find the perimeter and area of the triangle.

7) Hypotenuse: 17 ft; leg: 8 ft

8) Hypotenuse: 53 in.; leg: 45 in.

Find the area of the quadrilateral.

9)

10)

11)

Find the area of the shaded polygon.

12)

13)

14)

15) The area of a triangle is 225 square units. The base of the triangle is twice the height. Find the base and height.

16) The area of a parallelogram is 216 square centimeters. The height of the parallelogram is two thirds its base. Find the base and height.

17) The area of a square is 256 square units. Find the side length and perimeter of the square.

18) The area of a rectangle is 84 square inches. The length of the rectangle is 2 inches longer than twice the width. Find the width and the perimeter of the rectangle.

19) In \(\square ABCD\), base \(\overline{AD}\) is 25 units and \(\overline{AB}\) is 12 units. Find the height and area of \(\square ABCD\) if \(m\angle A = 30^\circ\).

20) In \(\square EFGH\), base \(\overline{EH}\) is 15 units and \(\overline{EF}\) is \(6\sqrt{2}\) units. Find the height and area of \(\square EFGH\) if \(m\angle E = 45^\circ\).
Extra Problems with SRT and Trig for 13-1

1) \[ \text{12 in.} \]
   - \[ 63^\circ \]
   - \[ 26^\circ \]

2) \[ 13 \text{ in.} \]
   - \[ 7 \text{ in.} \]
   - \[ 75^\circ \]

3) \[ 3 \sqrt{15} \text{ in.} \]
   - \[ 30^\circ \]

4) \[ 8 \text{ in.} \]
   - \[ 45^\circ \]
   - \[ 30^\circ \]

5) \[ 6 \text{ in.} \]
   - \[ 3 \sqrt{6} \text{ in.} \]
   - \[ 30^\circ \]

6) \[ 16 \text{ in.} \]
   - \[ 52^\circ \]

7) \[ 8 \text{ cm} \]
   - \[ 30^\circ \]
   - \[ 30^\circ \]

8) \[ 8 \text{ cm} \]
   - \[ 6 \text{ cm} \]
   - \[ 12 \text{ cm} \]

9) \[ 3 \text{ in.} \]
   - \[ 36^\circ \]
   - \[ 23^\circ \]
   - \[ 6 \text{ in.} \]

---

1) 184.3077  
2) 87.0237  
3) \( \frac{135 \sqrt{3}}{4} \)  
4) \( 16 + \frac{16 \sqrt{3}}{3} \) or \( \frac{48 + 16 \sqrt{3}}{3} \)  
5) \( 27 \sqrt{2} + \frac{27 \sqrt{3}}{2} \)  
6) 124.1979  
7) 72\sqrt{3}  
8) \( 8 \sqrt{5} + 32 \sqrt{2} + 36 \sqrt{3} \)  
9) 50.7297
### 13-2 Area of Rhombus, Trapezoids, and Kites

Find the area of the trapezoid.

1) ![Trapezoid 1](image1)

2) ![Trapezoid 2](image2)

3) ![Trapezoid 3](image3)

Find the area of the rhombus or kite.

4) ![Rhombus 1](image4)

5) ![Rhombus 2](image5)

6) ![Kite 1](image6)

Use the given information to find the value of \( x \).

7) \( \text{Area} = 80 \text{ m}^2 \)

8) \( \text{Area} = 5.5 \text{ mi}^2 \)

9) \( \text{Area} = 288.96 \text{ ft}^2 \)

Find the area of the figure.

10) ![Figure 1](image10)

11) ![Figure 2](image11)

12) ![Figure 3](image12)

Find the lengths of the bases of the trapezoid described.

13) The height is 5 meters. One base is three times as long as the other base. The area is 70 square meters.

14) The height is 10 feet. One base is 4 feet longer than the other base. The area is 120 square feet.

Find the area of the shaded region.

15) ![Shaded Region 1](image15)

16) ![Shaded Region 2](image16)

17) ![Shaded Region 3](image17)
21) Making a Kite: You are making a kite. The frame is to be made from two pieces of balsa wood, one measuring 60 inches and the other 36 inches. If you buy 1 square yard of material, will you have enough to piece together the covering for the kite? Explain and show work.

22) Garage Roof: The garage roof shown is made from two isosceles trapezoids and two isosceles triangles. Find the area of the entire roof.
Find Area of the following problems. If the problem has a *, then the answer should be exact. All other problems, answers should be rounded to the nearest thousandths.

1) 

2) 

3)* 

4)* 

5) 

6)* 

7) 

8) 

9)*
Draw a diagram if needed. All answers must be exact unless otherwise told in the problem. Show work or no credit.

1) A walk 2m. wide surrounds a rectangular grass plot 30m. long and 10 m. wide. Find the area of the walk.

2) The longer diagonal of a rhombus is 3 times as long as the shorter diagonal. Find the length of the shorter diagonal if the area is 24 in².

3) A triangular shaped boat sail is 16 feet high. Find the length of the base if the area is 640 ft².

4) Find the area of the shaded region.

5) Find the area of \( \triangle ADB \)

6) Find the area of the trapezoid whose coordinates are \((-2,0);(0,4);(5,4);(7,0)\).

7) Find the area of the rhombus whose coordinates are \((-2,-1);(3,2);(-2,5);(-7,2)\).

8) Find the area of the trapezoid to the right.

9) Find the area of the rhombus to the right.
10) A rhombus has sides of length 10 m and one diagonal of length 16 m. Find its area.

11) A service station operator bought the parallelogram shaped lot A and the adjoining lot B for $6 per square foot. What was the total cost?

12) A triangle and a parallelogram each have an area of 64 and a height of 4. How do their bases compare?

Find the area of each figure.

13) 14) 15)

Find the area of each trapezoid. Don’t forget Special Right Triangles.

16) 17)
18) $\overline{AB}$, $\overline{DC}$, and $\overline{EF}$ are parallel.

Find the area of hexagon $ABCFED$.

19) Find the area of rhombus $QRST$ if $m \angle QSR = 50^\circ$ and the length of the shorter diagonal is 6.

(Hint for #20-22, Remember the base does not have to be the part that is horizontal)

20) Find $\overline{AB}$.

21) Find $\overline{AB}$.

22) Find $\overline{AB}$.

For problems 23-26, make sure to know how to do these problems.

23) The area of a rectangle is given by the equation $6\ell^2 + 2\ell = 48$, in which $\ell$ is the rectangle’s length. What is the length of the rectangle?

24) The area of a rectangle is $2m^2 + 7m + 5$, and the width is $m + 1$. What would the length of the rectangle be?

25) The area of a rectangle is $14k^2 + 29k + 12$, and the width is $2k + 3$. What would the length of the rectangle be?

26) The area of a rectangle is $12c^2 - 7c - 10$, and the width is $3c + 2$. What would the length of the rectangle be?
13-4 Similar Figures

The polygons are similar. Find the ratio (shaded to unshaded) of the perimeters and of the areas. Find the unknown area.

1) The ratio of the areas of two similar figures is given. Write the ratio of the lengths of corresponding sides.
   5) Ratio of areas = 169:144
   6) Ratio of areas = 112:196
   7) Ratio of areas = 125:108

Use the given area to find XY.

8) $ABCD \sim WXYZ$

9) $EFGHKJ \sim UVWXYZ$

Find the ratio (shaded to unshaded) of the areas.

10)
12) \( \triangle ABC \) and \( \triangle DEF \) are similar. The height of \( \triangle ABC \) is 30 inches. The base of \( \triangle DEF \) is 8 inches and the area is 40 square inches. Find the area of \( \triangle ABC \).

13) The dimensions of a rectangle are 8 centimeters by 12 centimeters. What are the dimensions of a similar rectangle with exactly double the area?

14) Rhombus \( RSTU \) and rhombus \( VWXY \) are similar. The area of \( RSTU \) is 384 square feet. The diagonals of \( VWXY \) are 24 feet long and 18 feet long. Find the area of \( VWXY \). Then use the ratio of the areas to find the lengths of the diagonals of \( RSTU \). Find the length of a side of \( RSTU \).

15) Regular hexagon \( ABCDEF \) has a side length of 8 millimeters and an area of \( 96\sqrt{3} \) square millimeters. Regular hexagon \( JKLMNO \) has a perimeter of 72 millimeters. Find its area.

Use the information about a pair of similar polygons to find all possible values of \( x \).

16) The area of \( \triangle ABC \) is 5. The perimeter of \( \triangle ABC \) is 2. The area of \( \triangle DEF \) is \( x^2 + 9 \). The perimeter of \( \triangle DEF \) is \( x \).

17) The area of \( HIJK \) is \( x + 4 \). The perimeter of \( HIJK \) is \( \frac{x}{2} \). The area of \( STUV \) is 5. The perimeter of \( STUV \) is \( \sqrt{x} \).

The polygons are similar. Find the values of \( x \) and \( y \) (if applicable).

18) [Diagram]

19) [Diagram]

20) [Diagram]

21) [Diagram]

22) [Diagram]

23) [Diagram]

24) [Diagram]

25) [Diagram]
Review Chapter 13.1-13.2.13-4 PAP

Find the shaded area of each figure:

1. \[ \text{Area} = \frac{1}{2} \times 12 \times 8 + \frac{1}{2} \times 6 \times 8 \]
   \[ \text{Area} = 48 + 24 = 72 \text{ m}^2 \]

2. \[ \text{Area} = \frac{1}{2} \times (8 + 12) \times 9 + \frac{1}{2} \times 6 \times 12 \]
   \[ \text{Area} = 63 + 36 = 99 \text{ cm}^2 \]

3. \[ \text{Area} = \frac{1}{2} \times 30 \times 15 + \frac{1}{2} \times 5 \times (9 + 9 + 9) \]
   \[ \text{Area} = 225 + 67.5 = 292.5 \text{ in}^2 \]

4. \[ \text{Area} = \frac{1}{2} \times 16 \times 11 + \frac{1}{2} \times 5 \times 16 \]
   \[ \text{Area} = 88 + 40 = 128 \text{ ft}^2 \]

5. \[ \text{Area} = \frac{1}{2} \times 4 \times 24 + \frac{1}{2} \times 35 \times 35 \]
   \[ \text{Area} = 48 + 612.5 = 660.5 \text{ cm}^2 \]

6. \[ \text{Area} = \frac{1}{2} \times (18 + 10) \times 9 \]
   \[ \text{Area} = 99 \text{ cm}^2 \]

7. \[ \text{Area} = \frac{1}{2} \times (16 + 16) \times 40 \]
   \[ \text{Area} = 320 \text{ cm}^2 \]

8. \[ \text{Area} = \frac{1}{2} \times 12 \times 10 \]
   \[ \text{Area} = 60 \text{ mm}^2 \]

9. \[ \text{Area} = \frac{1}{2} \times (4 + 5) \times 10 \]
   \[ \text{Area} = 35 \text{ in}^2 \]

10. \[ \text{Area} = \frac{1}{2} \times 9.6 \times 7.25 \]
    \[ \text{Area} = 35.1 \text{ in}^2 \]

11. \[ \text{Area} = \frac{1}{2} \times 8 \times \sin(43°) \times 12 \]
    \[ \text{Area} = 64 \text{ m}^2 \]

12. \[ \text{Area} = \frac{1}{2} \times 8 \times \sqrt{3} \times 8 \]
    \[ \text{Area} = 32 \sqrt{3} \approx 55.4 \text{ ft}^2 \]

13. \[ \text{Area} = \frac{1}{2} \times 6 \times 6 \]
    \[ \text{Area} = 18 \text{ in}^2 \]

14. \[ \text{Area} = \frac{1}{2} \times (8 + 8) \times 9 \]
    \[ \text{Area} = 36 \text{ m}^2 \]

15. \[ \text{Area} = \frac{1}{2} \times (6 + 6) \times 3.1 + \frac{1}{2} \times 5.2 \times 12.3 \]
    \[ \text{Area} = 18.6 + 32.8 = 51.4 \text{ m}^2 \]

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16. A trapezoid has an area of 126 in\(^2\), one base is 15 in, and the height is 9 in. Find the length of the missing base.

17. The area of a trapezoid is 39 square meters. The trapezoid has two bases that measure 8 meters and 18 meters. What is the height in meters of the trapezoid?

18. A 4.5 by 6 m kitchen floor will be covered with square vinyl tiles that are 30 cm on a side. How many tiles will be needed?

19. The area of a rectangle is \(2m^2 + 7m + 5\), and the width is \(m + 1\). What would the length of the rectangle be?

20. John needs to paint a accent was in his living room. The wall is 22 feet long by 12 feet high. If each gallon of paint cover 60 square ft, how many gallons of paint will he need to do 2 coats on the wall.

21. Mr. Fixit wants to tile his dining room floor. The room has dimensions of 16 feet by 12 feet. If he is using square tiles that sides measure 2 foot. How many tiles will be needed for the room?

22. The width of a rectangle is 15 inches and the area is 120 inches squared. What is the length of the diagonal of the rectangle?

23. Find the height of the following isosceles trapezoid if the perimeter is 48 inches.

24. Find the area (in square units) of a rhombus with vertices of \(A(1,4), B(6,-1), C(1,-6),\) and \(D(-4,-1)\).

25. The base of a parallelogram is 3 times its height. The area of the parallelogram is 108 square inches. Find the base and the height.

26. A right triangle has a hypotenuse of 17 cm and a height of 8 cm. What is perimeter and area?

27. Two similar triangles have bases of 8 cm and 13 cm. The smaller triangle has an area of 19 \(cm^2\). What is the area of the second triangle? Round answer to hundredths if necessary?

28. Find the length of \(JK\).

29. Find the area of the shaded figure.