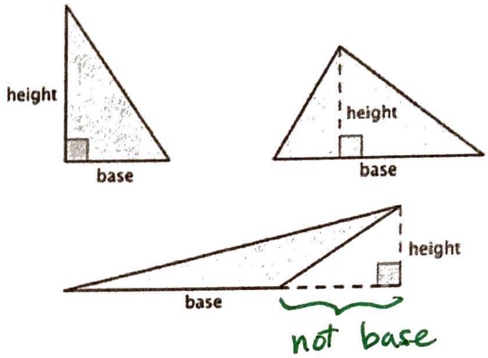
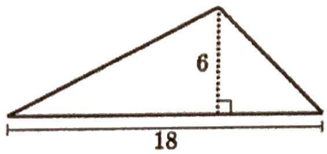
8.1 Notes: Area of Triangles and Circles

Objectives:
- **Students will be able to find the area of a triangle.**
- **Students will be able to find the area of a circle.**

Height of a Triangle	**The height of a triangle forms a** right angle **with one side of the triangle. The height may not be an actual side of a triangle.**	
Base of a Triangle	**The base of a triangle is a** Side **of the triangle that is** ***perpendicular to the height.*** $\underbrace{\text{perpendicular}}_{\text{forms a right angle}}$	
Area of a Triangle	$A = \frac{1}{2}bh$	A : Area b : base h : height also $A = \frac{bh}{2}$

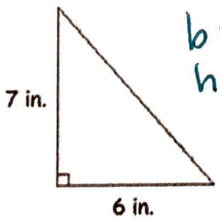
For #1-3: Find the area of each triangle.

1)



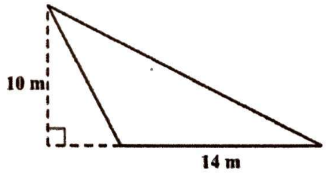
b=18
h=6
$= \frac{1}{2}(18)(6)$
$= \frac{1}{2}(108)$
$= \boxed{54}$

2)



b = 6 in.
h = 7 in.
$\frac{1}{2}(6\text{in})(7\text{in})$
$\boxed{21 \text{ in}^2}$

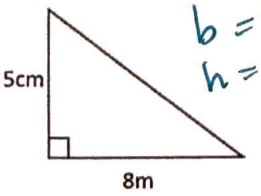
3)



b = 14 m
h = 10 m
$\frac{1}{2}(14)(10)$
$\boxed{70 \text{ m}^2}$

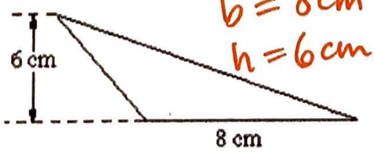
You try #4 – 6! Find the area of each triangle.

4)



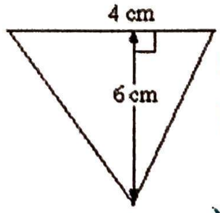
b = 8m
h = 5cm

5)



b = 8cm
h = 6cm
$\frac{1}{2}(8)(6)$
$\boxed{24 \text{ cm}^2}$

6)

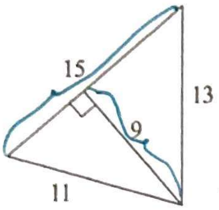


b = 4cm
h = 6cm
$\frac{1}{2}(4\text{cm})(6\text{cm})$
$\boxed{12 \text{ cm}^2}$

When it is more difficult to identify the base and height of a triangle: consider using the Pythagorean Theorem, a triple, or a special right triangle to find the missing side you need.

For #7 – 10: Find the area of each triangle. If needed, simplify radical answers.

7)

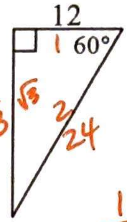


$b=15$
$h=9$

$\frac{1}{2}(15)(9)$

$\frac{135}{2} = \boxed{67.5}$

8)

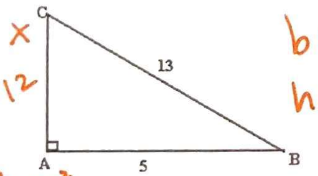


$b=12$
$h=12\sqrt{3}$

$= \frac{1}{2}(12)(12\sqrt{3})$

$= \frac{1}{2}(144\sqrt{3}) = \boxed{72\sqrt{3}}$

9)

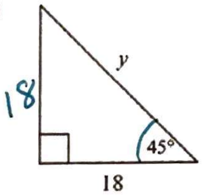


$b=5$
$h=12$

$5^2+x^2=13^2$
$25+x^2=169$
$-25 \quad -25$
$\sqrt{x^2}=\sqrt{144}$
$x=12$

$\frac{1}{2}(5)(12)=\boxed{30}$

10)

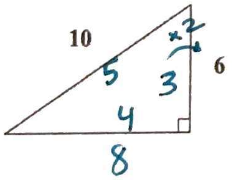


$b=18$
$h=18$

$\frac{1}{2}(18)(18) = \boxed{162}$

You try #11 – 13! Find the area of each triangle. If needed, simplify radical answers.

11)

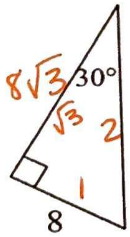


$b=8$
$h=6$

$\frac{1}{2}(8)(6)$

$\boxed{24}$

12)

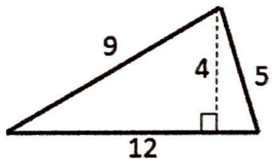


$b=8$
$h=8\sqrt{3}$

$A=\frac{1}{2}(8)(8\sqrt{3})$

$\boxed{32\sqrt{3}}$

13)



$b=12$
$h=4$

$\frac{1}{2}(12)(4)=\boxed{24}$

14) A triangle has an area of $40\ in^2$. If the height of the triangle is $10\ in$, what is the length of the base of the triangle?

A) $4\ in$

B) $30\ in$

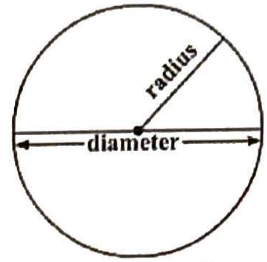
C) $2\ in$

D) $8\ in$

$\frac{1}{2}bh = 40\ in^2$
$\uparrow$
$10in$

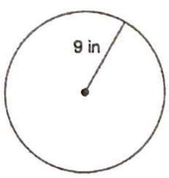
$\frac{1}{2}b(10) = 40$

$\frac{5b}{5}=\frac{40}{5}$ $\boxed{b=8}$

Radius of a Circle	**The radius of a circle connects the** Center **of the circle and a point on the circle.**	
Diameter of a Circle	**The diameter of a circle is a segment passing through the** Center **of the circle with endpoints on the circle.**	radius is half of diameter $d=2r$ $r=\frac{d}{2}$
Area of a Circle	$A = \pi r^2$	r = radius π = pi $\pi \approx 3.14...$

For #15 – 17: Find the area of each circle in the requested form.

15) In terms of π.

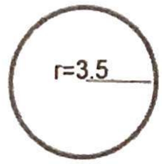


$r=9$

$A=\pi(9)^2$

$A=\boxed{81\pi}$

16) Round to one decimal.



$r=3.5$

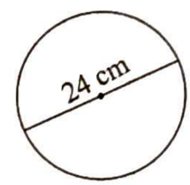
$\pi \approx 3.14$

put in calculator as π

$A=\pi(3.5)^2 = 38.4845$

$\boxed{A = 38.5}$

17) In terms of π.



$d=24$ cm

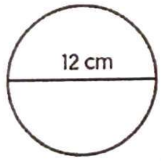
$r=12$ cm

$A=\pi(12)^2$

$A=\boxed{144\pi}$

You try #18 – 19! Find the area of each circle in the requested form.

18) Round to one decimal.



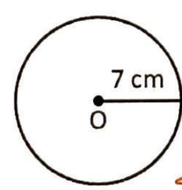
$d=12$ cm

$r=6$ cm

$A=\pi(6)^2$

$=36\pi=\boxed{113.1}$

19) In terms of π.



$r=7$ cm

$A=\pi(7)^2$

$\boxed{A=49\pi}$

20) A circle has area of $36\pi\ cm^2$. Find the length of the radius. Also, what is the length of the diameter?

$\frac{36\cancel{\pi}\ cm^2}{\cancel{\pi}} = \frac{\cancel{\pi} r^2}{\cancel{\pi}}$

$\sqrt{36\ cm^2} = \sqrt{r^2}$

$\boxed{r = 6 cm}$

$d = 6 cm \times 2$

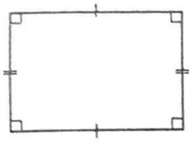
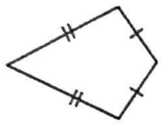
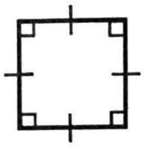
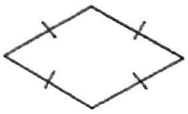
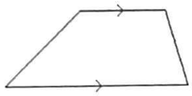
$\boxed{d = 12 cm}$

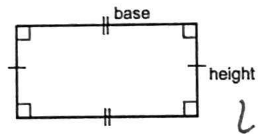
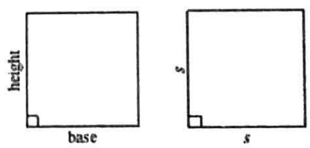
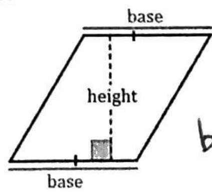
8.2 Notes: Area of Quadrilaterals

Objectives:

- **Students will be able to identify quadrilaterals by their names.**
- **Students will be able to find the area of common quadrilaterals.**

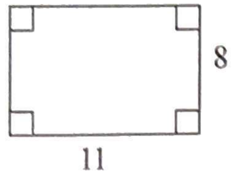
Do you know the names of quadrilaterals (4-sided figures)? Write the name, in the box, of each shape. Choose from: square, rectangle, parallelogram, rhombus, kite, and trapezoid.

	rectangle		kite
	parallelogram		square
	rhombus		trapezoid

Area of a Rectangle	$A = bh$ or $A = lw$ Note: opposite sides are congruent.	 b: base h: height l: length w: width
Area of a Square	$A = bh$ or $A = s^2$ Note: all sides are congruent.	 b: base h: height s: side
Area of a Parallelogram	$A = bh$ Note: opposite sides are congruent.	 b: base h: height bases are the same length

For #1–3: Find the area of each quadrilateral. Identify the name of each shape, as well.

1)



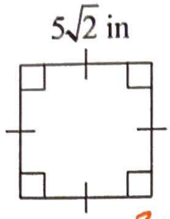
$b=11$
$h=8$

Rectangle

$A=(8)(11)$

$A=\boxed{88}$

2)



Square

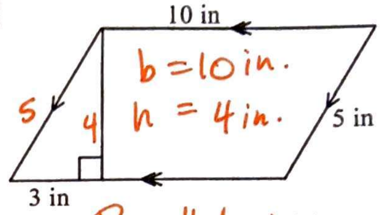
$s=5\sqrt{2}$

$A=(5\sqrt{2})^2$

$(5\sqrt{2})(5\sqrt{2})$

$25\cdot 2=\boxed{50\text{ in}^2}$

3)



$b=10$ in.
$h=4$ in.
5
4

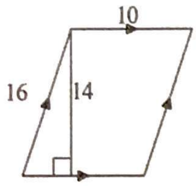
Parallelogram

$A=(10)(4)$

$=\boxed{40\text{ in}^2}$

You try #4–6! Find the area of each quadrilateral. Identify the name of each shape, as well.

4)



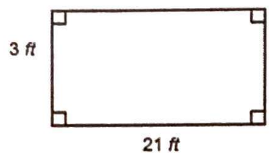
$b=10$
$h=14$

Parallelogram

$A=(10)(14)$

$=\boxed{140}$

5)



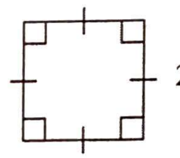
$b=21$ ft.
$h=3$ ft.

Rectangle

$A=(21)(3)$

$=\boxed{63\text{ ft}^2}$

6)



$s=2\sqrt{3}$ cm

Square

$A=(2\sqrt{3})^2$

$=(2\sqrt{3})(2\sqrt{3})$

$=4\cdot 3=\boxed{12\text{ cm}^2}$

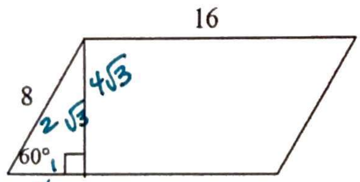
7) The area of a square is 50 ft^2. Find the length of one side, rounded to one decimal place.

$\sqrt{s^2}=\sqrt{50\text{ ft}^2}$

$s=\sqrt{50}$

$\boxed{s=7.1}$

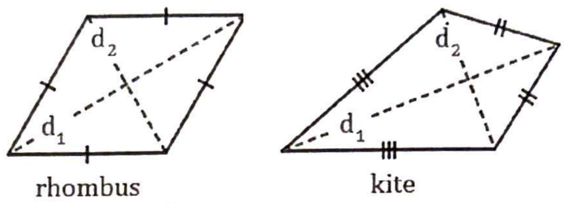
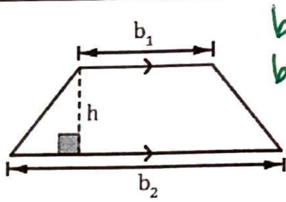
Challenge! 8) Find the area of the parallelogram shown. Simplify radical answers.



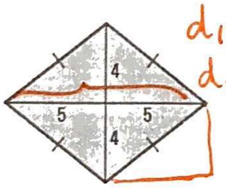
$4\sqrt{3}$
$2\sqrt{3}$
4

$b=16$
$h=4\sqrt{3}$

$A=(16)(4\sqrt{3})=\boxed{64\sqrt{3}}$

Area of a Rhombus	$A = \frac{1}{2} d_1 \cdot d_2$	
Area of a Kite	$A = \frac{1}{2} d_1 \cdot d_2$	d_1 = diagonal 1 d_2 = diagonal 2 $\boxed{A = \frac{1}{2} d_1 d_2}$
Area of a Trapezoid	$A = \frac{1}{2} h(b_1 + b_2)$ Note: bases are the parallel sides	 b_1 = top base b_2 = bottom base h = height

For #9–11: Find the area of each quadrilateral. Identify the name of each shape, as well.

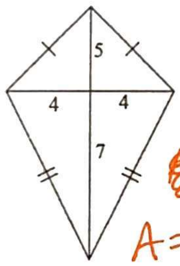
9) 

$d_1 = 10$
$d_2 = 8$

rhombus

$A = \frac{1}{2}(10)(8)$

$= \boxed{40}$

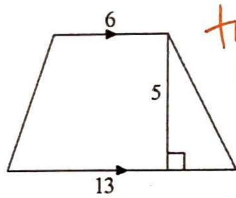
10) 

kite

$d_1 = 8$
$d_2 = 12$

$A = \frac{1}{2}(8)(12)$

$= \boxed{48}$

11) 

trapezoid

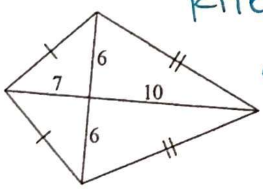
$b_1 = 6$
$b_2 = 13$
$h = 5$

$(b_1 + b_2) = 19$

$\frac{1}{2}(5)(19)$

$= \boxed{47.5}$

You try #12 – 14! Find the area of each quadrilateral. Identify the name of each shape, as well.

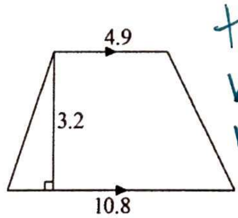
12) 

kite

$d_1 = 12$
$d_2 = 17$

$A = \frac{1}{2}(12)(17)$

$\boxed{102}$

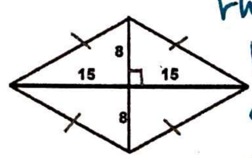
13) 

trapezoid

$b_1 = 4.9$
$b_2 = 10.8$
$h = 3.2$

$\frac{1}{2}(3.2)(4.9 + 10.8)$

$\boxed{25.12}$

14) 

rhombus

$d_1 = 16$
$d_2 = 30$

$A = \frac{1}{2}(16)(30)$

$\boxed{240}$

15) A rhombus has an area of $28\ ft^2$. If the measure of one diagonal is $16\ ft$, then what is the measure of the other diagonal?

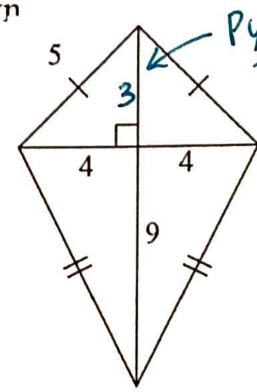
$A = \frac{1}{2}(d_1)(d_2)$ $d_1 = 16$ ft. $A = 28$ ft^2

$28 = \frac{1}{2}(16)(d_2)$

$\frac{28}{8} = \frac{8d_2}{8}$

$\boxed{d_2 = \frac{28}{8} = 3.5}$

16) **Challenge!** Find the area of the kite shown



Pythagorean triple

$d_1 = 8$

$d_2 = 12$

$A = \frac{1}{2}(8)(12)$

$\boxed{48}$

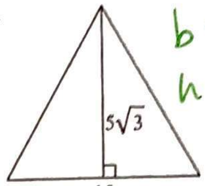
8.3 Notes: Area of Regular Polygons

Objectives:

- **Students will be able to name regular polygons by the sides.**
- **Students will be able to find the area of a regular polygon.**

Exploration: Consider the triangle shown.

A. Find the area of the triangle. $A = \frac{1}{2}bh$

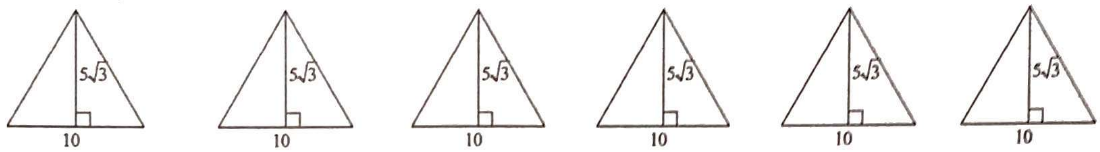


$b = 10$
$h = 5\sqrt{3}$

$A = \frac{1}{2}(10)(5\sqrt{3})$

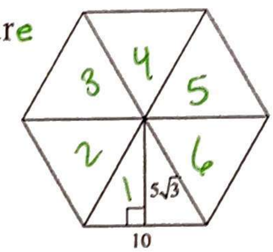
$= \boxed{25\sqrt{3}} \approx 43.3$

B. Imagine you had six of these exact same triangles. What would the combined area of all six triangles be?



$6(25\sqrt{3}) = 150\sqrt{3} \approx 259.8$

C. We could rearrange these triangles to form a hexagon (six-sided figure). What would the area of this hexagon be?

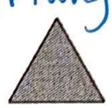
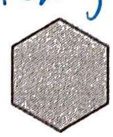
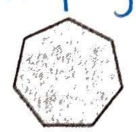


$6(25\sqrt{3}) = 150\sqrt{3}$ or 259.8

Polygon

A polygon is a flat **- sided** 2D **figure made of** straight **edges.**

Polygons are named by the number of sides.

3 sides	**4 sides**	**5 sides**
Triangle	Quadrilateral	Pentagon
		
6 sides	**7 sides**	**8 sides**
Hexagon	Heptagon	Octogon
		
9 sides	**10 sides**	**12 sides**
Nonagon	Decagon	Dodecagon
		

For #1-8: What is the name of a polygon with the number of specified sides? Try to do this without looking at the previous page.

1) 8 sides octogon

2) 5 sides pentagon

3) 9 sides nonagon

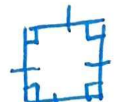
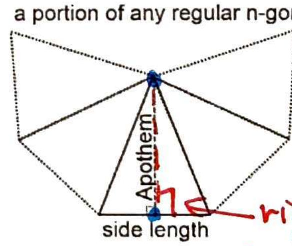
4) 4 sides quadrilateral

5) 10 sides decagon

6) 7 sides heptagon

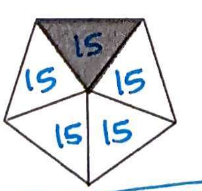
7) 3 sides triangle

8) 12 sides Dodecagon

Regular Polygon	**A regular polygon has all sides that are** equal**, and all angles that are** equal**.** In other words, a regular polygon is both equilateral and equiangular.	A quadrilateral is regular. What is a common name for this shape?  square A triangular shape is regular. What is a common name for this shape?  equilateral triangle
Area of a Regular Polygon	**To find the area of a regular polygon, there are 2 methods.** **Option 1:** Find the **area of one triangle** and multiply it by the number of Sides of the polygon. **Option 2:** Use the **formula:** $A = \frac{1}{2}aP$ Where, a is apothem P is Perimeter	$A = \frac{1}{2}aP$ a portion of any regular n-gon  apothem- distance from center of shape to the middle of one edge

For #9-11: Find the area of each regular polygon if the area of the shaded region is given.

9) 15 in^2

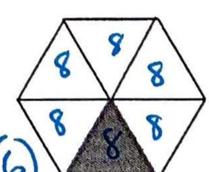


$15 \times 5 = \boxed{75\,in^2}$

10) 40 mm^2

$(40\,mm^2)(3) = \boxed{120\,mm^2}$

11) 8 cm^2

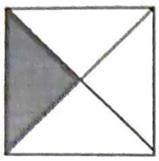


$(8\,cm^2)(6)$

$\boxed{48\,cm^2}$

You try #12 – 13! Find the area of each regular polygon if the area of the shaded region is given.

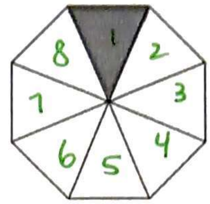
12) $120\ mm^2$



$4(120\ mm^2)$

$\boxed{480\ mm^2}$

13) $11\ ft^2$

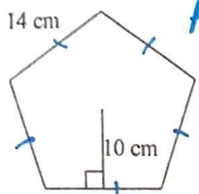


$(11\ ft^2)(8)$

$\boxed{88\ ft^2}$

For #14-16: Find the area of each regular polygon.

14)



$A = \frac{1}{2}aP$

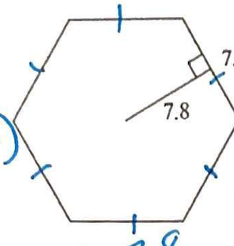
$\frac{1}{2}(10\text{ cm})(70\text{cm})$

$\boxed{350\text{ cm}^2}$

$a = 10\text{cm}$

$P = (14\text{cm})(5) = 70\text{cm}$

15)



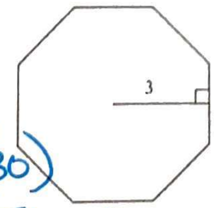
$A = \frac{1}{2}(7.8)(43.8)$

$A = \boxed{170.82}$

$a = 7.8$

$P = (7.3)(6) = 43.8$

16) The perimeter is 30 *in.*



$= \frac{1}{2}(3)(30)$

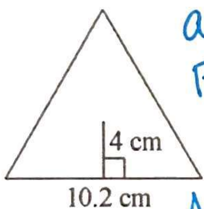
$= \boxed{45\text{ in}^2}$

$a = 3$

$P = 30\text{in}$

You try #17–18! Find the area of each regular polygon.

17)



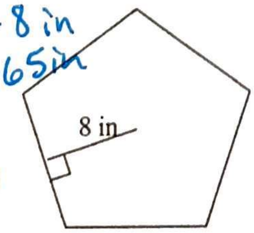
$a = 4\text{ cm}$

$P = (10.2\text{ cm})(3) = 30.6$

$A = \frac{1}{2}(4)(30.6)$

$= \boxed{61.2\text{ cm}^2}$

18) The perimeter is 65 *in.*



$a = 8\text{ in}$

$P = 65\text{in}$

$\frac{1}{2}(8)(65)$

$\boxed{260\text{ in}^2}$

19) A regular decagon has one side of 12 inches and the apothem is 9 inches. Find the area of the regular decagon.

10 sides

$a = 9\text{ in}$

$P = (12\text{in})(10) = 120\text{ in}$

$\frac{1}{2}(9)(120) = \boxed{540\text{ in}^2}$

20) **Challenge!** Find the area of the regular hexagon shown. *Hint: Use the special right triangle shown to find the length of one side of the hexagon.*

$a = 4\sqrt{3}$

$P = 8(6\text{ sides}) = 48$

$\frac{1}{2}(4\sqrt{3})(48) = 96\sqrt{3}$

≈ 166.28