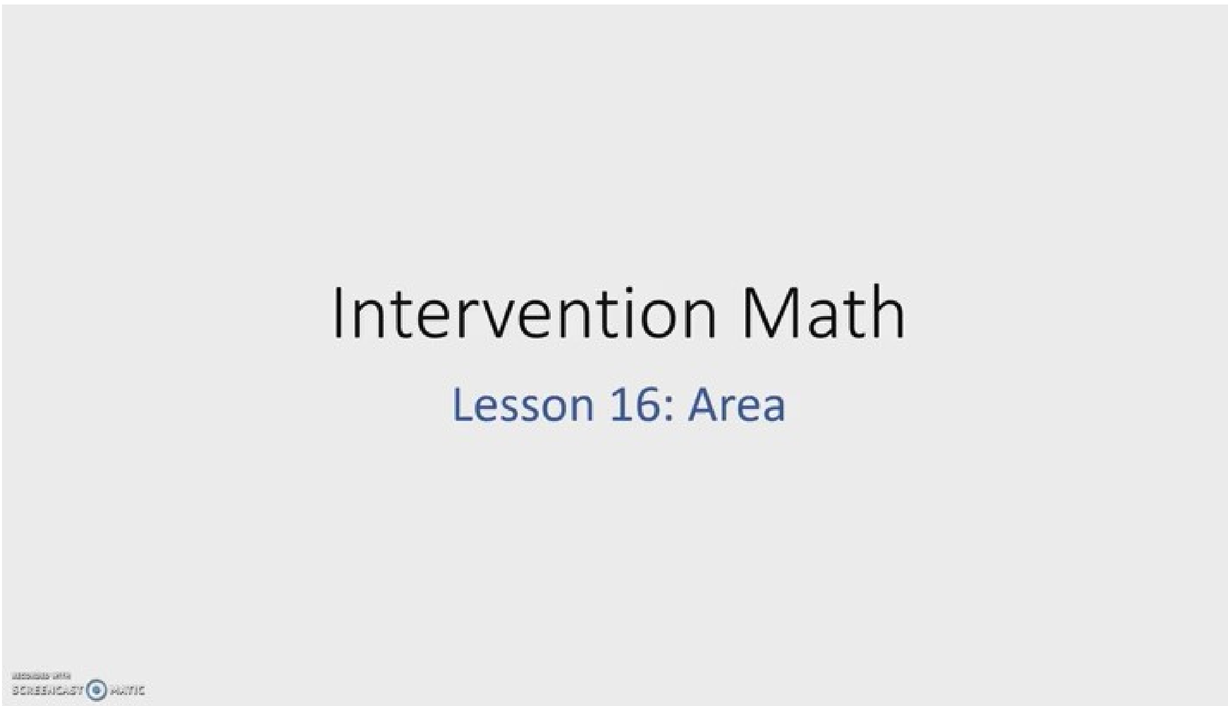
PDF

AREA

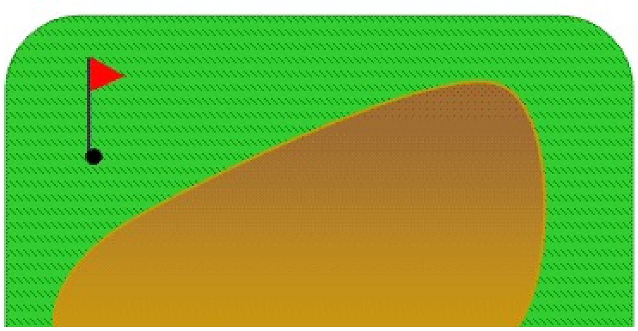
This unit is about calculating the area of many different two-dimensional shapes such as rectangles, squares, parallelograms, trapezoids, and circles. The topic of area is extended to include estimating area of irregular shapes, finding the area circle sectors, and calculating the area of composite shapes.



Estimating Area

Sometimes it is necessary to estimate the area of an object that has an irregular shape.

For example, the manager of a golf course must determine the area of one of the sand traps. The sand trap does not have a shape that has straight edges and square corners; therefore, it is necessary to *estimate* the area of the sand trap.



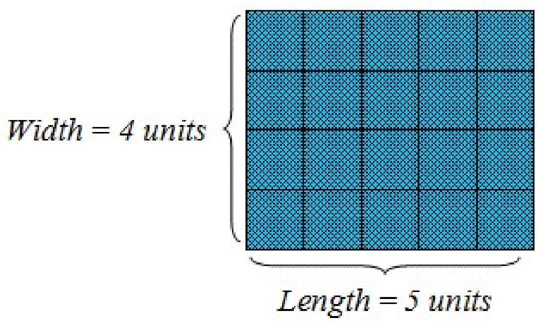
Area of a Rectangle and a Triangle

The **area of a rectangle** is the product of the length and the width.

Area is a measurement of coverage and is measured in **square units**.

$$A = lw$$

Example 1: Find the area of a rectangle that measures 5 units by 4 units.



$A = lw$

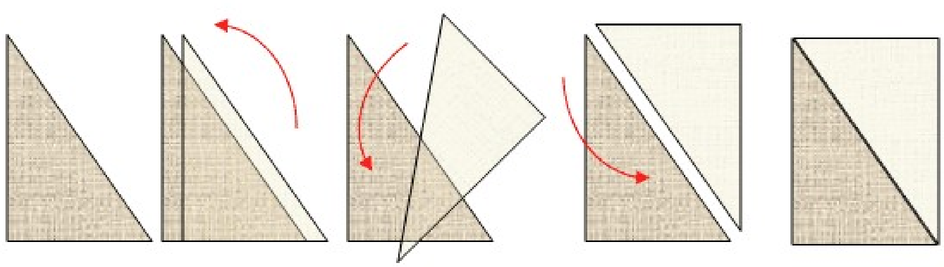
$A = 5 \times 4$

$A = 20$ square units

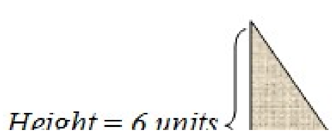
The area of the rectangle is 20 square units.

The **area of a triangle** is equal to half the area of a rectangle with the same base and height. Study the figure below and follow the arrows to see that the area is only half as much.

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



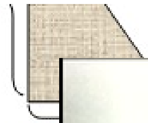
Example 2: Find the area of a triangle that measures 5 units by 6 units.



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

$A = \frac{1}{2} \times 5 \times 6$

Height = 6 units   2



30

Base   square units

The area of the triangl

Now *estimate* the area of the **irregular part** shaded in brown. Count both the whole squares (w) and th[redacted]partial square is shaded less than half, don't c[redacted]alf, count it as a whole.

- Whole Squares (w): 6 [redacted]et
- Partial Squares (p): 13 [redacted] feet

Add all the areas together to get an estimate of the area of the sand trap.

16 square feet ⟶ Square
6 square feet ⟶ Rectangle
6 square feet ⟶ Whole Squares

Practice Worksheet: Area of a Triangle
Answer Key (Password Protected)

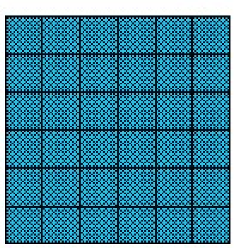
Area of a Square and a Parallelogram

Area is a measurement of coverage and is measured in **square units**.

The **area of a square** is the product of its length and width. Since squares have sides of equal length, the area of a square is the product of its length (side) and its width (side).

$$A = lw$$
$$A = s \times s$$
$$A = s^2$$

Example 1: Find the area of a square that is 6 units in length on each side.

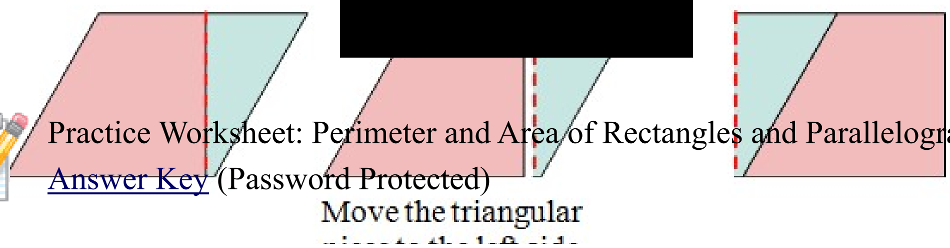


Side = 6 units

$$A = s^2$$
$$A = 6^2$$
$$A = 36 \text{ square units}$$

The area of the square is 36 square units.

The **area of a parallelogram** can be rearranged into the shape of a rectangle if the parallelogram is cut al[redacted]rom the top to its base. Thus, a formula for th[redacted]n be written based on the formula for the area o[redacted]

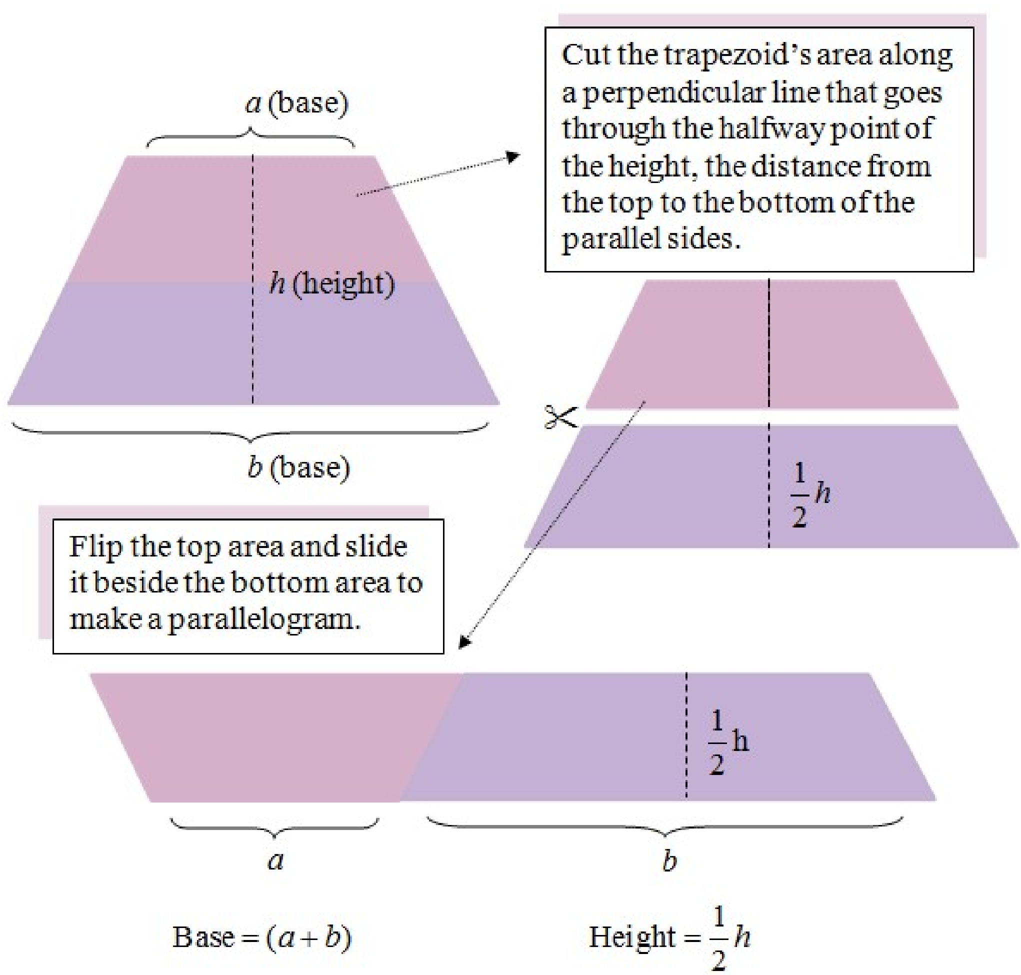


Practice Worksheet: Perimeter and Area of Rectangles and Parallelograms
Answer Key (Password Protected)

Area of a Trapezoid

Area is a measurement of coverage and is measured in **square units**.

The **area of a trapezoid** can be rearranged into the shape of a parallelogram. Let's take a look at how this can happen.



Practice Worksheet: Area of a Trapezoid
Answer Key (Password Protected)

ild the formula for the area of a trapezoid based on the formula for the a of a parallelogram.

Area of a Circle

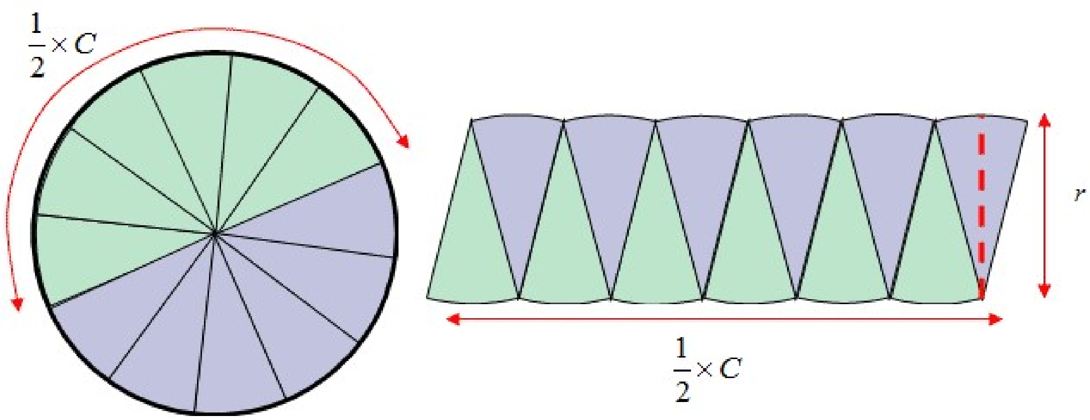
Area is a measurement of coverage and is measured in **square units**.

The area of a circle can be rearranged into a shape that approximates a parallelogram.

The length of the parallelogram is the same length as half the circle's circumference. The height of the parallelogram is the same as the radius of the circle.

Let's take a look at how this can happen.

The circle shown below is divided into 12 congruent pieces. The pieces are then laid out to make a shape that looks similar to a parallelogram.



Notice that the length of the "parallelogram" is half of the length of the circumference of the circle.

Notice that the height of the parallelogram is close to the radius of the circle.

For this theory to truly work, the circle would be divided into many, many, more pieces. When that is done, then the bottom of the parallelogram is close to a straight line and the height of the parallelogram is closer to a perpendicular line.

Now, we'll build the formula based on this theory.

Statement	Reason
$A = bh$	Formula for area of a parallelogram.

$A = (\frac{1}{2}C) \times r$ base $= \frac{1}{2}C$ height $= r$

$A = (\frac{1}{2} \times 2\pi r) \times r$

[redacted]

$A = 1 \times \pi r \times r$

$A = \pi r \times r$ number times 1 is the number.)

$A = \pi \times (r \times r)$ Associative Property (Regrouping is allowed in multiplication.)

Practice Worksheet: Area of a Circle
Answer Key (Password Protected)

Formula Chart for Area

The chart below is a list of many shapes and the corresponding formulas for calculating the area of the shapes.

Shape	Area
Triangle	$A = \frac{1}{2}bh$
Rectangle	$A = lw$
Square	$A = s^2$
Parallelogram	$A = bh$
Trapezoid	$A = \frac{1}{2}h(a+b)$
Circle	$A = \pi r^2$

$A = 314$ square feet

The area of the circle is 314 square feet.

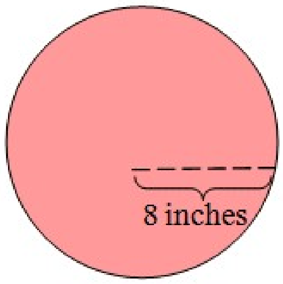
Practice Worksheet: Review of Perimeter and Area
Answer Key (Password Protected)
Practice Worksheet: Word Problems for Perimeter and Area
Answer Key (Password Protected)

Area of a Circle Sector

To find the area of a sector of a circle, first determine the **area of the whole circle,** and then find the **fractional part** that represents the circle.

Example: Find the area of three-fourths of a circle with a radius of eight inches.

First, find the area of the whole circle.



$$A = \pi \times r^2$$

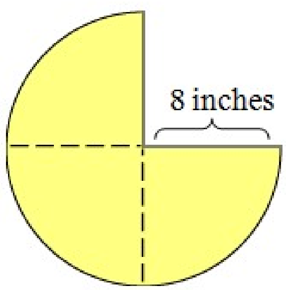
$$A = 3.14 \times 8^2$$

$$A = 3.14 \times 64$$

$$A = 200.96 \text{ sq in}$$

Then, find three-fourths of the total area.

Since the sector is 3/4 of the area of the entire circle, the area of the sector is:



$$\frac{3}{4} \text{ of } 200.96 = \frac{3}{4} \times \frac{200.96}{1}$$

$$= \frac{602.88}{4}$$

$$= 150.72 \text{ sq in}$$

The area of the circle sector that is three-fourths of the area of the whole circle is 150.72 square inches.

Area of a Composite Figure

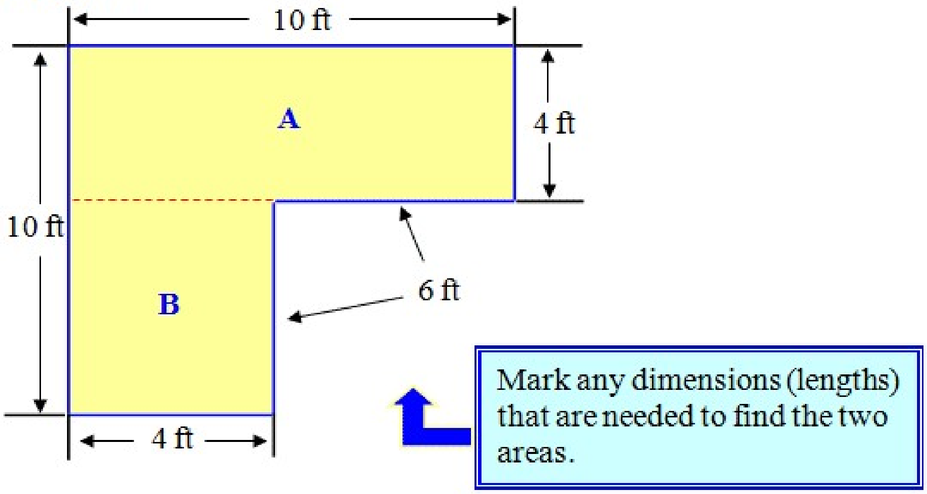
Composite figures are shapes that are made up of simpler distinct shapes.

Figure 1 is an illustration of two rectangles combined to make a composite figure.

To find the area of a composite figure, determine the simpler shapes that make up the figure. Draw lines to divide the larger figure into the smaller shapes.

The red dotted line clearly differentiates between Rectangle A and Rectangle B.

***Figure 1*:**



Example 1: What is area of Figure 1?

First, find the area of **Rectangle A**.

- $A = L \times W$
- $A = 10 \times 4 = 40$ square feet

Next, find the area of **Rectangle B**.

- $A = L \times W$
- $A = 4 \times 6 = 24$ square feet

Finally, add the two areas.

40	Rectangle A
+24	Rectangle B
64 ft^2	Composite Area

*Note: The abbreviation for square feet is ft^2.

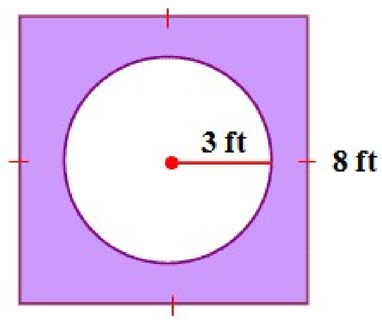
The composite area of Figure 1 is 64 square feet.

What if the shape has a "hole" in it? In this type of problem, it is necessary to **subtract** to find the area of the

shape.

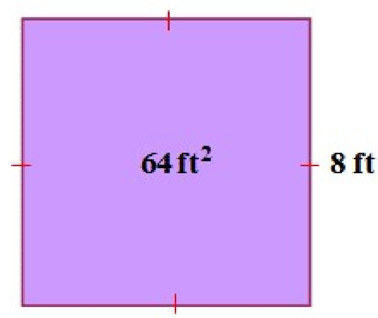
Example 2: Find the area for the region shaded outside of the circle, but within the square (purple area).

In other words, find the area of the square, but subtract away the area of the circle, the "hole".



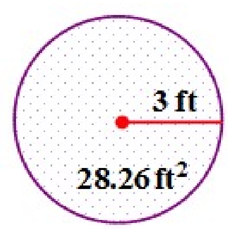
First, find the **entire area** of the **square**.

- Area (square) = s^2
- $A = 8^2 = 64\ \text{ft}^2$



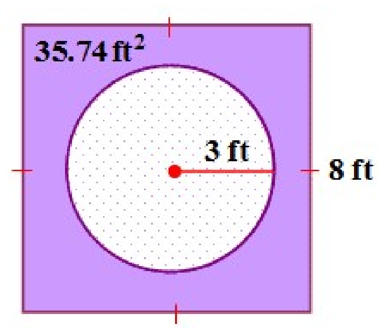
Next, find the **area** of the **circle (hole).**

- Area (circle) = $\pi \times r^2$
- $A = 3.14 \times 3^2 = 28.26\ \text{ft}^2$



Finally, **subtract** the area of the circle from the area of the square.

$$\begin{array}{r} 64.00 \\ -\underline{28.26} \\ 35.74\ \text{ft}^2 \end{array}$$



The area of the region **outside of the circle, but within the square**, (light purple region) is 35.74 square feet.