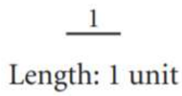
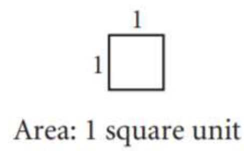
Lesson 8.1 – Areas of Rectangles and Parallelograms

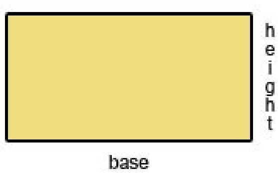
The **area** of a plane figure is the measure of the region enclosed by the figure. You measure the area of a figure by counting the number of square units (units^2) that you can arrange to fill the figure completely.



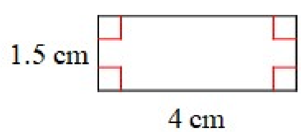


***Remember that units on area should always have a power of 2 because area is 2-dimensional (i.e. cm^2, in^2, ft^2, mi^2, unit^2, etc.)

Rectangle Area Conjecture - The area of a rectangle is given by the formula $A = bh$, where A is the area, b is the length of the base, and h is the height of the rectangle.



Example 1: Finding area of a rectangle given base and height



$A =$ __?___

It doesn't actually matter which side we call the base and which side we call the height since we will just be multiplying the two values and the order in which we multiply them does not change the output value.

$$A = bh$$

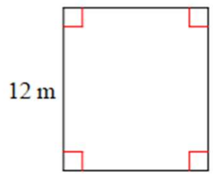
$b = 4, h = 1.5$ or $b = 1.5, h = 4$

$A = (4)(1.5)$ or $A = (1.5)(4)$

$A = 6$ $\quad$ $A = 6$

Notice that we get the same answer regardless of which side we call the base and which side we call the height. So, the area is **6 cm^2**.

Example 2: Finding base of a rectangle given area and height



Area = 128.4 m² $\quad b =$ __?__

$A = bh$

$A = 128.4, h = 12$

$128.4 = (b)(12)$

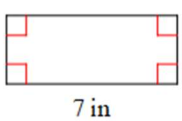
$$\frac{128.4}{12} = \frac{(b)(12)}{12}$$

$10.7 = b$

The base is **10.7 m**.

**Notice that the units are not squared. When we find a base or height, we are finding a length, which is 1-dimensional, so our units have a power of 1.

Example 3: Finding height of a rectangle given area and base



Area = 19.6 in² $\quad h =$ __?__

$A = bh$

$A = 19.6, b = 7$

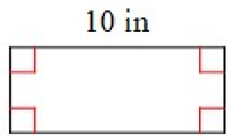
$19.6 = (7)(h)$

$$\frac{19.6}{7} = \frac{(7)(h)}{7}$$

$2.8 = h$

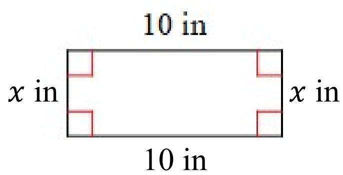
The height is **2.8 in**. (Again, units are not squared because we are finding a length which is 1-dimensional)

Example 4: Finding rectangle area given a perimeter and a side



$P = 28 \text{ in}$ $A =$ __?__

We know that perimeter is the length of all the sides added together. We also know that opposite sides of a rectangle are congruent. We know the longer two sides are both 10, but we do not know the shorter sides.

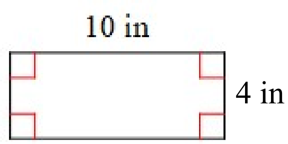


$10 + 10 + x + x = 28$

$20 + 2x = 28$

$2x = 8$

$x = 4$



$A = bh$

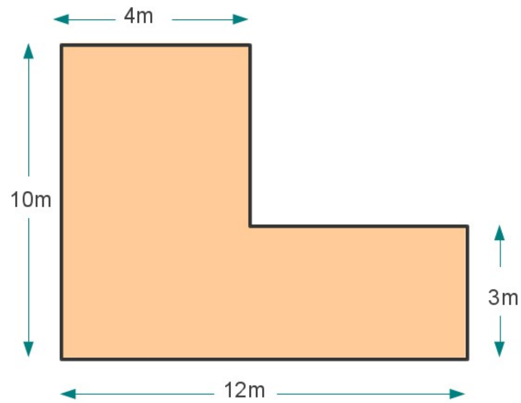
$b = 10, h = 4$

$A = (10)(4)$

$A = 40$

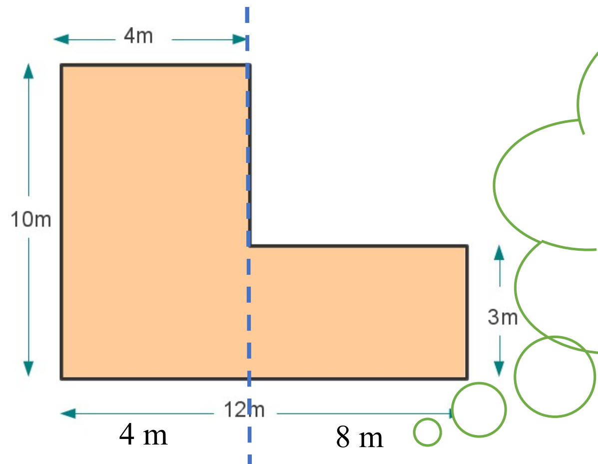
The area is **40 in²**. (Remember that units are squared because area is 2-dimensional)

Example 5: Finding area of a composite rectangle figure



Shaded area = __?___

We can split this figure into two rectangles to find the area.



Common Question: How did that side get split into 4 and 8?

The top and bottom of the rectangle on the left must be congruent, so they are both 4 m.

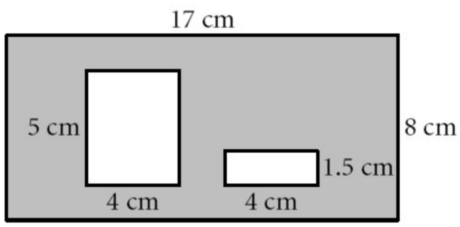
Then take the entire length (12 m) and subtract the 4 m to determine the remaining length. $(12 - 4 = 8)$

$A = bh$	$A = bh$
$b = 4, h = 10$	$b = 8, h = 3$
$A = (4)(10)$	$A = (8)(3)$
$A = 40$	$A = 24$

$A = 40 + 24 = 64$

The shaded area is **64 m²**.

Example 6: Finding area of a composite rectangle figure



Shaded area =__?___

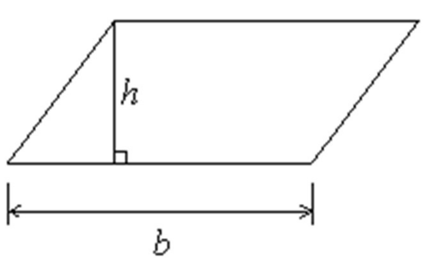
We can find the area of the big rectangle (17x8) and subtract out the area of the two smaller rectangles.

Big rectangle:	Small rectangle on the left:	Small rectangle on the right:
$A = bh$	$A = bh$	$A = bh$
$b = 17, h = 8$	$b = 4, h = 5$	$b = 4, h = 1.5$
$A = (17)(8)$	$A = (4)(5)$	$A = (4)(1.5)$
$A = 136$	$A = 20$	$A = 6$

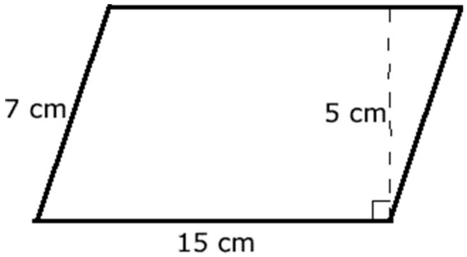
$A = 136 - 20 - 6 = 110$

The shaded area is **110 cm²**.

Parallelogram Area Conjecture - The area of a parallelogram is given by the formula $A = bh$, where A is the area, b is the length of the base, and h is the height of the parallelogram. The base and height must be perpendicular.



Example 7: Finding area of a parallelogram given base and height



$A = \underline{\quad ? \quad}$

***The base and height of a parallelogram must be perpendicular (meet at a right angle), so the 7 cm is a side length and extra information that we don't need.

$A = bh$

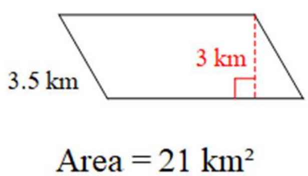
$b = 15, h = 5$

$A = (15)(5)$

$A = 75$

The area is **75 cm²**.

Example 8: Finding base of a parallelogram given area and height



$b = \underline{\quad ? \quad}$

***Remember that the side length of 3.5 km doesn't help us find the base. We are looking for the two sides that meet at a right angle.

$A = bh$

$A = 21, h = 3$

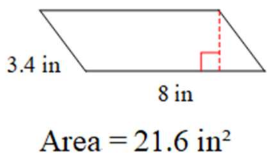
$21 = (b)(3)$

$\frac{21}{3} = \frac{(b)(3)}{3}$

$7 = b$

The base is **7 km**.

Example 9: Finding height of a parallelogram given area and base



$h =$ __?___

$A = bh$

$A = 21.6, b = 8$

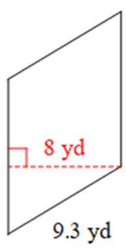
$21.6 = (8)(h)$

$$\frac{21.6}{8} = \frac{(8)(h)}{8}$$

$2.7 = h$

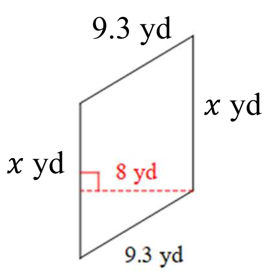
The height is **2.7 in**.

Example 10: Finding area of a parallelogram given perimeter and height



$P = 40.6$ yd $\quad A =$ __?___

We know that perimeter is the length of all the sides added together. We also know that opposite sides of a parallelogram are congruent.

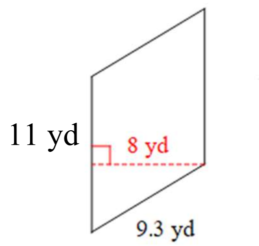


$9.3 + 9.3 + x + x = 40.6$

$18.6 + 2x = 40.6$

$2x = 22$

$x = 11$



$A = bh$

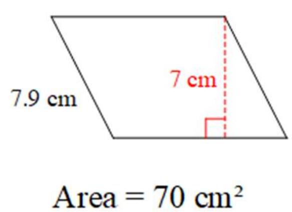
$b = 11, h = 8$

$A = (11)(8)$

$A = 88$

The area is **88 yd²**.

Example 11: Finding perimeter of a parallelogram given area and height



$P =$ __?___

To find perimeter, we will need to know the base of the parallelogram.

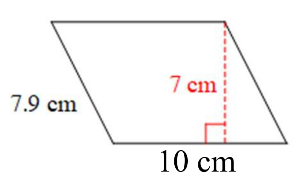
$A = bh$

$A = 70, h = 7$

$70 = (b)(7)$

$$\frac{70}{7} = \frac{(b)(7)}{7}$$

$10 = b$



$P = 10 + 10 + 7.9 + 7.9$

$P = 35.8$

The perimeter is **35.8 cm**. (Perimeter is a 1-dimensional length, so units are just cm)