Using literal equations

Warm-up: The warm-up is a short review of the area and perimeter of a rectangle and the concepts explored during this lesson.

Quadrant I: This problem has students write the perimeter of the rectangle with respect to length and width. Include units.

Quadrant II: This problem reviews concretely the perimeter of a rectangle with units.

Quadrant III: This problem has students write the area of the rectangle with respect to length and width. Include units.

Quadrant IV: This problem reviews concretely the area of a rectangle. Introduce the idea of two dimensions and cm^2.

Page 4: We begin the lesson using the formulas discussed in the warm-up to begin our work with literal equations.

Ex 1: We are given the perimeter and length of a rectangle and asked to find the width. We will solve the problem two different ways. First we will substitute the given values into the formula and then solve for the width. Then, we will solve the perimeter formula for the width, and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

Ex 2: We are given the area and width of a rectangle and asked to find the length. We will again solve the problem two different ways. First we will substitute the given values into the formula and then solve for the length. Then, we will solve the area formula for the length, and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

Page 5: On page 2 we will plot some points and then draw a triangle through those points. We will discuss the various ways that sides of a triangle our named in mathematics. Such as: line segment $\overline{bc}$, as a side of a triangle $\overline{bc} = side$ a , and as the height. We will find the lengths of *side a* and *side b* from the graph

Ex 3b: We are given the perimeter of the triangle and asked to find the hypotenuse (side c). We will solve the problem two different ways. First we will substitute the values of side *a* and *side b* into the formula and then solve for the hypotenuse (side c). Then, we will solve the perimeter formula for the hypotenuse (side c), and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

Ex 3c: We then substitute values of *side a* (height) and *side b* (base) into the formula for the area of a triangle and simplify. We will highlight and use the given units in this problem.

Page 6: We will continue the use of triangles to explore literal equation on this page. We will first identify the length of the base and hypotenuse of the triangle. We will note that we do not know the length of the height.

Ex 4b: We are given the area of the triangle and we will use the values noted above to help find the height of the triangle. We will solve the problem two different ways. First we will substitute the given values into the formula and then solve for the height. Then we will solve the area formula for the height, and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

Ex 4c: We use the Pythagorean Theorem to help us find height (side a) of the triangle. We will solve the problem two different ways. First we will substitute the given values into the formula and then solve for the height. Then we will solve the formula for the height, and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

<u>Page 7:</u> We will give the two formulas for the circumference of a circle and begin with an exploration of where they come from.

Ex 5: We are given the circumference of a circle and asked to find the radius. We will solve the problem two different ways. First we will substitute the value of the circumference into the formula and then solve for the radius. Then, we will solve the circumference formula for the radius and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

Ex 6: We are given the area of a circle and asked to find the radius. We will solve the problem two different ways. First we will substitute the value of the area into the formula and then solve for the radius. Then, we will solve the area formula for the radius and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

<u>Page 8:</u> We will use the distance equals rate times time formula (d = r x t) on this page to solve for each of the variables in a different example.

Ex 7: We will find the distance a car has traveled from Sacramento to LA. We will highlight and use the given units in the problem.

Ex 8: We will use the (d = r x t) formula to find the time it takes to drive from LA to San Diego given the distance and speed (rate). We will solve the problem two different ways. First we will substitute the given values into the formula and then solve for the time. Then, we will solve the (d = r x t) formula for the time and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

Ex 9: We will use the (d = r x t) formula to find the speed (rate) you have when you walk from your hotel to the beach. We will solve the problem two different ways. First we will substitute the given values into the formula and then solve for the rate (speed). Then, we will solve the (d = r x t) formula for the rate (speed) and then substitute the given values into the literal equation and simplify. A twist added to this problem is that we will have to convert a distance of a half-mile to feet as a way of highlighting and using units in the problem.

<u>Page 9:</u> We will use the work equals rate times time formula (w = r x t) on this page to solve for each of the variables in a different example.

Ex 10: We will find the work you do while you are washing cars. We will highlight and use the given units in the problem.

Ex 11: We will use the (w = r x t) formula to find the rate at which you are washing cars given the number of cars you have washed (work) and the time you work. We will solve the problem two different ways. First we will substitute the given values into the formula and then solve for the rate. Then, we will solve the (w = r x t) formula for the rate at which you are working (washing cars) and then substitute the given values into the literal equation and simplify. We will highlight and use the given units throughout the problem.

Date ________________

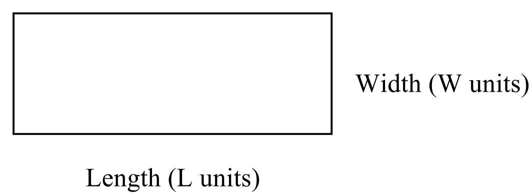
Warm-Up

CA 5.0/7G.1

Find the *perimeter* of a rectangle if the length is 4 centimeters and width is 7 centimeters. What are the units?

CA 5.0/7G.1

The *perimeter* of a rectangle is the distance around a rectangle. Find the *perimeter* for the figures below:



CA 5.0/7G.1

The *area* of a rectangle is the number of square units inside the rectangle. For the figure in Q1, the *area* is?

CA 5.0/7G.1

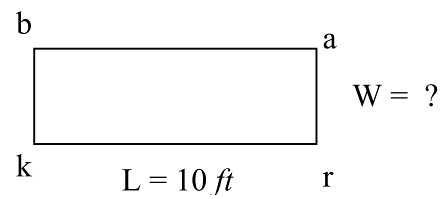
Find the area of the rectangle described in Q2. What are the units?

Solving and Using Literal Equations

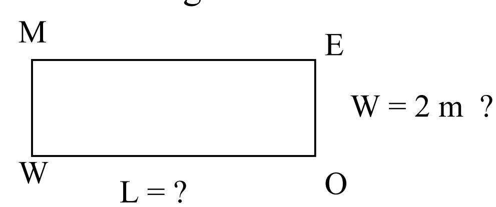
Perimeter is 1-dimensional and is measured in linear units such as inches, feet or meters. Area is 2-dimensional and is measured in square units such as square inches, square feet or square meters. The formula for the perimeter and area of a rectangle is:

$$P = l + w + l + w = \qquad\qquad = \qquad\qquad\qquad\qquad A = lw$$

1. The perimeter of rectangle **bark** is 32 ft. Let us explore a couple different methods to find the width of the rectangle? What are the units?



2. The area of rectangle **MEOW** is $14\ m^2$. What is the length of the rectangle? What are the units?



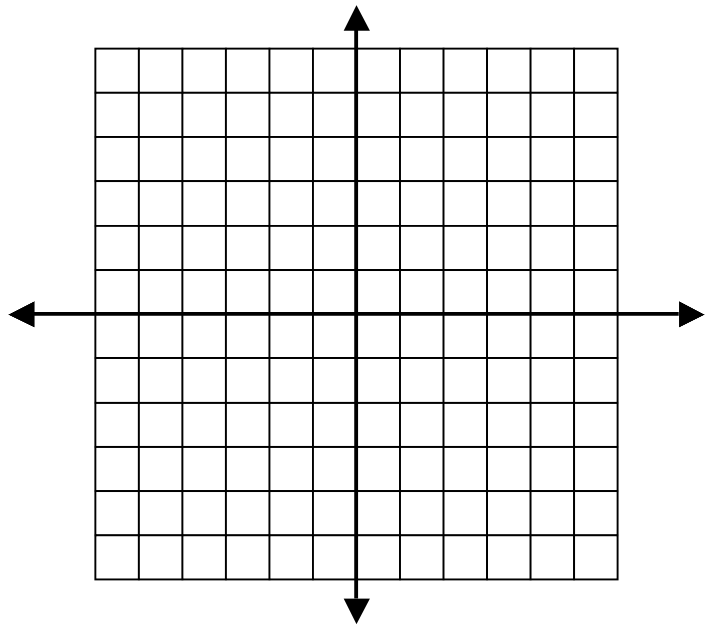
An equation or formula with different variables is called a literal equation. Today we will be working with several literal equations that are frequently used in science and mathematics.

3. Plot the points A (1, -1), B (-2,3), and C (-2, -1) on the centimeter graph. Then, draw the triangle formed by the points. Find the lengths of the following line segments:

$\overline{BC} =$

$\overline{CA} =$

$\overline{BA} =$



Another way to identify sides of a triangle is:

$\overline{BC} = side$ a =

$\overline{CA} = side$ b =

$\overline{BA} = side$ c =

3b. The perimeter of $\triangle ABC$ is 12 cm. What is the length of the hypotenuse (side $\overline{BA}$)?

$$P = a + b + c$$

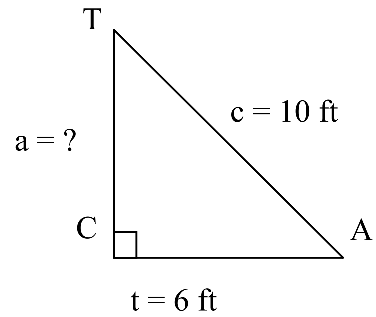
3c. What is the area for the triangle above? What are the units? $A = \frac{1}{2}(base)(height)$

4. The area of $\triangle CAT$ is $24\ ft^2$. Identify the side lengths below:

$\overline{CA} =$

$\overline{TA} =$

$\overline{TC} =$



4b. Let us use the area formula to find the length of side $\overline{TC}$? What are the units?

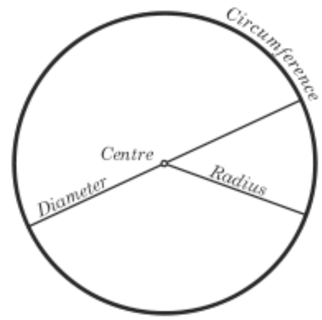
$$A = \frac{1}{2}(b)(h)$$

4c. We can also use the Pythagorean Theorem to find the length of side $\overline{tc}$.

$$a^2 + b^2 = c^2$$

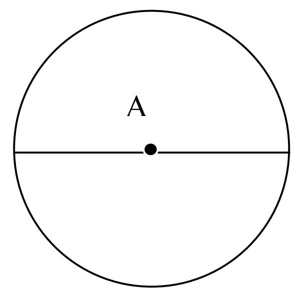
The *circumference* is the distance around a *circle*.

$$c = 2\pi r \quad \text{or} \quad c = \pi d$$

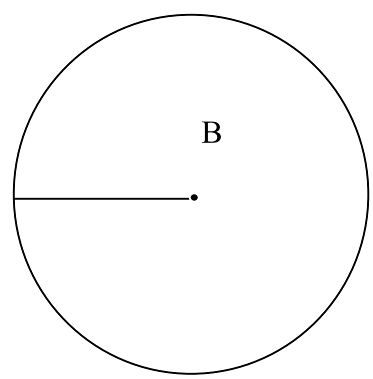


The *circumference* is a special example of *perimeter*
There are two different formulas for *circumference.* Do you know *why?*

5. The circumference of $\odot A$ is 25.12 in. Find the length of the radius. What are the units?
(Let $\pi \approx 3.14$) $c = 2\pi r$



6. The area of $\odot B$ is $153.86\ \text{cm}^2$. Find the length of the radius. What are the units?
(Let $\pi \approx 3.14$) $a = \pi r^2$



7. You leave Sacramento at 6:00 am for a drive to Los Angeles. Traffic was really light and you arrive in LA at 11:00 am. Your average speed on the trip was 75 miles per hour ($^{m}/_{hr}$). How far is LA from Sacramento? What are the units?
(hint: $distance = rate \bullet time$: $(\text{d} = r \bullet t)$)

8. The next day you leave Los Angeles and drive to San Diego. The distance to San Diego is 105 miles and your average speed during the trip was 70 miles per hour ($^{m}/_{hr}$). How long did the trip take? What are the units?

9. That evening you take a 20-minute walk from your hotel to the beach. The bellhop told you that beach is ½ mile away. What is your speed in feet per minute?
(hint: $1\ mile = 5280\ feet$)

10. In Seattle you get a job washing cars. You wash 3 cars per hour ($^{cars}/_{hr}$) and you work for 4 hours. How many cars did you wash your first day? What are the units?
(hint: $work = rate \bullet time$: $(w = r \bullet t)$)

11. Two weeks later you work an eight-hour shift. During that time you wash 36 cars. What was your work rate that shift? What are the units?
(hint: $work = rate \bullet time$ $(w = r \bullet t)$)