Unit 9 Reference Page

Expressions with Two Variables

If there is more than one variable in an expression, we use a different letter for each variable.

Terms with the same variable part are called like terms. To simplify expressions with more than one variable, we combine like terms.

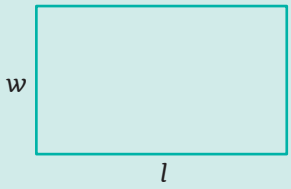
9.5

Ex. Write an expression for the perimeter of a rectangle with length l and width w.

$l + w + l + w$

$2l + w + w$

$\mathbf{2l + 2w}$



Equations

An equation is a mathematical statement with an equals sign. The two sides of the equation are like the two sides of a scale. The equals sign tells that the two sides equal each other and are in balance.

A solution to an equation is a value for the variable that makes the equation true. To check whether a number is a solution to an equation, substitute the number into the equation. Evaluate both sides and check whether the two sides are equal.

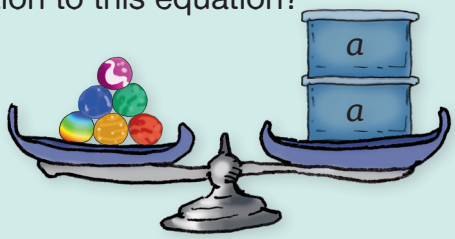
9.6

Ex. Is $a = 4$ a solution to this equation?

$6 = 2a$

$6 \stackrel{?}{=} 2 \cdot 4$

$6 \neq 8$ **No.**



Ex. Is $b = 4$ a solution to this equation?

$2b - 1 = 7$

$2 \cdot 4 - 1 \stackrel{?}{=} 7$

$8 - 1 \stackrel{?}{=} 7$

$7 = 7$ **Yes.**

Unit 9 Reference Page

Solve Equations, Part 1

9.7

The two sides of an equation are like the two sides of a scale. If you change one side of the equation, you must change the other side in the same way.

To solve an equation, we change both sides until we have the variable by itself on one side of the equation.

1. Identify what happens to the variable in the equation. Identify the opposite operation.
2. Do the opposite to both sides of the equation.
3. Simplify both sides.
4. Substitute the solution into the equation to check your answer.

Ex. Solve: $x + 18 = 37$

The opposite of adding 18 is subtracting 18.

$$x + 18 = 37$$
$$x + 18 - 18 = 37 - 18$$
$$\mathbf{x = 19}$$

Check:

$19 + 18 \stackrel{?}{=} 37$

$37 = 37$ ✓

Ex. Solve: $46 = w - 24$

The opposite of subtracting 24 is adding 24.

$$46 = w - 24$$
$$46 + 24 = w - 24 + 24$$
$$\mathbf{70 = w}$$

Check:

$46 \stackrel{?}{=} 70 - 24$

$46 = 46$ ✓

Solve Equations, Part 2

9.8

We solve multiplication and division equations in the same way that we solve addition and subtraction equations. We change both sides until we have the variable by itself on one side of the equation.

1. Identify what happens to the variable in the equation. Identify the opposite operation.
2. Do the opposite to both sides of the equation.
3. Simplify both sides.
4. Substitute the solution into the equation to check your answer.

Ex. Solve: $45 = 5x$

The opposite of multiplying by 5 is dividing by 5.

$$45 = 5x$$
$$\frac{45}{5} = \frac{5x}{5}$$
$$\mathbf{9 = x}$$

Check:

$45 \stackrel{?}{=} 5 \cdot 9$

$45 = 45$ ✓

Ex. Solve: $\frac{y}{6} = 7$

The opposite of dividing by 6 is multiplying by 6.

$$\frac{y}{6} = 7$$
$$\frac{y}{6} \cdot 6 = 7 \cdot 6$$
$$\mathbf{y = 42}$$

Check:

$\frac{42}{6} \stackrel{?}{=} 7$

$7 = 7$ ✓

Unit 9 Reference Page

Independent and Dependent Variables

Variable can be independent or dependent. An independent variable stands for the quantity that changes or can be controlled in the situation.

A dependent variable stands for a quantity that depends on an independent variable. It can't be changed or controlled on its own.

9.9

Ex. Isabella's family's minivan takes 1 gallon of gas to drive 30 miles. What is the independent variable? What is the dependent variable?

The independent variable is the amount of gas, because Isabella's family can choose how much gas to put in the tank.

The dependent variable is the number of miles Isabella's family can drive, because this distance depends on how much gas is in the tank.

We can write an equation to show the relationship between an independent variable and a dependent variable. We usually write the dependent variable on its own on one side of the equation.

Ex. Use g to stand for the number of gallons of gas and m to stand for the number of miles they can drive. Write an equation that shows the relationship between g and m.

$$\mathbf{30}g = m$$

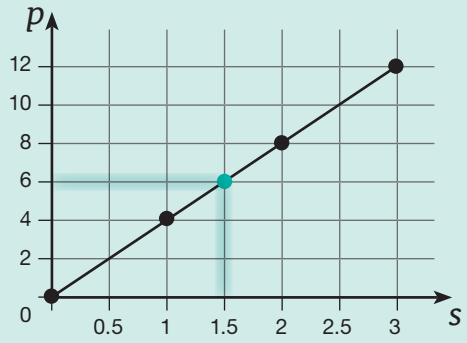
How to Graph an Equation

1. Make a chart that shows a few solutions to the equation.
2. Label the horizontal axis with the independent variable. Label the vertical axis with the dependent variable.
3. Plot points at the ordered pairs that match the solutions in your chart.
4. Connect the points with a line.

We can use the graph to find other solutions to the equation.

9.10

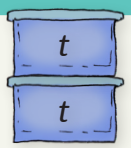
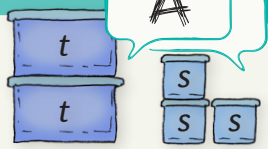
Ex. Make a graph to match the chart in Part A. Then, use the graph to find the value of p when $s = 1.5$.



When $s = 1.5$, $p = 6$. If the side length is 1.5 units, the perimeter of the square is 6 units.

Lesson Activities

A

$3s$			
$2t$			
$3s + 2t$			

B

Expressions with Two Variables

If there is more than one variable in an expression, we use a different letter for each variable.

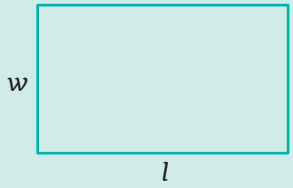
Terms with the same variable part are called like terms. To simplify expressions with more than one variable, we combine like terms.

Ex. Write an expression for the perimeter of a rectangle with length l and width w.

$l + w + l + w$

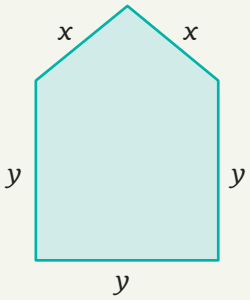
$2l + w + w$

$\mathbf{2l + 2w}$



Write an expression (in simplest terms) for the total length of the line.

Write an expression (in simplest terms) for the perimeter of the pentagon.



C

Cameron orders m t-shirts and n pairs of shorts. Each t-shirt costs \$14, and each pair of shorts costs \$18. He also pays a \$10 shipping fee. Write an expression that shows the total cost of his order.

Grace's family buys 2 adult tickets and 3 child tickets for the concert. They also pay a \$6 service fee. Write an expression that shows the total amount they pay. Use a for the cost of each adult ticket and c for the cost of each child ticket.

Practice

Complete the charts.

c	d	$c + d$	$5(c + d)$
1	5	6	30
0	6		
7	3		
8	2		
15	15		

e	f	$e \cdot f$	$e \cdot f + 1$
1	3	3	4
4	0		
3	4		
6	2		
10	10		

Simplify each expression.

$u + u + v + v + v$

$x + y + 3 + x + 8$

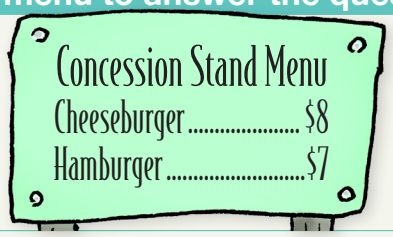
$5m + 3m + 6n - n$

★ $3(2g) + 4h + h$

★ $9(4j + k)$

★ $\frac{9x}{3} + \frac{24y}{6}$

Use the menu to answer the questions.

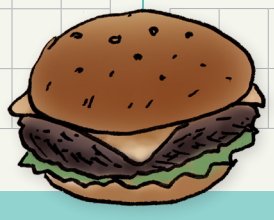


Write an expression that tells the total cost of an order from the concession stand. Use c to stand for the number of cheeseburgers and h to stand for the number of hamburgers in the order.

Evaluate your expression for $c = 3$ and $h = 1$.

Evaluate your expression for $c = 2$ and $h = 2$.

★ Ana's family paid $37 for their order. How many cheeseburgers and how many hamburgers did they buy?



Review

Match.

The sum of x, 3, and 8	$\frac{3x}{8}$
3 times x, plus 8	$3x + 8$
3 times x, divided by 8	$3(x + 8)$
3 times the quantity x plus 8	$x + 3 + 8$

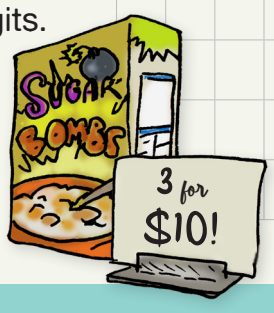
Circle the fractions whose simplest form is the fraction in the star.

$\frac{1}{4}$	$\frac{2}{8}$	$\frac{4}{12}$	$\frac{4}{16}$	$\frac{6}{28}$	$\frac{20}{80}$	$\frac{25}{45}$
$\frac{1}{3}$	$\frac{3}{12}$	$\frac{3}{9}$	$\frac{5}{15}$	$\frac{3}{10}$	$\frac{33}{99}$	$\frac{25}{75}$
$\frac{2}{3}$	$\frac{6}{9}$	$\frac{8}{12}$	$\frac{9}{15}$	$\frac{4}{6}$	$\frac{15}{30}$	$\frac{30}{45}$

Solve. Write the equations you use in the work space.

Each bookshelf costs $139.83.
How much do 4 bookshelves cost?

What is the unit price for 1 box of cereal?
Write your answer with 2 decimal digits.



WORK SPACE

Lesson Activities

A

Equations

An equation is a mathematical statement with an equals sign. The two sides of the equation are like the two sides of a scale. The equals sign tells that the two sides equal each other and are in balance.

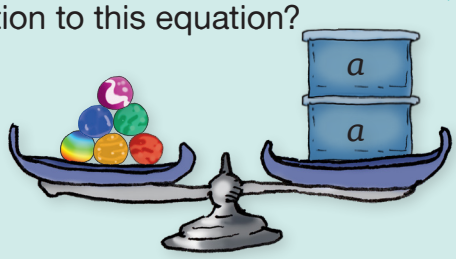
A solution to an equation is a value for the variable that makes the equation true. To check whether a number is a solution to an equation, substitute the number into the equation. Evaluate both sides and check whether the two sides are equal.

Ex. Is $a = 4$ a solution to this equation?

$6 = 2a$

$6 \stackrel{?}{=} 2 \cdot 4$

$6 \neq 8$ **No.**



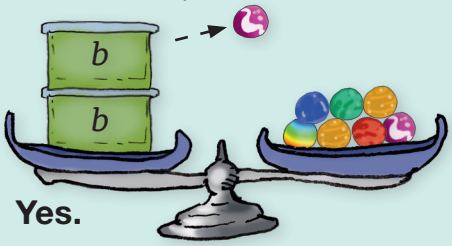
Ex. Is $b = 4$ a solution to this equation?

$2b - 1 = 7$

$2 \cdot 4 - 1 \stackrel{?}{=} 7$

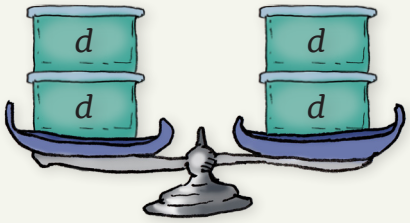
$8 - 1 \stackrel{?}{=} 7$

$7 = 7$ **Yes.**



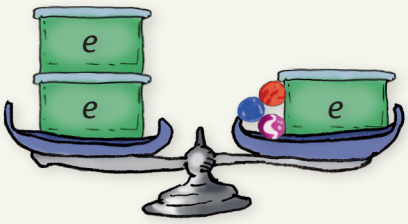
_____ = _____

Is $c = 7$ a solution to the equation?



_____ = _____

Is $d = 8$ a solution to the equation?



_____ = _____

Is $e = 5$ a solution to the equation?

B

I'm thinking of a secret number. Double my number plus 27 equals 53.

Write an inequality to match the statement. Use n to stand for the secret number.

_____ = _____

Which of these numbers is the secret number?

11	12	13

Practice

Use mental math to check whether each number is a solution to the equation. Circle the numbers that are the solutions to the equation. (Some equations will have more than one solution.)

$4a = 24$	$b = 20 - 18$	$c + 3 = 3 + c$
4 5 6	1 2 3	8 9 10
$\frac{35}{d} = 7$	$e + e + e = 3e$	$2f = f + 7$
5 6 7	4 5 6	6 7 8

Match.

32 equals the sum of x and 5.	$\frac{4x}{5} = 32$
4 times x, plus 5, equals 32.	$4x + 5 = 32$
4 times x, divided by 5, equals 32.	$32 = 4(x + 5)$
32 equals 4 times the quantity x plus 5.	$32 = x + 5$

Substitute the number into the equation to check whether the number is a solution to the equation.

is $x = 27$ a solution to this equation?

$$32 = x + 5$$

is $x = 25$ a solution to this equation?

$$\frac{4x}{5} = 32$$

is $x = 3$ a solution to this equation?

$$32 = 4(x + 5)$$

is $x = 3$ a solution to this equation?

$$4x + 5 = 32$$

Review

Evaluate.

87 + 13 – 13

76 – 29 + 29

47 – 47 + 56 – 56

Rewrite each division problem as a multiplication problem and solve. Write your answers in simplest form and convert improper fractions to mixed numbers.

$3\frac{3}{4} \div \frac{7}{8} =$

$5\frac{1}{4} \div 1\frac{1}{6} =$

$4 \div \frac{2}{3} =$

Write the word that matches each definition.

coefficient
∘
term
∘
variable
∘
constant

A letter than stands for a number

A number multiplied by a variable

Parts of an expression that are added or subtracted

Term with only a number and no variable part

Answer the questions.

Eli saves and spends his money in a 3 : 2 ratio. What fraction of his money does he save?

Layla mixes 1 part dish soap with 3 parts water to make homemade bubble solution. What fraction of the total amount is water?

Lesson Activities

A

Keep It Balanced! (2-Player Game)

$x + 18 = 37$

B

Solve Equations, Part 1

The two sides of an equation are like the two sides of a scale. If you change one side of the equation, you must change the other side in the same way.

To solve an equation, we change both sides until we have the variable by itself on one side of the equation.

1. Identify what happens to the variable in the equation. Identify the opposite operation.
2. Do the opposite to both sides of the equation.
3. Simplify both sides.
4. Substitute the solution into the equation to check your answer.

Ex. Solve: $x + 18 = 37$

The opposite of adding 18 is subtracting 18.

$$x + 18 = 37$$
$$x + 18 - 18 = 37 - 18$$
$$\mathbf{x = 19}$$

Check:

$19 + 18 \stackrel{?}{=} 37$

$37 = 37$ ✓

Ex. Solve: $46 = w - 24$

The opposite of subtracting 24 is adding 24.

$$46 = w - 24$$
$$46 + 24 = w - 24 + 24$$
$$\mathbf{70 = w}$$

Check:

$46 \stackrel{?}{=} 70 - 24$

$46 = 46$ ✓

$p - 41 = 56$

Check:

$49 = n + 15$

Check:

$m + 32 = 75$

Check:

$105 = h - 93$

Check:

Practice

Solve each equation. Show all your steps. Then, substitute the solution into the equation to check that it is correct.

$54 = a - 36$

$54 + 36 = a - 36 + 36$

$90 = a$

Check:

$54 = 90 - 36$

$54 = 54$

$58 = b + 26$

Check:

$c - 18 = 40$

Check:

$100 = d - 49$

Check:

$e + 32 = 64$

Check:

$f - 35 = 52$

Check:

Follow the directions.

I'm thinking of a secret number. The sum of my number and 48 quals 136.

Write an equation to match the clue. Use m to stand for the secret number.

Solve the equation to find the secret number. Show all your steps.

I'm thinking of a secret number. My number decreased by 89 equals 47.

Write an equation to match the clue. Use n to stand for the secret number.

Solve the equation to find the secret number. Show all your steps.

Review

Evaluate. Use cancelling where possible.

$\frac{3 \cdot 4}{4}$

$\frac{9 \cdot 10}{10}$

$\frac{67 \cdot 100}{100}$

$\frac{7}{8} \cdot \frac{8}{1}$

$\frac{4}{9} \cdot 9$

$\frac{7}{12} \cdot 12$

Use the chart to complete the conversions.
(Think carefully about whether to multiply or divide.)

1 cm = 10 mm

1 m = 100 cm

1 km = 1,000 m

74.5 cm = _____ m

3.8 cm = _____ mm

999 m = _____ km

2.5 km = _____ m

Use bar models to answer the questions.

The basketball team's ratio of wins to losses is 5 to 4. They have won 3 more games than they have lost.

Wins

Losses

How many games has the team won?

How many games has the team lost?

How many games has the team played in all?

What fraction of the games has the team won?

What fraction of the games has the team lost?

Lesson Activities

A

$79 = x + 26$

Check:

$x - 104 = 202$

Check:

B

Solve Equations, Part 2

We solve multiplication and division equations in the same way that we solve addition and subtraction equations. We change both sides until we have the variable by itself on one side of the equation.

1. Identify what happens to the variable in the equation. Identify the opposite operation.
2. Do the opposite to both sides of the equation.
3. Simplify both sides.
4. Substitute the solution into the equation to check your answer.

Ex. Solve: $45 = 5x$

The opposite of multiplying by 5 is dividing by 5.

$45 = 5x$

$\frac{45}{5} = \frac{5x}{5}$

$\mathbf{9 = x}$

Check:

$45 \stackrel{?}{=} 5 \cdot 9$

$45 = 45$ ✓

Ex. Solve: $\frac{y}{6} = 7$

The opposite of dividing by 6 is multiplying by 6.

$\frac{y}{6} = 7$

$\frac{y}{6} \cdot 6 = 7 \cdot 6$

$\mathbf{y = 42}$

Check:

$\frac{42}{6} \stackrel{?}{=} 7$

$7 = 7$ ✓

$8g = 240$

Check:

$42 = 2h$

Check:

$\frac{j}{5} = 20$

Check:

$32 = \frac{k}{4}$

Check:

Practice

Solve each equation. Show all your steps. Then, substitute the solution into the equation to check that it is correct.

$25 = \frac{m}{4}$

$25 \cdot 4 = \frac{m}{4} \cdot 4$

$100 = m$

Check:

$25 = \frac{100}{4}$

$25 = 25$

$5b = 40$

Check:

$\frac{p}{4} = 7$

Check:

$64 = 8q$

Check:

$9r = 180$

Check:

$25 = \frac{s}{4}$

Check:

Follow the directions.

I'm thinking of a secret number. The product of my number and 4 equals 160.

Write an equation to match the clue. Use x to stand for the secret number.

Solve the equation to find the secret number. Show all your steps.

I'm thinking of a secret number. My number divided by 20 equals 15.

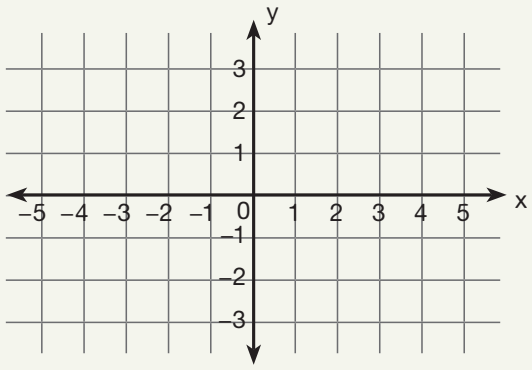
Write an equation to match the clue. Use y to stand for the secret number.

Solve the equation to find the secret number. Show all your steps.

Review

Graph the points and connect the points to create a quadrilateral. Then, find the area of the quadrilateral.

(–1,3) (2,–3) (–2,–3) (–5,3)



What is the area of the quadrilateral?

Circle the most reasonable answer for each product or quotient.

81.5 × 9			0.815 × 9			8.15 × 9		
7.35	73.5	733.5	7.35	73.5	733.5	7.35	73.5	733.5

2.934 ÷ 3			29.34 ÷ 3			0.2934 ÷ 3		
0.0978	0.978	9.78	0.0978	0.978	9.78	0.0978	0.978	9.78

Solve. Write the equations you use. Write your answers in simplest form.

Nova has 6 boards. Each board is $4\frac{2}{3}$ ft. long. What is the total length of the boards?

Maverick makes 3 pizzas for 10 people. If each person eats the same amount of pizza, what fraction of a pizza does each person eat?

Asher makes $5\frac{1}{2}$ liters of hot apple cider. He pours $\frac{1}{4}$ liter into each mug. How many mugs does he fill?

Mila practices soccer for $1\frac{3}{4}$ hr. each day. How many hours does she practice soccer in 5 days?

Lesson Activities

A

Isabella's family's minivan takes 1 gallon of gas to drive 30 miles.

Gallons	1	2	3	4	5	6
Miles	30					

B

Independent and Dependent Variables

Variable can be independent or dependent. An independent variable stands for the quantity that changes or can be controlled in the situation.

A dependent variable stands for a quantity that depends on an independent variable. It can't be changed or controlled on its own.

Ex. Isabella's family's minivan takes 1 gallon of gas to drive 30 miles. What is the independent variable? What is the dependent variable?

The independent variable is the amount of gas, because Isabella's family can choose how much gas to put in the tank.

The dependent variable is the number of miles Isabella's family can drive, because this distance depends on how much gas is in the tank.

We can write an equation to show the relationship between an independent variable and a dependent variable. We usually write the dependent variable on its own on one side of the equation.

Ex. Use g to stand for the number of gallons of gas and m to stand for the number of miles they can drive. Write an equation that shows the relationship between g and m.

$$\mathbf{30}g = m$$

Isabella's family goes on a road trip and drives an average of 60 miles per hour.

Time (hours)	1	2	3	4	5	6
Distance (miles)	60					

Use t to stand for amount of time they spend driving (in hours) and d to stand for the distance they drive (in miles). Write an equation that shows the relationship between t and d.

Use your equation to predict how far they can drive in 12 hours.

Their destination is 480 miles away. Use your equation to find how many hours it will take for them to reach their destination.

Practice

Complete the charts and answer the questions.

Ezra has a lawn-mowing business. He earns $20 for each lawn he mows.

Lawns mowed	1	2	3	4	5	6
Dollars earned	20					

Write an equation that shows the relationship between the number of lawns he mows (l) and the number of dollars he earns (d).

Use your equation to predict how much Ezra makes if he mows 12 lawns.

Ezra wants to earn $300 this summer. Use your equation to find how many lawns he needs to mow to reach his goal.

12 gallons of water flow out of the hose in 1 minute.

Minutes	1	2	3	4	5	6
Gallons of water	12					

Write an equation that shows the relationship between the time in minutes (t) and the amount of water in gallons (w).

Use your equation to predict how much water flows out of the hose in 20 minutes.

The kiddie pool has a capacity of 120 gallons. How many minutes will it take to fill the pool?

Follow the pattern to complete the chart. Then, answer the questions.

x	1	2	3	4	5	6	7	8
y	4	5	6	7				

Use words to describe the relationship between x and y.

Write an equation that shows the relationship between x and y.

If $x = 30$, what does y equal?

Review

Evaluate each expression for $x = 4$. Show all your steps.

$\frac{3}{2}x + 10$

$\frac{3}{8} \cdot \frac{x}{6}$

$\frac{x}{2} + \frac{3}{8}$

$\frac{3}{2}(x + 10)$

$\frac{3 \cdot x}{8 \cdot 6}$

$\frac{x + 3}{2 + 8}$

Write whether each mathematical statement is an expression, equation, or inequality.

$5a + 7 = 29$ _____

$5a + 7$ _____

$a < 7$ _____

Compare with <, >, or =.

$-2.78 \bigcirc -3.94$

$5.4 \bigcirc -0.7$

$-1\frac{3}{4} \bigcirc \frac{5}{6}$

$-2\frac{2}{3} \bigcirc -4\frac{1}{5}$

$-\frac{1}{2} \bigcirc 0.65$

$2\frac{1}{4} \bigcirc 2.25$

$3\frac{3}{4} \bigcirc 3.6$

$-7\frac{1}{5} \bigcirc 7.2$

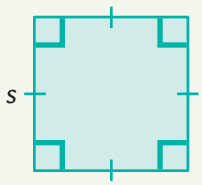
Solve. Write the equations you use.

At the track meet, Ilona threw the shotput 6.45 m. She threw the shotput 2.68 m further than Callie. How far did Callie throw the shotput?

Mira threw the shotput 1.93 m. Grace threw the shotput 3 times as far as Mira did. How far did Grace throw the shotput?

Lesson Activities

A



$4s = p$

Side length (s)	0	1	2	3
Perimeter (p)				

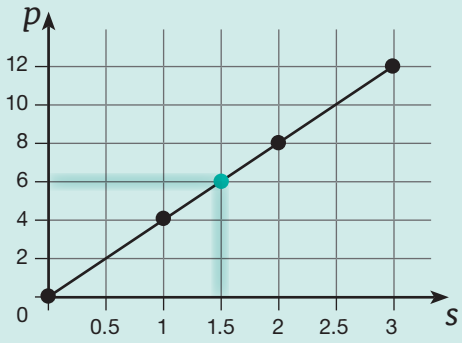
B

How to Graph an Equation

1. Make a chart that shows a few solutions to the equation.
2. Label the horizontal axis with the independent variable. Label the vertical axis with the dependent variable.
3. Plot points at the ordered pairs that match the solutions in your chart.
4. Connect the points with a line.

We can use the graph to find other solutions to the equation.

Ex. Make a graph to match the chart in Part A. Then, use the graph to find the value of p when $s = 1.5$.

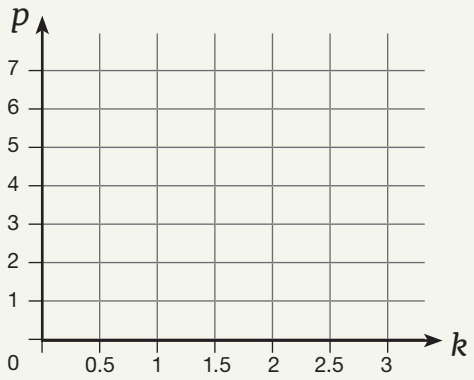


When $s = 1.5$, $p = 6$. If the side length is 1.5 units, the perimeter of the square is 6 units.

C

1 kg ≈ 2.2 lb.

Kilograms (k)	Pounds (p)
0	
1	
2	
3	



Draw a point on the graph where $k = 1.5$. What is the approximate value of p for this point?

Use your answer to complete the blank.

1.5 kg ≈ _____ lb.

Draw a point on the graph where $p = 6$. What is the approximate value of k for this point?

Use your answer to complete the blank.

_____ kg ≈ 6 lb.

Practice

Use the formula to complete the blanks.

To convert a Celsius temperature (c) to a Fahrenheit temperature (f), multiply the temperature by $\frac{9}{5}$. Then, add 32.

$$\frac{9}{5}c + 32 = f$$

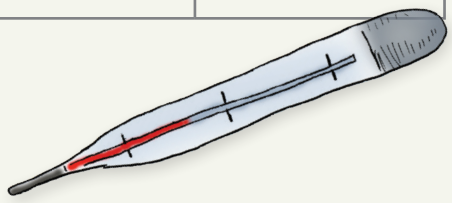
0° Celsius = _____° Fahrenheit

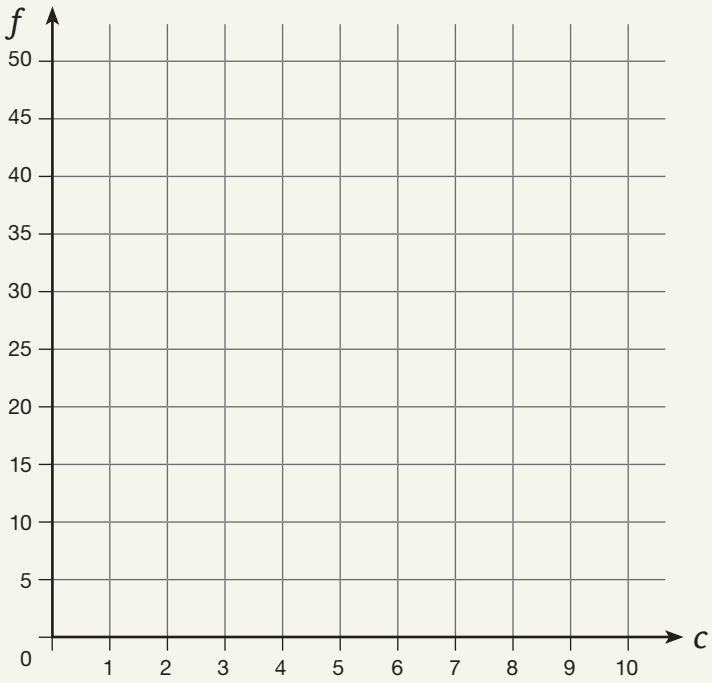
5° Celsius = _____° Fahrenheit

10° Celsius = _____° Fahrenheit

Use your above answers to complete the chart. Then, make a graph to match the chart. Use the graph to answer the questions.

Celsius Temperature (c)	Fahrenheit Temperature (t)
0	
5	
10	





Draw a point on the graph where $c = 3$. What is the approximate value of f for this point?

Use your answer to complete the blank.

3° Celsius ≈ _____° Fahrenheit

Draw a point on the graph where $f = 45$. What is the approximate value of c for this point?

Use your answer to complete the blank.

_____° Celsius ≈ 45° Fahrenheit

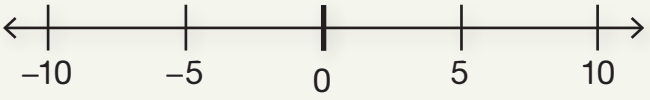
Review

Follow the directions.

I have more than $5 in my bank account.

Write an inequality to match the statement. Use m to stand for the amount of money.

Graph the inequality on the number line.



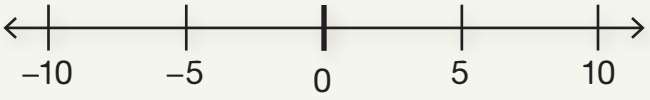
Circle the numbers that make the inequality true. X the numbers that do not make the inequality true.

–5	0	5	10

The temperature is less than 10 degrees.

Write an inequality to match the statement. Use t to stand for the temperature.

Graph the inequality on the number line.



Circle the numbers that make the inequality true. X the numbers that do not make the inequality true.

–5	0	5	10

Solve each equation. Show all your steps. Then, substitute the solution into the equation to check that it is correct.

$25 = \frac{a}{6}$

Check:

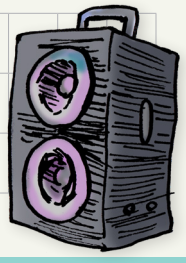
$140 = 7n$

Check:

Use bar models to solve. Write the equations you use.

Dominic has $75. He uses $\frac{3}{5}$ of his money on new headphones. How much does he spend on the headphones?

Zara spends $\frac{3}{4}$ of the money in her savings account on a new speaker. The speaker costs $84. How much money did she have in her savings account to start?



Unit Wrap-Up

Use the expression to answer the questions.

$4r + 5s + 8$

How many terms are in this equation?

What are the variables in this expression?

What is the constant in this equation?

What is the coefficient of r?

What is the coefficient of s?

Evaluate each expression for $t = 8$. Use the order of operations.

$3t - 4 \cdot 5$

$\frac{34 + 6}{t}$

$t^2 - 3t + 7$

Simplify each expression.

$(7w)(3)$

$5(3c + 6)$

$\frac{35m}{5}$

$a + 4 + 2a + a + 2$

$7b - 2b + 6$

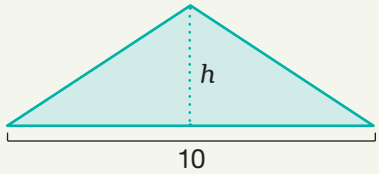
$x + y + 4 + y + 1$

Answer the questions.

Eric earns $12 per hour for shoveling snow. Write an expression that tells how much he earns for t hours of shoveling.

Evaluate your expression for $t = 3$.

Write an expression that tells the area of the triangle.



Evaluate your expression for $h = 4$.

Unit Wrap-Up

Solve each equation. Show all your steps. Then, substitute the solution into the equation to check that it is correct.

$74 = k + 31$

Check:

$35 = l - 23$

Check:

$\frac{m}{8} = 6$

Check:

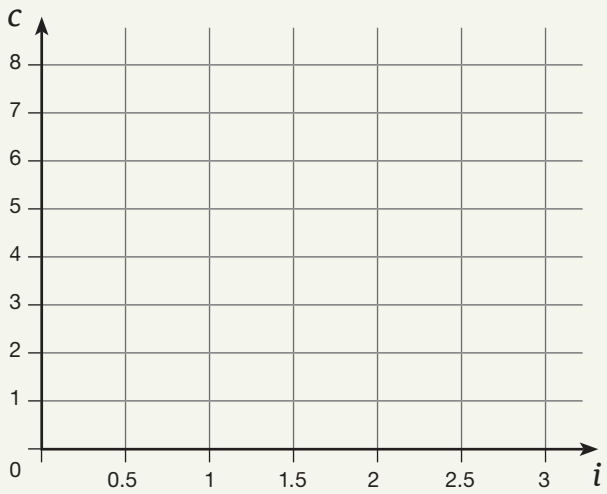
$63 = 9n$

Check:

Use the information to complete the chart. Make a graph to match the chart. Answer the questions.

1 in. ≈ 2.54 cm

Inches (i)	Centimeters (c)
0	
1	
2	
3	



Draw a point on the graph where $i = 1.5$. What is the approximate value of c for this point?

Use your answer to complete the blank.

1.5 in. ≈ _____ cm

Draw a point on the graph where $c = 4$. What is the approximate value of i for this point?

Use your answer to complete the blank.

_____ in. ≈ 4 cm