

• Solving Problems Using Scientific Notation

Power Up

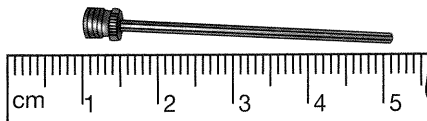
Building Power

facts

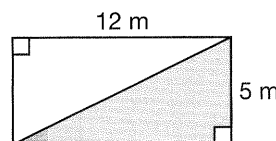
mental math

Power Up J

- Number Sense:** $10\frac{1}{2} \times 16$
- Probability:** What is the probability of rolling an odd number with one roll of a number cube?
- Fractional Parts:** $\frac{2}{5}$ of the 30 students were girls. How many girls were there?
- Ratio:** The ratio of the length to width of a rectangular field is 4 to 2. If the field is 100 yards long, how wide is the field?
- Measurement:** Find the length of this object:



- Geometry:** Find the area of the rectangle. Then find the area of the shaded triangle.



- Powers/Roots:** $\sqrt{10 \cdot 10}$
- Calculation:** $7 \times 6, + 3, \div 5, \sqrt{\quad}, \times 8, + 1, \sqrt{\quad}, \times 10, - 1, \sqrt{\quad}$

problem solving

Find the sum of all the multiples of 3 from 30 to 81. ($30 + 33 + 36 + \dots + 75 + 78 + 81$).

New Concept

Increasing Knowledge

To multiply numbers written in scientific notation, we multiply the coefficients to find the coefficient of the product. Then we multiply the powers of 10 by adding the exponents.

Steps:	Justification:
$(1.2 \times 10^6)(4 \times 10^8)$	Given
$(1.2 \times 4)(10^6 \times 10^8)$	Assoc. and Comm. Properties
4.8×10^{14}	Simplified

If the product is not in the proper form of scientific notation, we revise the product so that there is one digit to the left of the decimal point.

Steps:	Justification:
$(7.5 \times 10^4)(2 \times 10^3)$	Given
$(7.5 \times 2)(10^4 \times 10^3)$	Assoc. and Comm. Properties
15.0×10^7	Simplified (but incorrect form)
$1.5 \times 10^1 \times 10^7$	$15.0 = 1.5 \times 10^1$
1.5×10^8	Proper form ($10^1 \times 10^7 = 10^8$)

Look carefully at the last three steps. The coefficient 15.0 is not the correct form. We write 15.0 in scientific notation (1.5×10^1) and simplify again.

Generalize Write a rule that explains how moving the decimal point of the coefficient changes the exponent.

Example 1

Find each product

a. $(1.2 \times 10^5)(3.0 \times 10^5)$

b. $(4.0 \times 10^4)(5.0 \times 10^5)$

Solution

a. We multiply the coefficients and add the exponents.

$$(1.2 \times 10^5)(3.0 \times 10^5) = 3.6 \times 10^{10}$$

b. We multiply the coefficients and add the exponents.

$$(4.0 \times 10^4)(5.0 \times 10^5) = 20.0 \times 10^9$$

The answer is not in proper form because the coefficient has two digits left of the decimal point. We reposition the decimal point.

$$20.0 \times 10^9 = \mathbf{2.0 \times 10^{10}}$$

To divide numbers in scientific notation we divide the coefficients, and we divide the powers of 10 by subtracting the exponents.

$$\frac{4.8 \times 10^6}{4.0 \times 10^3} = \frac{4.8}{4.0} \times \frac{10^6}{10^3} = 1.2 \times 10^3$$

If the quotient is not in the proper form, we reposition the decimal point and change the exponent.

$$\frac{1.0 \times 10^8}{4.0 \times 10^3} = 0.25 \times 10^5 = 2.5 \times 10^4$$

When changing the exponent of a number written in scientific notation, first decide whether the shifting decimal point makes the coefficient larger or smaller, then compensate by changing the exponent.

$$0.25 \times 10^5 \rightarrow 2.5 \times 10^4$$

The coefficient becomes 10 times larger, so we remove one power of ten.

Conclude Can the coefficient for a number written in scientific notation ever be greater than or equal to 10? Explain your answer.

Thinking Skill

Justify

Write 1.2×10^3 in standard form. Explain how you found your answer.

Example 2

Light travels at a speed of about 300,000 kilometers per second. An hour is 3600 seconds. Write both numbers in scientific notation. Then estimate the distance light travels in an hour using scientific notation.

Solution

The rate 300,000 km/sec is equal to 3.0×10^5 km/sec.

The measure 3600 sec is equal to 3.6×10^3 sec.

The product of 3.0×10^5 km/sec and 3.6×10^3 sec is 10.8×10^8 km. The product is not in proper form for scientific notation, so we adjust the answer.

The distance light travels in one hour is about 1.08×10^9 km, which is more than 1 billion kilometers.

Example 3

Find each quotient

a. $\frac{1.44 \times 10^{12}}{1.2 \times 10^8}$

b. $\frac{3.0 \times 10^8}{4.0 \times 10^4}$

c. $\frac{7.5 \times 10^6}{2.5 \times 10^6}$

Solution

We divide the coefficients and subtract the exponents.

a. $\frac{1.44 \times 10^{12}}{1.2 \times 10^8} = 1.2 \times 10^4$

b. $\frac{3.0 \times 10^8}{4.0 \times 10^4} = 0.75 \times 10^4$

The quotient is not in proper form. We move the decimal point one place to the right and subtract 1 from the exponent.

$$0.75 \times 10^4 = 7.5 \times 10^3$$

c. $\frac{7.5 \times 10^6}{2.5 \times 10^6} = 3 \times 10^0$

Recall that 10^0 equals 1. Thus the quotient is simply 3.

Example 4

Earth's average distance from the sun is about 150 million kilometers. Light travels about 300 thousand kilometers per second. Express both numbers in scientific notation and estimate how long it takes the sun's light to reach Earth.

Solution

We rewrite 150 million km as 1.5×10^8 km.

We rewrite 300 thousand km/sec as 3.0×10^5 km/sec.

Dividing 1.5×10^8 km by 3.0×10^5 km/sec equals 0.5×10^3 sec. We rewrite the answer in proper form. To reach Earth, light from the sun travels about 5×10^2 seconds, which is 500 seconds.

Practice Set

Find each product in **a–d**.

a. $(2.4 \times 10^6)(2.0 \times 10^5)$

b. $(1.25 \times 10^4)(2 \times 10^6)$

c. $(4.0 \times 10^5)(4.0 \times 10^5)$

d. $(2.5 \times 10^6)(5 \times 10^7)$

e. One day is 86,400 seconds. Express this number in scientific notation and estimate how far the sun’s light travels in a day.

f. Analyze What operation did you use for the exponents in problems **a–e**?

Find each quotient in **g–j**.

g. $\frac{3.6 \times 10^{10}}{3.0 \times 10^6}$

h. $\frac{6.0 \times 10^8}{4.0 \times 10^8}$

i. $\frac{1.2 \times 10^7}{3.0 \times 10^3}$

j. $\frac{3 \times 10^9}{8 \times 10^4}$

k. If Mars is 225 million kilometers from the sun, how long does it take light from the sun to reach Mars?

l. Analyze What operation did you apply to the exponents in problems **g–k**?

Written Practice

Strengthening Concepts

* **1.** ⁽⁴⁵⁾ The ratio of the cat’s weight to the rabbit’s weight is 7 to 4. Together, they weigh 22 pounds. How much does the rabbit weigh?

* **2.** ⁽⁴⁵⁾ The ratio of the weight of the Guinea pig to the weight of the Goliath beetle is 8 to 1. Together, they weigh 27 ounces. How much does the Goliath beetle weigh?

3. ^(6, 25) The mass of a flea is about 0.005 grams. How many fleas does it take to make 1 gram?

* **4.** ⁽⁴⁶⁾ Simplify: $\frac{3.36 \times 10^7}{1.6 \times 10^3}$

* **5.** ⁽⁴⁶⁾ Simplify: $(9.0 \times 10^2)(1.1 \times 10^7)$

* **6.** ^(41, 44) **Model** Graph the equation $y = \frac{3}{2}x - 2$. (Hint: For the table select even numbers for x .) What is the slope of the line?

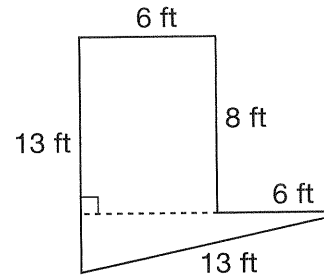
7. ^(39, 40) Find the **a** area and **b** the circumference of a circle that has a diameter of 100. (Use a decimal approximation for π .)

* **8.** ⁽⁴²⁾ **Analyze** Find the volume of a plastic CD case with dimensions 12.0 cm by 12.5 cm by 0.3 cm.

9. ⁽⁴¹⁾ It will cost a manufacturer \$45 to make machinery modifications in order to produce a new product. Each item will cost \$10 to manufacture. To the right is a chart of the number of items (x) that are manufactured and the total cost (y). Write an equation that shows the relationship in the table.

x	y
0	45
1	55
2	65
3	75

10. Find the **a** area and **b** perimeter of this figure.
(8, 37)



Solve for x .

11. $\frac{1}{2}x = \frac{3}{7}$
(22, 38)

12. $x + \frac{1}{12} = \frac{1}{2}$
(13, 38)

13. $x - 1.2 = 1.95$
(24, 38)

14. $\frac{x}{16} = \frac{30}{20}$
(36)

15. **a.** Expand: $-6(x^2 - 18x + 81)$ **b.** Factor: $9x - 3$
(21, 36)

16. **a.** Write $\frac{11}{20}$ as a decimal and percent.
(12)

- b.** Which of the three forms is most appropriate for a store owner to describe a discount of \$11 from a \$20 item?

Simplify:

17. $\frac{mr}{3mr}$
(27)

18. $\frac{(-12) - (-2)(3)}{(-2)(-3)}$
(33, 36)

19. $\frac{1}{2} \div \frac{3}{4} - \frac{1}{3}$
(13, 22)

20. $(0.15)^2$
(25)

Combine like terms to simplify:

21. $x^3 + 2x^2y - 3xy^2 - x^2y$
(31)

- * 22. **Connect** Simplify $5(x - 3) + 2(3 - x)$ (Hint: expand first using the Distributive Property.)
(31, 36)

23. Find all values of x which make the equation true: $x^2 - 9 = 0$
(14, 36)

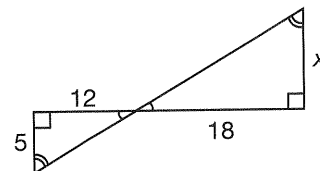
24. Claire flips a coin twice.
(32)

- a.** Use the sample space to find the probability of Claire getting tails at least once.
b. Find the probability of Claire getting heads twice.

		First Toss	
		H	T
Second Toss	H	HH	TH
	T	HT	TT

25. Consider the similar triangles.
(35)

- a.** What is the scale factor from the smaller to the larger triangle?
b. Find x .

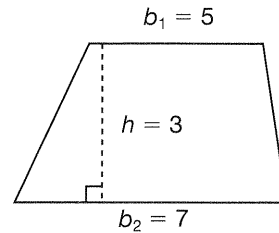


- * 26. **Evaluate** Richard drew the floor plan of his dream house. On his scale drawing of a kitchen, he drew a 6 in. segment to represent a distance of 30 ft.
- Each inch in the drawing represents what distance in the house?
 - If Rick's kitchen is to measure 10 ft by 20 ft, what are the dimensions of the floor plan of the kitchen?

- * 27. **Analyze** We can use this formula to find the area of a trapezoid.

$$A = \frac{b_1 + b_2}{2} \cdot h$$

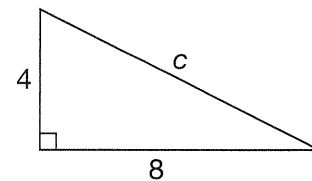
Solve for A if $b_1 = 5$, $b_2 = 7$, and $h = 3$.
(Units are in centimeters.)



- * 28. What is the length of the hypotenuse?

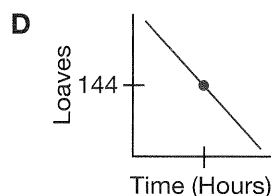
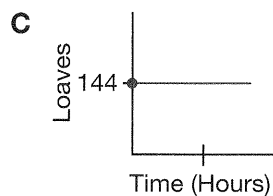
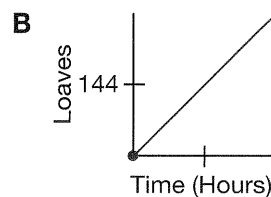
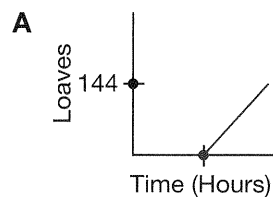
(Inv. 2)

- A $\sqrt{80}$ B $\sqrt{81}$
C 9.1 D 9.3



- * 29. Miguel is going to build a storage cube for his sports equipment. How many square feet of wood will he need to make a three-foot cube?

- * 30. A bakery produces 144 loaves (l) of bread per hour (h) every day. Which graph represents the relationship of time and the number of loaves baked? Is this a proportional relationship? How do we know? Write an equation that describes the relationship. What is the constant of proportionality?



• Graphing Functions

Power Up

Building Power

facts

Power Up J

mental math

- a. **Number Sense:** $8\frac{1}{2} \times 10$
- b. **Statistics:** Find the mean of 5, 6, and 10.
- c. **Fractional Parts:** Calculate a 20% tip on a bill of \$30.
- d. **Measurement:** The odometer read 5306.5 miles at the end of her trip. When she started, the odometer read 5103.5. How long was her trip?
- e. **Proportions:** If Zollie can write 40 multiplication facts in 2 minutes, how many can she write in 5 minutes?
- f. **Geometry:** Two angles of a triangle measure 80° and 20° . Is the triangle a right triangle, an acute triangle, or an obtuse triangle? Explain.
- g. **Estimation:** Approximate the total: \$2.47 plus \$3.47 plus 5 at \$6.99
- h. **Calculation:** Square 10, $\times 5$, $\div 10$, $\times 2$, $\sqrt{\quad}$, $\times 4$, $- 4$, $\sqrt{\quad}$

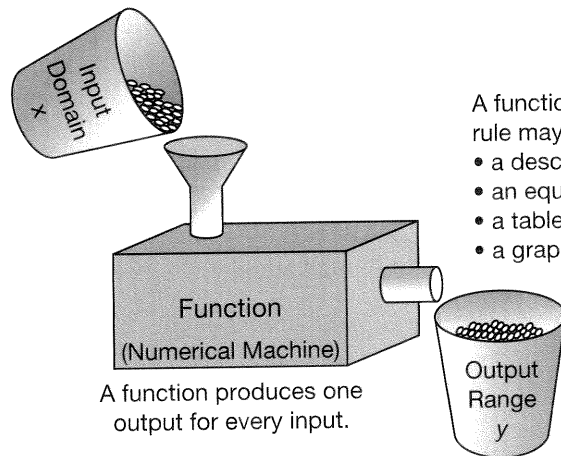
problem solving

Three painters paint a house in 3 days. How many houses could 6 painters paint in 6 days working at the same rate?

New Concept

Increasing Knowledge

Recall that a **function** is a rule that pairs one output number with each input number. The following picture of a function machine and two buckets illustrates the relationship between the **domain** (set of inputs) and **range** (set of outputs) of a function.



A function machine takes each element (member) from the domain “bucket” (set) and produces one element for the range “bucket.”

A checkout scanner at a store is a real-world example of a function machine. The input is the product code the scanner reads and the domain is the set of codes programmed for the scanner. The output is the price the register records for that product code and the range is the set of prices of the coded items. The function pairs a code with a price.

For each coded item there is only one price. Different coded items may have the same price, but each coded item has only one price.

Functions may be expressed with descriptions, equations, tables, or graphs. The sign in example 1 is an example of a description for a function that pairs the number of hours parked and the number of dollars charged for parking.

Example 1

The sign at right describes a function—a rule that relates hours parked to dollars charged.

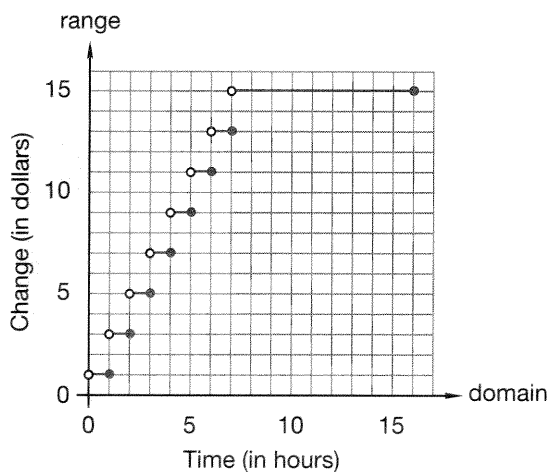
- What is the domain of the function?
- What is the range of the function?
- Graph the function.

Parking

\$1.00 for first hour
 \$2.00 for each additional
 hour or part thereof
 \$15.00 maximum
 Lot open 6 a.m. to 10 p.m.
 No overnight parking

Solution

- The domain of the function is the number of hours a car can be parked in the lot. Since the lot is open from 6:00 a.m. to 10:00 p.m., the domain is from a few moments in the lot up to a maximum of 16 hours, so the domain is the set of real numbers from **0–16**.
- The range is the number of dollars charged for parking. For up to one hour the charge is \$1.00. Any time during the second hour the charge is \$3.00 (\$1.00 + \$2.00). During the third hour the charge is \$5.00. The pattern of odd dollar charges continues to \$15.00: **\$1, \$3, \$5, ... \$13, \$15**.
- We use the horizontal axis for the domain and the vertical axis for the range.



The parking charge during an hour is flat, but as the hour passes the charge increases by two dollars until the maximum charge is reached. Because of the stair step pattern, this type of function is sometimes called a **step function**. The small filled and empty circles on each step of the graph mean that at the exact hour the charge is the lower amount, not the higher amount. The next minute the charge jumps to the next level.

A formula can be an example of a function expressed as an equation. Consider the formula that computes the perimeter of a square given a side length.

$$\begin{array}{c}
 P = 4s \\
 \uparrow \qquad \uparrow \\
 \text{output} \quad \text{input}
 \end{array}$$

Example 2

Consider the function $P = 4s$.

- What is the domain?
- What is the range?
- Create a table for some function pairs.
- Graph the function.

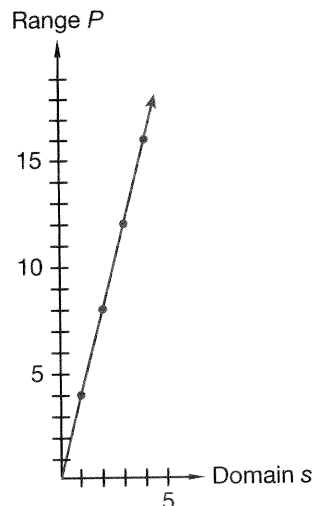
Solution

- The domain is any number that can represent a side length. Lengths are positive, so any positive number on the number line can represent a length. Thus the domain is **all positive real numbers**.
- The range is any number that can represent the perimeter. A perimeter is a length, so any positive number on the number line can represent the perimeter of a square. The range is **all positive real numbers**.
- To create a table we choose input numbers (side length) and use the function rule to find the output (perimeter). Although we may choose any positive real number for s , we decide to select numbers that are easy to compute and graph.

$$P = 4s$$

s	P
1	4
2	8
3	12

- Since lengths are positive, the graph of the function is in the first quadrant only. We graph the pairs from the table and notice that the points are aligned. We could have chosen and graphed $(4, 16)$, $(0.5, 2)$, $(1.5, 6)$, $(0.1, 0.4)$, or countless other pairs. All such pairs would be aligned with these points. By drawing a line from the origin through the points from the table, the line becomes a representation of all possible side-length and perimeter pairs for the function.



Notice how the graph in example 2 is different from the graph in example 1. The graph in example 2 is not interrupted with gaps. This means that the function $P = 4s$ is a **continuous function**.

Notice two more important features of the graph in example 2.

1. The graph begins at the origin.
2. All points in the graph are aligned.

Together, these two features indicate that the function is a **direct proportion**. We will be studying direct proportions in many lessons in this book. Any two pairs from a direct proportion form a proportion. Take (2, 8) and (3, 12) for example.

$$\frac{2}{8} = \frac{3}{12}$$

Verify How can we verify that these two ratios form a proportion?



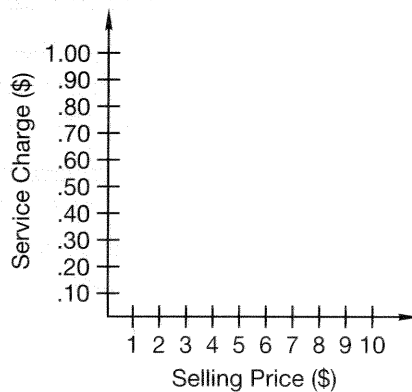
Example 3

Visit www.SaxonPublishers.com/ActivitiesC3 for a graphing calculator activity.

An online auction service charges a 30¢ listing fee plus 6% of the selling price for items up to \$25. The total service charge (c) is a function of the selling price (p) of an item.

$$c = 0.30 + 0.06p$$

- a. Use a calculator to generate a table of pairs of values for the selling price and service charge.
- b. Graph the function on axes like the ones below.



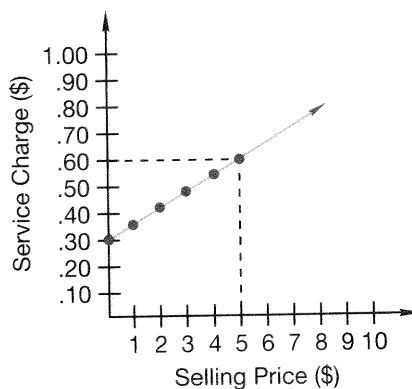
- c. Is the relationship a proportion? How do you know?

Solution

- a. We choose input values (selling prices) that are easy to calculate.

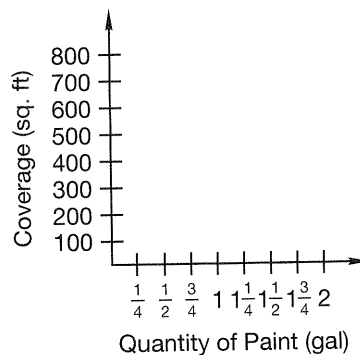
p	c
1	0.36
2	0.42
3	0.48
4	0.54
5	0.60

- b. We graph the points from our table on the given axes and draw a line connecting the points.
- c. The relationship is not proportional. The graph does not intercept zero and the price/charge ratio is not constant.



Practice Set

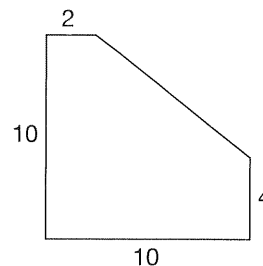
- a. **Represent** The directions on the can of paint described a function: One gallon covers 400 sq. ft of a sealed, non-textured surface. On graph paper draw and extend axes like the ones illustrated. Then create a function table relating quantity of paint in gallons (g) to area (A) covered in square feet. Use numbers from the table to graph the function on your paper.



- b. Referring to problem a, which equation below describes the relationship between the number of gallons (g) of paint and the area (A) covered in square feet?
- A** $A = 400 + g$ **B** $A = 400g$ **C** $A = \frac{400}{g}$ **D** $A = \frac{g}{400}$
- c. Referring to problem a, painting 700 square feet of wall would require about how many *quarts* of paint?
- d. Janine works in a high-rise building. When she wants to go to upper floors she enters an elevator and pushes a button (input), and the elevator takes her a distance above street level (output). Assuming that the building has 12 floors and that floors are 10 feet apart, graph the relationship between the floor Janine is on and her distance (elevation) above street level. Let the tick marks on the vertical axis (output) increase by tens.
- e. In problem d, what is the domain of the function?
- f. Is the relationship described in problem d proportional? Why or why not?

- * 1. **Analyze** The ratio of buses to cars entering the lot was 2 to 11. (45)
If 650 vehicles entered the lot all together, how many were cars?
- 2. A pack of 8 collectable cards contains 1 rare card, 3 uncommon cards, (45)
and 4 common cards. If Javier has 45 packs of cards, how many more
uncommon cards does he have than rare cards?
- 3. Kimberly used coupons worth \$1.00 off and \$1.25 off and two coupons (3, 4)
for \$1.50 off. If the discount of each of these coupons were doubled,
how much would Kimberly save?
- * 4. **Generalize** Simplify: $(4.0 \times 10^3)(3.0 \times 10^4)$ (28, 46)
- * 5. **Model** Graph the equation $y = x - 1$. Is the point (3, 1) on the line? (41)
- 6. Find the **a** area and **b** circumference of a circle with a radius of 5 in. (40)
Express the measures in terms of π .
- 7. Find the volume of an aquarium with dimensions 1 ft \times 2 ft \times 1.5 ft. (42)
- 8. Polly's pie shop is famous for its 12-inch blueberry pies. Is the (39)
circumference of Polly's pie greater or less than 1 yard?

For problems 9 and 10, refer to the following information. Salvador has a yard of this shape. (Dimensions are in meters.) He would like to lay sod and fence his yard.



- 9. How many square meters of sod will he need? (37)
- 10. What length of fencing will he need if he fences all but one 10-meter (8, Inv. 2) edge of his yard?

Solve.

11. $\frac{4}{3}x = 12$ (22, 38)

12. $x - \frac{2}{5} = 12$ (13, 38)

13. $4x^2 = 64$ (36, 38)

14. $\frac{24}{x} = \frac{15}{20}$ (44)

15. a. Expand: $-5(4r - 2d - 1)$ (21, 36)

b. Factor: $4x - 28$

- * 16. a. Write 0.005 as a percent and as a reduced fraction. (12)
- b. Which of the three forms would be most convenient for finding 0.5% of \$1000?

Simplify.

17. $\frac{24wx^2y}{-12xy}$ (27, 36)

18. $\frac{3}{8} - \frac{1}{2} \cdot \frac{2}{3} \cdot \frac{3}{4}$ (13, 22)

19. $1\frac{2}{3} \div 3\frac{1}{3} + 1\frac{5}{6}$
(13, 23)

20. $\frac{(-12) - (-2)(-3)}{-(-2)(-3)}$
(33, 36)

21. $\frac{1.2 - 0.12}{0.012}$
(24, 25)

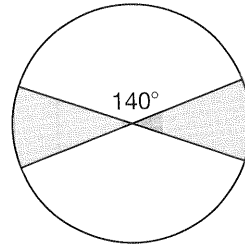
22. $(-1)^2 + (-1)^3$
(36)

23. Combine like terms: $2(x + 1) + 3(x + 2)$ (Hint: Expand first using the distributive property.)
(31, 36)

* 24. **Analyze** Find the slope of the line that passes through points $(0, 0)$ and $(2, -4)$.
(44)

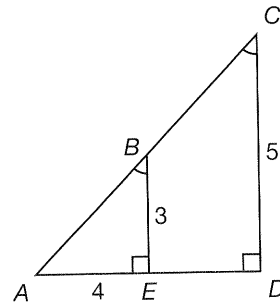
* 25. The radius of this circle is 10 ft.
(40)

- Using 3.14 for π , what is the area of the circle?
- What fraction of the circle is shaded?
- What is the combined area of the shaded regions? (Round to the nearest square foot.)



* 26. For **a-c**, refer to these triangles.
(35)

- Redraw $\triangle ABE$ and $\triangle ACD$ as two separate triangles.
- Explain how you know that $\triangle ABE \sim \triangle ACD$.
- What is the scale factor from $\triangle ABE$ to $\triangle ACD$?



27. For the equation $E = mc^2$, find E when $m = 0.001$ and $c = 3.0 \times 10^8$.
(28)

28. Express $\frac{1}{12}$ **a** as a decimal number and **b** as a percent.
(30)

* 29. Amelia is making a scratching post for her cat. She has a rectangular prism post that is 4 inches wide by 4 inches deep by 18 inches tall. How much carpet does Amelia need to go around the post without covering the top or bottom of the post?
(43)

30. Two business partners split their profits evenly. The table shows possible x - and y -values with x representing their profit and y representing the amount they each receive.
(41)
- Write an equation for the function shown in the table.
 - Graph the function.
 - Is the relationship proportional? Explain your answer.

x	y
0	0
2	1
4	2
6	3
8	4

• Percent of a Whole

Power Up

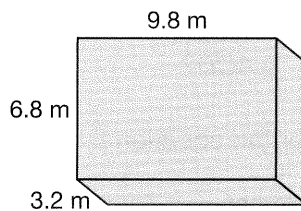
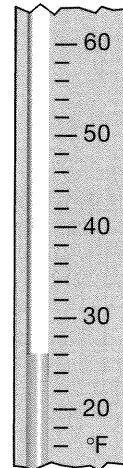
Building Power

facts

Power Up J

mental
math

- a. **Number Sense:** $\$3.25 \times 4$
- b. **Measurement:** How many degrees below “freezing” is the temperature shown on the thermometer? (Water freezes at 32°F .)
- c. **Percent:** How much is 75% of $\$1,000$?
- d. **Scientific Notation:** Write 63,400,000 in scientific notation.
- e. **Rate:** Maria walks 4 miles per hour south, while Reginald strolls 3 miles per hour north. If they start at the same place and same time, how long will it take them to be 14 miles apart?
- f. **Algebra:** $x + 3 = 5.8$
- g. **Geometry:** Approximate the volume of this prism.



- h. **Calculation:** $12 \div 4, \times 3, \times 4, \sqrt{\quad}, \times 8, + 1, \sqrt{\quad}, \times 9, + 1, \sqrt{\quad}$

problem
solving

The mystery man listened and replied. Juan said 1, the mystery man said 13. Samantha said 11, the mystery man said 113. Francisco said 5, the mystery man said 53. Wally whispered. The mystery man said 5283. What did Wally whisper?

New Concept

Increasing Knowledge

Percents are commonly used to describe part of a whole.

- Shanna answered 92% of the questions correctly.
- A basketball player has made 80% of her free throws.
- The governor was elected with 56% of the vote.

In this lesson we will use a three-row ratio table to help us solve percent problems about parts of a whole. A percent is a ratio, with the given percent representing the part and 100% representing the total.

Example 1

Thirty percent of the students ride the bus. If 210 do not ride the bus, how many students are there in all?

Solution

We draw a three-row ratio table and fill it in as completely as possible.

If 30% ride the bus, then 70% do not. To write a proportion we use the row with two known numbers and the row with the number we want to find.

	Percent	Count	
Bus	30	a	
Not Bus	(70)	210	$\rightarrow \frac{70}{100} = \frac{210}{t}$
Total	100	t	$\rightarrow \frac{70}{100} = \frac{210}{t}$

$$70t = 21,000$$

$$t = 300$$

There were **300 students** in all.

Example 2**Thinking Skill****Analyze**

How could we use the answer to find what percent of the questions Shanna answered incorrectly?

Shanna correctly answered 17 of the 20 questions on the game show. What percent of the questions did she answer correctly?

Solution

In an earlier lesson we found the fraction of correct answers and then found the equivalent percent. Here we use a proportion to find the percent Shanna answered correctly. We draw a three-row ratio table and fill it in as completely as possible. We want to find the percent for the number correct, so we use the numbers in the first and third rows to write the proportion.

	Percent	Count	
Correct	c	17	$\rightarrow \frac{c}{100} = \frac{17}{20}$
Incorrect	n	3	
Total	100	20	$\rightarrow \frac{c}{100} = \frac{17}{20}$

$$20c = 17 \cdot 100$$

$$\frac{20c}{20} = \frac{17 \cdot 100}{20}$$

$$c = 85$$

We find that **85%** of Shanna's answers were correct.

Practice Set

Formulate Solve each of these problems using a proportion. Begin by making a ratio table.

- Mariah has read 135 of the 180 pages in the book. What percent of the book has she read?

- b. McGregor is growing alfalfa on 180 acres, which is 30% of his farmland. McGregor has how many acres of farmland?
- c. The frequency of the letter e in written English is about 13%. On a page of a novel that has about 2000 letters per page, about how many occurrences of the letter e can we expect to find?
- d. The Springfield Sluggers won 64% of their games and lost 9 games. How many games did the Sluggers win?

Written Practice

Strengthening Concepts

- * 1. **Analyze** ⁽⁴⁵⁾ The ratio of people watching whales to people fishing was 5 to 7. If there were 72 in all, how many people were fishing?
2. ^(4, 11) Sergio purchased 4 items for \$1.50 each. Sales tax was 8.25%. What was the total price?
3. ⁽⁵⁾ At back-to-school night, $\frac{1}{2}$ of the algebra students came, and $\frac{1}{3}$ of the pre-algebra students came. If there are 62 algebra students and 66 pre-algebra students, how many of the students came to back-to-school night?
4. ⁽⁴⁸⁾ Betsy correctly answered 19 of the 25 trivia questions. What percent of the questions did she answer correctly?
- * 5. **Evaluate** ⁽⁴⁴⁾ Find the slope of the line passing through points $(-2, 2)$ and $(2, 0)$.

Simplify.

6. ⁽²⁷⁾ $\frac{a^2b^2c}{12a^2c^2}$

7. ^(13, 22) $\frac{4}{9} \div \frac{2}{3} - \frac{1}{2}$

8. ^(15, 21) $3^3 \div 3 + 3 - 3(3)$

9. ^(13, 15) $\left(\frac{2}{5}\right)^2 - \left(\frac{1}{5}\right)^2$

* 10. ⁽⁴⁶⁾ $\frac{5.2 \times 10^7}{1.3 \times 10^4}$

* 11. ⁽⁴⁶⁾ $(5.0 \times 10^7)(3.0 \times 10^4)$

12. ^(24, 25) $(12.4 + 2)(1 - 0.998)$

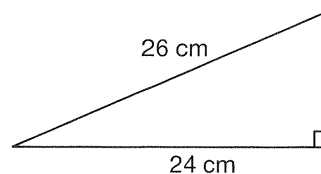
- * 13. ⁽⁴¹⁾ Graph $y = x - 3$. Is the point $(3, 0)$ on the line?

- * 14. ^(39, 40) Find the **a** area and **b** the circumference of a circle that has a diameter of 40 cm. Use 3.14 for π .

- * 15. ⁽⁴²⁾ Find the volume of a drawer with dimensions $10'' \times 15'' \times 4''$.

16. ^(20, Inv. 2) For **a–c**, refer to this triangle.

- a. Classify the triangle by angles.
- b. Find the area of the triangle.
- c. Find the perimeter of the triangle.



Solve.

17. ^(13, 38) $x - 3\frac{1}{3} = 2\frac{1}{2}$

18. ^(13, 38) $x - \frac{2}{3} = \frac{5}{6}$

19. $4x^2 = 400$
(36, 38)

* 20. $\frac{1.2}{3} = \frac{x}{2}$
(44)

21. a. Write 250% as a decimal and reduced fraction.
(11, 12)
- b. Which of the three forms would you choose to find the price of a home that is now worth 250% of its original price of \$160,000?

Combine like terms to simplify.

22. $abc - cab + bac - 2b^2$
(31)

23. $5x^2y - 4yx^2 + 2x - x$
(31)

- * 24. At a high-rise hotel, the ground floor is 3 feet above street level. Each successive floor is 10 feet above the one below it. At the right is a chart of the number of floors (x) a person is above the ground floor and how high they are in feet (y) above street level. Write an equation for the function shown in the table. Is the function a proportional relationship? How do you know?

x	y
1	13
2	23
3	33
4	43

- * 25. A circle with a radius of 4 in. is divided into congruent sectors, each with a central angle of 30° .
(40)

- a. How many sectors cover the circle?
- b. What is the area of one sector? (Round to the nearest square inch.)

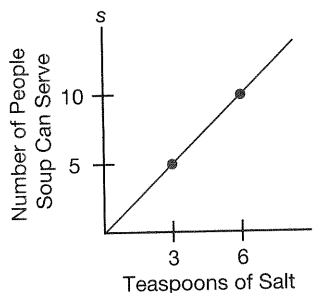
26. A rate formula is $r = \frac{d}{t}$. Find r when $d = 26.2$ miles and $t = 2$ hours.
(14, 25)

27. An entomologist recorded the lengths of two newly discovered species of beetles. The first beetle was 2.76 cm and the second was 3.14 cm long. What is the difference in their lengths?
(24)

28. When Jon began eating lunch the clock read 12:30. Fifteen minutes later the clock read 12:45. Describe the transformation of the minute hand on the clock between 12:30 and 12:45.
(26)

- * 29. **Evaluate** Rivera is creating a package for a new product. The package is a box that is 5 in. by 9 in. by 14 in. He needs to let the manufacturer know the amount of surface area for each box. What is the surface area?
(43)

- * 30. The graph shows the relationship between the number of servings of soup (s) and the number of teaspoons (t) of salt in the soup. Is the relationship proportional? If the relationship is proportional, write an equation for the relationship and state the constant of proportionality, k .
(41)



• Solving Rate Problems with Proportions and Equations

Power Up

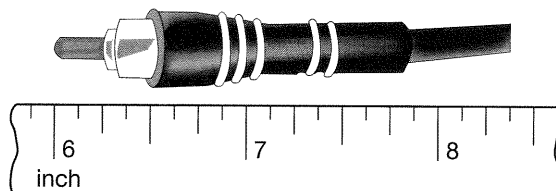
Building Power

facts

mental math

Power Up J

- a. **Number Sense:** 10.5×4
- b. **Statistics:** Find the mean of 13, 3, and 2.
- c. **Fractional Parts:** Because of the sale, Liz only had to pay 75% of the original price of \$28. How much did she pay? What was the percent of discount?
- d. **Measurement:** Find the length of this section of cable.



- e. **Geometry:** Two angles of a triangle measure 50° and 30° . Is the triangle acute, obtuse, or right?
- f. **Proportions:** $\frac{6}{x} = \frac{12}{2}$
- g. **Powers/Roots:** $\sqrt{3 \cdot 3} + \sqrt{2 \cdot 2}$
- h. **Calculation:** Start with a dozen, $\times 4$, $+ 1$, $\sqrt{\quad}$, $\times 5$, $+ 1$, $\sqrt{\quad}$, $- 2$, $\sqrt{\quad}$, $- 2$, $\sqrt{\quad}$

problem solving

Five coins total \$1. What are the coins?

New Concept

Increasing Knowledge

Math Language

Recall that a **rate** is a ratio that compares two different units. A **unit rate** is a rate with a denominator of 1 unit.

Recall that a rate is a ratio of two measures. For example, speed is a rate that is a ratio of distance to time. If an object's speed is constant, then the ratio of its distance traveled to time of travel is constant. A car traveling at an average speed of 50 miles per hour travels the following distances in the given time periods.

$$\frac{50 \text{ miles}}{1 \text{ hour}} \quad \frac{100 \text{ miles}}{2 \text{ hours}} \quad \frac{150 \text{ miles}}{3 \text{ hours}} \quad \frac{200 \text{ miles}}{4 \text{ hours}}$$

These ratios are equivalent, and each reduces to 50 miles/1 hour, which is the unit rate. Therefore, the relationship is proportional, and any two of these ratios form a proportion. Thus we may solve rate problems two ways: with proportions or by multiplying by the unit rate.

These two methods are based on two forms of the rate equation.

1. The ratio is constant: $\frac{y}{x} = k$
2. The unit rate is constant: $y = kx$

All proportional relationships can be expressed with these two equations. Examples 1 and 2 show how we can use a proportion or multiplying by the unit rate to solve the same problem.

Example 1

If 6 books weigh 15 pounds, how much would 20 books weigh?

Solution

We do not need to find the weight per book. Instead we can use the given information to write a proportion. We are given the ratio of books to weight in one case and we are asked to complete the ratio in another case. We record the information in a table with the headings Case 1 and Case 2.

Books	Case 1	Case 2	
	6	20	→ $\frac{6}{15} = \frac{20}{p}$
Weight (lbs)	15	p	→ $6p = 15 \cdot 20$

$$p = \frac{15 \cdot 20}{6}$$

$$p = 50$$

We find that 20 books would weigh **50 pounds**.

Example 2

If 6 books weigh 15 pounds, what is the unit rate? What is the weight of 20 books? Write an equation that shows how to find the weight (w) of books knowing the number (n) of books and the unit rate.

Solution

To find the unit rate (weight of one book), we divide:

$$\frac{\text{weight } (w)}{\text{number } (n)} = \frac{15 \text{ pounds}}{6 \text{ books}} = \mathbf{2.5 \text{ pounds per book}}$$

To find the weight of a number of books, we multiply the number by the unit rate:

$$\mathbf{w = 2.5n}$$

To find the weight of 20 books, we multiply the unit rate by 20:

$$w = 2.5 \cdot 20 = \mathbf{50 \text{ lbs}}$$

Thinking Skill

Connect

What method did we use to find the weight of 20 books? Why is the relationship proportional?

Example 3

Julio is riding in a 50 km bike race. He passed the 15 km mark in 27 minutes. If Julio continues to ride at the same rate, what will be his time for the whole race?

Solution

At the 15 km mark, Julio was less than one-third of the way through the race and he had been riding for nearly half an hour.

Predict Will it take Julio more or less than one hour to complete the whole race?

To solve the problem we can write a proportion. We use the given distance/time ratio for one point in the race and the incomplete ratio for the end of the race.

	One Point in the Race	End of the Race	
Distance (km)	15	50	$\rightarrow \frac{15}{27} = \frac{50}{m}$
Time (min)	27	m	$\rightarrow \frac{15}{27} = \frac{50}{m}$

$$15m = 50 \cdot 27$$

$$m = \frac{50 \cdot 27}{15}$$

$$m = 90$$

If Julio continues riding at the same rate, his time for the whole race will be **90 minutes**, which is $1\frac{1}{2}$ hours.

Example 4

In example 3, what is Julio's rate in km/min? Write an equation that relates Julio's distance to time riding.

Solution

The ratio of distance to time is:

$$\frac{d}{t} = \frac{15 \text{ km}}{27 \text{ min}}$$

$$\frac{d}{t} = \frac{5 \text{ km}}{9 \text{ min}}$$

This can also be expressed:

$$d = \frac{5}{9} t$$

Example 5

Three tickets cost \$20.25. How much would 7 tickets cost? What is the unit cost?

Solution

Since 7 is more than double 3, we expect 7 tickets to cost more than twice as much as 3 tickets, that is, more than \$40.

We record the information in a ratio table. Then we write and solve a proportion.

	Actual	Estimate
Tickets	3	7
Price (\$)	20.25	p

$$\rightarrow \frac{3}{20.25} = \frac{7}{p}$$

$$\rightarrow 3p = 7 \cdot 20.5$$

$$p = \frac{7 \cdot 20.25}{3}$$

$$p = 47.25$$

Seven tickets would cost **\$47.25**, which agrees with our original estimate. We find the unit cost by dividing \$20.25 by 3. The unit cost is **\$6.75**.

Practice Set

For problems a–c below record the information in a ratio table. Estimate an answer and then solve the problem by writing and solving a proportion.

- a. If 5 pounds of seedless grapes cost \$3.80, how much would 9 pounds cost?
- b. If 8 cows eat 200 pounds of hay a day, how many pounds of hay would 20 cows eat in a day?
- c. Darcie can type 135 words in 3 minutes. At that rate, how many minutes would it take her to type 450 words?
- d. **Analyze** Find the price per pound of grapes in a, the pounds of hay per cow in b, and the words per minute in c.
- e. Solve problems a and b again using a rate equation instead of a proportion.

Written Practice

Strengthening Concepts

Evaluate For problems 1–2, record the information in a ratio table. Estimate and then solve by writing and solving a proportion.

- * 1. ⁽⁴⁹⁾ Marcus can run 3 miles in 18 minutes. At that rate, how long will it take him to run 7 miles?
- * 2. ⁽⁴⁹⁾ Felicia’s pets eat thirty pounds of food in two weeks. How many pounds of food would they eat in five weeks?

- * 3. **Analyze** In a bag of 60 marbles, 18 are green. If one marble is drawn from the bag, what is the probability the marble is
 (32) a. green? b. not green?

- * 4. **Evaluate** At the flag shop, for every 13 stripes there are 50 stars. If there are 10,000 stars, then how many more stars are there than stripes?
 (45)

5. The shipping charges for the store include a \$3.50 base fee plus \$0.65 per pound. How much would it cost to ship a 10 pound order?
 (3, 4)

Solve.

6. $1.4x = 84$
 (25, 38)

7. $x + 2.6 = 4$
 (24, 38)

8. $\frac{x}{3} = 1.2$
 (25, 38)

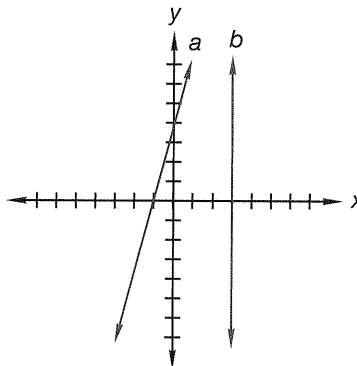
* 9. $x - 7 = -2$
 (31, 38)

- * 10. Austin has answered 21 of the 25 questions. What percent of the questions has he answered?
 (48)

- * 11. **Analyze** If 70% of the members remembered the password but 21 members forgot, then how many members were there in all?
 (48)

- * 12. Refer to the graph of lines a and b to answer the following questions.
 (Inv. 1, 44)

- a. What is the slope of line a ?
 b. Which line is perpendicular to the x -axis?
 c. Which line intersects the y -axis at positive 4?
 d. In which quadrant do lines a and b intersect?



- * 13. Graph $y = 3$. Is the point $(6, 3)$ on the line?
 (41)

14. At the park is a circular wading pool 20 feet in diameter. If parents are seated on the edge of the pool about every three feet, how many parents are sitting on the edge of the pool?
 (39)

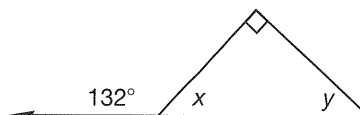
15. Find the volume of an oven with inside dimensions 3 ft by 1.5 ft by 3 ft.
 (42)

16. How many edges, vertices, and faces does a number cube have?
 (Inv. 4)

17. Which of the following is not a parallelogram?
 (Inv. 3)

A square B rectangle C trapezoid D rhombus

18. Find x and y .
 (18, 20)



19. About twenty-one percent of the earth's atmosphere is oxygen. Write 21% as a decimal and a fraction.

(11, 12)

20. Find $\frac{1}{2}mv^2$ when $m = 8$ and $v = 2$.

(14, 15)

* 21. Sketch a triangular prism that has an equilateral base.

(Inv. 4)

22. Yanos and Xena play a numbers game. The table shows some numbers Xena says and the numbers Yanos says in response.

(41)

X	6	2	1	-2
Y	3	1	$\frac{1}{2}$	-1

a. Describe the rule Yanos uses.

b. Write the rule as an equation beginning with $y =$.

c. Sketch a graph that shows all the pairs of numbers Xena and Yanos could say using the rule.

Combine like terms to simplify.

23. $5(x + 3) - 2(x + 4)$

(31, 36)

24. $-7x + 2(x^2 + 4x - 1)$

(31, 36)

Simplify.

* 25. $\frac{-(-3)}{-6}$

(36)

* 26. $-(-4) - 3$

(31, 33)

* 27. $\left(1\frac{1}{2}\right)^2 - 1\frac{1}{2}$

(23, 13)

* 28. $\frac{(5.2 \times 10^9)}{(4 \times 10^7)}$

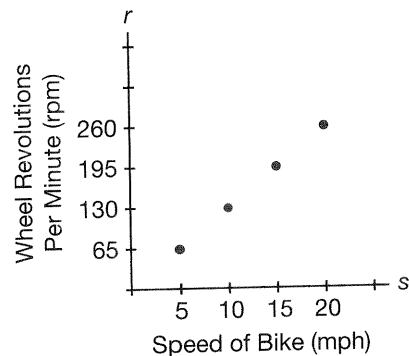
(46)

29. Find all values of x : $3|x| = 6$

(1, 14)

* 30. **Evaluate** What relationship does the graph show? Is the relationship proportional? How do you know? Using the information given, calculate the number of revolutions per minute at one mile per hour. Then write an equation for the relationship. If it is proportional, state the constant of proportionality, k .

(41)



• Solving Multi-Step Equations

Power Up

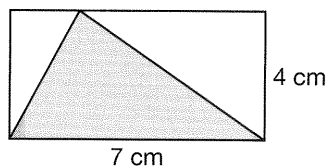
Building Power

facts

Power Up J

mental
math

- a. **Number Sense:** 6.4×4
- b. **Statistics:** Find the mean of 5, 6, and 1.
- c. **Fractional Parts:** Three-eighths of the class wore jackets. There were 32 students in the class. How many wore jackets?
- d. **Scientific Notation:** Write 4.05×10^5 in standard notation.
- e. **Rate:** Robert rode 8 miles per hour north. Stephen rode 7 miles per hour north. If they start at the same place and time, how far apart are they after 1 hour? After 2 hours?
- f. **Geometry:** Find the area of the rectangle, then the area of the shaded triangle.



- g. **Estimation:** Approximate the total for this shopping trip: $\$3.47 + 2 \times \$5.99 + \$39.97 + \1.47
- h. **Calculation:** $8 + 7, \div 5, \times 9, - 2, \sqrt{\quad}, \times 11, + 1, \div 7, + 1, \sqrt{\quad}, \times 1000$

problem
solving

$$\sqrt{900} = 30; \sqrt{1600} = 40; \sqrt{2500} = 50; \text{ Find } \sqrt{2025}$$

New Concept

Increasing Knowledge

We have used inverse operations to isolate a variable in an equation. The equations we will solve in this lesson require two or more steps to isolate the variable. Recall that isolating a variable, such as x , actually means that $1x + 0$ is on one side of the equal sign.

Example 1

Thinking Skill

Connect

How are the steps to solving and checking an equation related to the order of operations?

Suppose a taxi charges \$1.20 to start a ride plus \$3 per mile. If a ride costs \$5.40, how far was the ride? Let x represent the distance traveled in miles. Solve this equation to find the length of the ride.

$$3x + 1.20 = 5.40$$

Solution

We see that x is multiplied by 3 and that 1.20 is added to that product. We undo these operations in reverse order. First we subtract 1.20 from both sides of the equation, which leaves $3x$ on the left side. Then we divide both sides by 3 to isolate x . We find that x equals 1.4.

Step:	Justification:
$3x + 1.20 = 5.40$	Given
$3x + 1.20 - 1.20 = 5.40 - 1.20$	Subtracted 1.2 from both sides
$3x = 4.20$	Simplified
$\frac{3x}{3} = \frac{4.20}{3}$	Divided both sides by 3
$x = 1.4$	Simplified

The solution means that the taxi ride was **1.4 miles**.

We check the solution by substituting 1.4 for x in the original equation. Then we simplify.

$3(1.4) + 1.20 = 5.40$	Substituted
$4.20 + 1.20 = 5.40$	Simplified $3(1.4)$
$5.40 = 5.40$	Simplified

Example 2

Solve: $-2x - 5 = 9$

Solution

We see that x is multiplied by -2 and 5 is subtracted from that product. First we add 5 to both sides of the equation. Then we divide both sides by -2 .

Step:	Justification:
$-2x - 5 = 9$	Given
$-2x - 5 - 5 = 9 + 5$	Added 5 to both sides
$-2x = 14$	Simplified
$\frac{-2x}{-2} = \frac{14}{-2}$	Divided both sides by -2
$x = -7$	Simplified

We check the solution in the original equation.

$-2(-7) - 5 = 9$	Substituted -7 for x
$14 - 5 = 9$	Simplified $-2(-7)$
$9 = 9$	Simplified $14 - 5$

Every step in solving an equation forms a new equation with the same solution. Step by step we form simpler equations until the final equation states the value(s) of the variable.

Example 3**Solve:** $3x + 4 - x = 28$ **Solution**

We write a sequence of simpler but equivalent equations until the variable is isolated.

In this equation the variable appears twice. We collect like terms and then proceed to isolate the variable.

Step:	Justification:
$3x + 4 - x = 28$	Given equation
$(3x - x) + 4 = 28$	Commutative and Associative Properties
$2x + 4 = 28$	Added $3x$ and $-x$
$2x = 24$	Subtracted 4 from both sides
$x = 12$	Divided both sides by 2

We check the solution by replacing each occurrence of x with 12 in the original equation.

Step:	Justification:
$3x + 4 - x = 28$	Given equation
$3(12) + 4 - (12) = 28$	Substituted 12 for x
$36 + 4 - 12 = 28$	Simplified
$28 = 28 \checkmark$	Simplified

Practice Set

Justify Solve. Check your work.

- | | |
|------------------------|---------------------------|
| a. $3x + 5 = 50$ | b. $4x - 12 = 60$ |
| c. $30n + 22 = 292$ | d. $\frac{x}{5} + 4 = 13$ |
| e. $-2x + 17 = 3$ | f. $3m - 1.5 = 4.2$ |
| g. $4x + 10 + x = 100$ | h. $7x - 12 - x = 24$ |

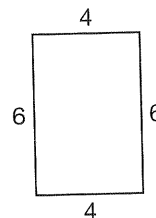
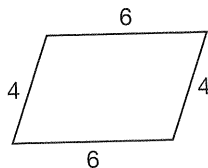
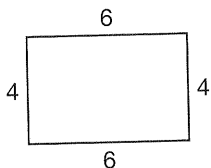
- i. A computer repair shop charges \$40 per hour plus the cost of parts. If a repair bill of \$125 includes \$35 in parts, then how long did the repair shop work on the computer? Solve this equation to find the answer. (Express your answer in both decimal form and in hours and minutes.)

$$40x + 35 = 125$$

Written Practice*Strengthening Concepts*

- * 1. **Analyze** ⁽⁴⁵⁾ The ratio of in-state to out-of-state visitors at the zoo is approximately 7 to 3. If 2000 people visited the zoo, about how many people were from out of state?
2. ^(3, 4) Arnold is planning a party for his friends. Renting the facilities will cost \$500. Feeding each friend will cost \$15. What will the total cost of the party be if Arnold invites 50 friends?

- * 3. **Generalize** Consider the quadrilaterals below.
(35)



Choose the correct word to complete the conjecture: Quadrilaterals with corresponding sides of equal length are _____ (sometimes/always/never) congruent."

Analyze Solve.

* 4. $5x + 25 = 100$
(50)

* 6. $2x - 1.2 = 3$
(50)

* 8. $-2w + 22 = 30$
(50)

* 5. $\frac{x}{2} + 8 = 16$
(50)

* 7. $-4m + 5.5 = 9.5$
(50)

* 9. $\frac{1}{2}x - \frac{1}{3} = \frac{2}{3}$
(50)

Generalize Simplify.

* 10. $-3^2 + (-3)^2$
(36)

* 12. $\frac{mc^2xc}{mx^2}$
(27)

* 14. $\frac{2.7 \times 10^8}{9 \times 10^3}$
(28, 46)

* 11. $\frac{1}{3} + \frac{5}{6} \cdot \frac{4}{5}$
(13, 22)

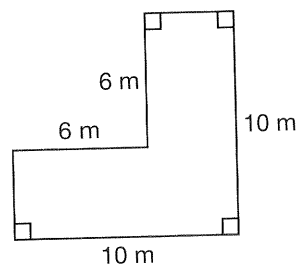
* 13. $1\frac{1}{2} \cdot 2\frac{2}{3} - 3\frac{3}{4}$
(13, 23)

* 15. $\frac{0.24 - 0.024}{0.02}$
(24, 25)

- * 16. Find the **a** area and **b** circumference of the circle with radius 1 meter.
(39, 40) Express the measures in terms of π .

- * 17. Estimate the volume in cubic feet of a cabinet with height 4 feet
(42) 2 inches, depth 13 inches, and width 2 feet 11 inches.

- * 18. Find the **a** area and **b** perimeter of this
(8) figure.



- * 19. The company will charge \$40 for each item it sells.
(41)
- Make a function table of possible x - and y -values with x representing the number of items sold and y representing the revenue from the sales.
 - Write an equation for the function table:

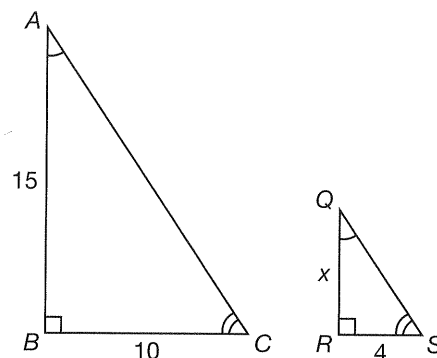
20. Write 7.5% **a** as a decimal and **b** as a reduced fraction.

(11, 12)

- * 21. Consider the triangles.

(35)

- a. Explain how you know that the triangles are similar.
- b. What is the scale factor from $\triangle ABC$ to $\triangle QRS$?
- c. Find x .



22. Find $\frac{r^2 - 4r}{t}$ when $r = 3$ and $t = -1$.

(14, 15)

23. Carlos was making necklaces to sell at the school carnival. He sold each necklace for \$3. Make a function table that relates the number of necklaces sold to the amount of money collected. Write an equation for the rule. Is the function linear? Is it proportional?

(41)

- * 24. **Analyze** Geraldo is going to paint the interior walls of the lobby of the local history museum. The room is 40 ft by 60 ft. Its height is 16 ft. In order to purchase the right amount of paint, Geraldo must calculate the lateral surface area of the room. What is the lateral surface area?

(43)

- * 25. There are approximately 2.25×10^{12} grains of sand on a stretch of beach. If a bucket holds 1.25×10^9 grains of sand, how many buckets would it take to remove all of the sand from the beach?

(46)

- * 26. Last month, Andrea missed two days of school because she had a cold. What percent of school days did Andrea miss? Hint: Assume that there are 20 school days in a month.

(48)

- * 27. **Evaluate** If the bowling alley charges \$3.50 for a pair of shoes and \$5.50 per game, how many games will Rita be able to play with a \$20 dollar bill? Write and solve an equation and check the solution.

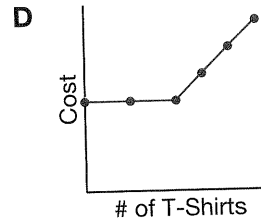
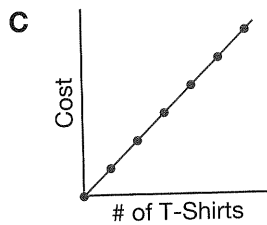
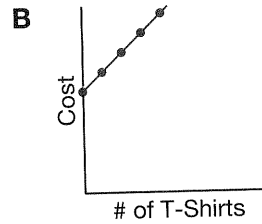
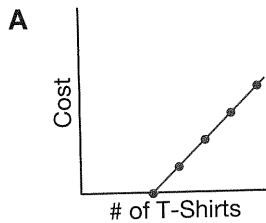
(50)

28. Write the mixed number $1\frac{1}{9}$ as a decimal.

(30)

- * 29. **Represent** Graph $y = -2x$. Is the point $(-1, -2)$ on the line? What is the slope of the line?

30. For a promotion, the clothes shop is giving every customer 2 free T-shirts. If the customers want more T-shirts, they must buy them for \$5 each. Which graph represents the relationship between the number of shirts a customer receives and the amount of money the customer pays for the shirts? Is the relationship proportional? Why or why not?



Early Finishers

Real-World Application

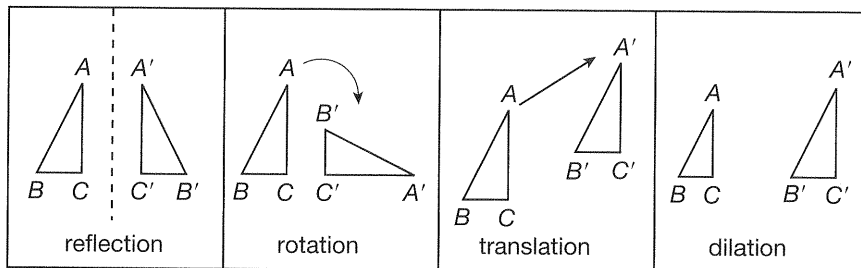
Ferdinand is planting four rose bushes in the city park. He is planning to place the bushes into four rectangular planters that are 3 feet long, 1 foot wide and 1.5 feet deep. How many bags containing 1.25 feet of cubic soil will he need to fill all four planters two-thirds full?



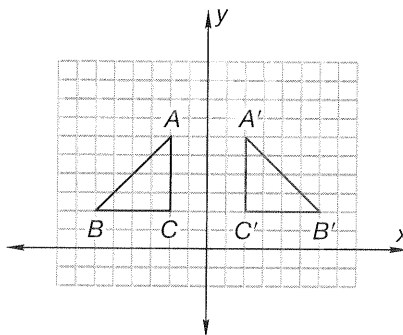
Focus on

• Graphing Transformations

Recall that **transformations** are operations on a geometric figure that alter its position or size. In this investigation we will graph different transformations on the coordinate plane.



A **reflection** occurs across a line. Below we show the reflection of $\triangle ABC$ across the y -axis. If we positioned a vertical mirror on the line, the reflection of $\triangle ABC$ would appear to be on the other side of the y -axis and the same distance from the y -axis as $\triangle A'B'C'$ (read “A prime, B prime, C prime”). A segment between corresponding points of a figure and its reflection is perpendicular to the line of reflection. If we were to fold a graph along the line of reflection, the figures would align exactly.



1. On a coordinate plane draw triangle ABC with A at $(-2, 6)$, B at $(-5, 2)$, and C at $(-2, 2)$. Then draw the reflection of $\triangle ABC$ across the x -axis. Label the coordinates of the vertices.
2. Describe how the coordinates of the reflection across the x -axis compare with the coordinates of the original triangle.
3. On the same coordinate plane as problem 1, draw a vertical line through the x -axis at $x = 1$. (The line should be parallel to the y -axis.) Then graph the reflection of $\triangle A'B'C'$ across the line $x = 1$. Name the reflection $\triangle A''B''C''$ (read “A double prime, B double prime, C double prime”) and label the coordinates of the vertices.