

Applications

1. Ms. Chang's class decides to use the *Cool Tee's* company to make their T-shirts. The following equation represents the relationship between cost C and the number of T-shirts n .

$$C = 2n + 20$$

- The class wants to buy 25 T-shirts from *Cool Tee's*. Describe how you can use a table and a graph to find the cost for 25 T-shirts.
- Suppose the class has \$80 to spend on T-shirts. Describe how you can use a table and a graph to find the number of T-shirts the class can buy.
- Sophia writes the following equation in her notebook:

$$C = 2(15) + 20$$

What information is Sophia looking for?

- Elisa uses the coordinates (30, 80) to find information about the cost of the T-shirts. What information is she looking for?

2. The following equations represent some walkathon pledge plans.

Plan 1: $14 = 2x$

Plan 2: $y = 3.5(10) + 10$

Plan 3: $100 = 1.5x + 55$

In each equation, y is the amount owed in dollars, and x is the number of kilometers walked. For each equation:

- Tell what information is unknown.
 - Describe how you could find the information.
3. Find the solution (the value of the variable for each equation).
- $y = 3(10) + 15$
 - $24 = x + 2$
 - $10 = 2x + 4$
4. Consider the equation: $y = 5x - 15$.
- Find y if $x = 1$.
 - Find x if $y = 50$.
 - Describe how you can use a table or graph to answer parts (a) and (b).

For each situation in Exercises 5–8, find the number of coins in each pouch.



9. Rudo’s grandfather gives Rudo \$5 and then 50¢ for each math question he answers correctly on his math exams for the year.
- Write an equation that represents the amount of money that Rudo receives during a school year. Explain what the variables and numbers mean.
 - Use the equation to find the number of correct answers Rudo needs to buy a new shirt that costs \$25. Show your work.
 - Rudo answered all 12 problems correctly on his first exam. How much money is he assured of receiving for the year? Show your work.
10. For each equation, sketch a picture using pouches and coins, and then determine how many coins are in a pouch.
- $3x = 12$
 - $2x + 5 = 19$
 - $4x + 5 = 2x + 19$
 - $x + 12 = 2x + 6$
 - $3(x + 4) = 18$

- 11.** For parts (a) and (b), find the mystery number and explain your reasoning.
- If you add 15 to 3 times the mystery number, you get 78. What is the mystery number?
 - If you subtract 27 from 5 times the mystery number, you get 83. What is the mystery number?
 - Make up clues for a riddle whose mystery number is 9.
- 12.** Use properties of equality and numbers to solve each equation for x . Check your answers.
- $7 + 3x = 5x + 13$
 - $3x - 7 = 5x + 13$
 - $7 - 3x = 5x + 13$
 - $3x + 7 = 5x - 13$
- 13. Multiple Choice** Which of the following is a solution to the equation $11 = -3x - 10$?
- A.** 1.3 **B.** $-\frac{1}{3}$ **C.** -7 **D.** 24
- 14.** Use properties of equality and numbers to solve each equation for x . Check your answers.
- $3x + 5 = 20$
 - $3x - 5 = 20$
 - $3x + 5 = -20$
 - $-3x + 5 = 20$
 - $-3x - 5 = -20$
- 15.** Solve each equation. Check your answers.
- $3(x + 2) = 12$
 - $3(x + 2) = x - 18$
 - $3(x + 2) = 2x$
 - $3(x + 2) = -15$
- 16.** Two students' solutions to the equation $6(x + 4) = 3x - 2$ are shown. Both students made an error. Find the errors and give a correct solution.

Student 1

$$\begin{aligned}
 6(x + 4) &= 3x - 2 \\
 x + 4 &= 3x - 2 - 6 \\
 x + 4 &= 3x - 8 \\
 x + 4 + 8 &= 3x - 8 + 8 \\
 x + 12 &= 3x \\
 12 &= 2x \\
 x &= 6
 \end{aligned}$$

Student 2

$$\begin{aligned}
 6(x + 4) &= 3x - 2 \\
 6x + 4 &= 3x - 2 \\
 3x + 4 &= -2 \\
 3x + 4 - 4 &= -2 - 4 \\
 3x &= -6 \\
 x &= -2
 \end{aligned}$$

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- 17.** Two students' solutions to the equation $58.5 = 3.5x - 6$ are shown below. Both students made an error. Find the errors and give a correct solution.

Student 1

$$58.5 = 3.5x - 6$$

$$58.5 - 6 = 3.5x$$

$$52.5 = 3.5x$$

$$\frac{52.5}{3.5} = x$$

$$\text{so, } x = 15$$

Student 2

$$58.5 = 3.5x - 6$$

$$58.5 + 6 = 3.5x - 6 + 6$$

$$64.5 = 3.5x$$

$$\frac{64.5}{3.5} = \frac{3.5}{3.5}x$$

$$\text{so, } x \approx 1.84$$

For Exercises 18 and 19, use the equation $y = 4 - 3x$.

- 18.** Find y if

a. $x = 4$

b. $x = -3$

c. $x = 2$

d. $x = -\frac{4}{3}$

e. $x = 0$

- 19.** Find x when:

a. $y = 0$

b. $y = 21$

c. $y = -15$

d. $y = 3.5$

- 20.** Explain how the information you found for Exercises 18 and 19 relates to locating points on a line representing $y = 4 - 3x$.

- 21.** Use the equation $P = 10 - 2.5c$.

a. Find P when $c = 3.2$.

b. Find c when $P = 85$.

- c.** Describe how you can use a table or graph to answer parts (a) and (b).

- 22.** Use the equation $m = 15.75 + 3.2d$.

- a.** Find m when:

i. $d = 20$

ii. $d = 0$

iii. $d = 3.2$

- b.** Find d when:

i. $m = 54.15$

ii. $m = 0$

iii. $m = 100$

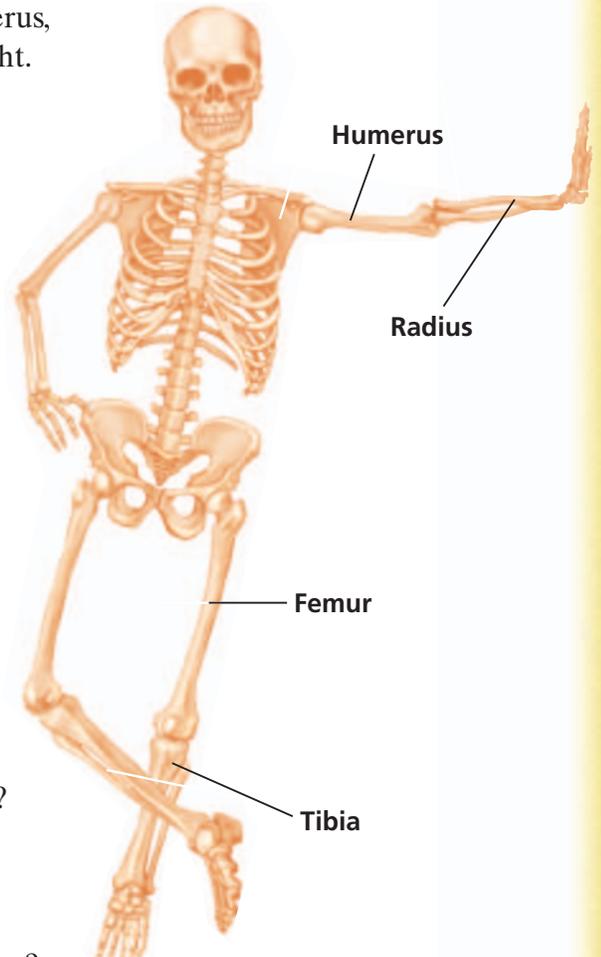
- 23.** Forensic scientists can estimate a person's height by measuring the length of certain bones, including the femur, the tibia, the humerus, and the radius.

The table below gives equations for the relationships between the length of each bone and the estimated height of males and females. These relationships were found by scientists after much study and data collection.

In the table, F represents the length of the femur, T the length of the tibia, H the length of the humerus, R the length of the radius, and h the person's height. All measurements are in centimeters.

| Bone | Male | Female |
|---------|-----------------------|-----------------------|
| Femur | $h = 69.089 + 2.238F$ | $h = 61.412 + 2.317F$ |
| Tibia | $h = 81.688 + 2.392T$ | $h = 72.572 + 2.533T$ |
| Humerus | $h = 73.570 + 2.970H$ | $h = 64.977 + 3.144H$ |
| Radius | $h = 80.405 + 3.650R$ | $h = 73.502 + 3.876R$ |

- About how tall is a female if her femur is 46.2 centimeters long?
- About how tall is a male if his tibia is 50.1 centimeters long?
- Suppose a woman is 152 centimeters tall. About how long is her femur? Her tibia? Her humerus? Her radius?
- Suppose a man is 183 centimeters tall. About how long is his femur? His tibia? His humerus? His radius?
- Describe what the graphs would look like for each equation. What do the x - and y -intercepts represent in this problem? Does this make sense? Why?



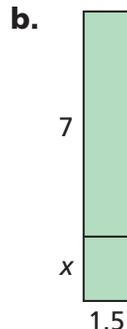
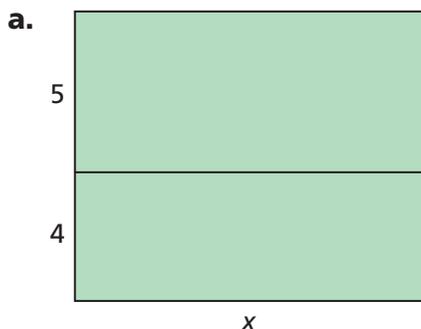
- 24.** The costs C and income I for making and selling T-shirts with a school logo are given by the equations $C = \$535 + 4.50n$ and $I = \$12n$, where n is the number of T-shirts.
- How many T-shirts must be bought and sold to break even? Explain.
 - Suppose only 50 shirts are sold. Is there a profit or loss? Explain.
 - Suppose the income is \$1,200. Is there a profit or loss? Explain.
 - For each equation, find the coordinates of a point that lies on the graph of the equation.
 - What information does this point give?
 - Describe how to use the equation to see that the point will be on the graph.
- 25.** The International Links long-distance phone company charges no monthly fee but charges 18 cents per minute for long-distance calls. The World Connections long distance company charges \$50 per month plus 10 cents per minute for long-distance calls. Compare the World Connections long-distance plan to that of International Links. Under what circumstances is it cheaper to use International Links? Explain your reasoning.
- 26.** Students at Hammond Middle School are raising money for the end-of-year school party. They decide to sell roses for Valentine's Day. The students can buy the roses for 50 cents each from a wholesaler. They also need \$60 to buy ribbon and paper to protect the roses as well as materials for advertising the sale. They sell each rose for \$1.30.
- How many roses must they sell to break even? Explain.
 - How much profit is there if they sell 50 roses? 100 roses? 200 roses?



- 27.** Ruth considers two different cable television plans. Company A has a cost plan represented by the equation $C_A = 32N$, where N is the number of months she has the plan and C_A is the total cost. Company B has a cost plan represented by the equation $C_B = 36 + 26N$, where N is the number of months she is on the plan and C_B is the total cost.
- Graph both equations on the same axis.
 - What is the point of intersection of the two graphs? What information does this give us?

Connections

- 28.** Describe what operations are indicated in each expression, then write each expression as a single number.
- $-8(4)$
 - $-2 \cdot 4$
 - $6(-5) - 10$
 - $2(-2) + 3(5)$
- 29.** Decide whether each pair of quantities is equal. Explain.
- $6(5) + 2$ and $6(5 + 2)$
 - $8 - 3x$ and $3x - 8$
 - $4 + 5$ and $5 + 4$
 - $-2(3)$ and $3(-2)$
 - $3 - 5$ and $5 - 3$
 - 2 quarters and 5 dimes
 - 1.5 liters and 15 milliliters
 - 2 out of 5 students prefer wearing sneakers to school and 50% of the students prefer wearing sneakers to school
- 30. a.** Use your knowledge about fact families to write a related sentence for $n - (-3) = 30$. Does this related sentence make it easier to find the value for n ? Why or why not?
- b.** Write a related sentence for $5 + n = -36$. Does this related sentence make it easier to find the value for n ? Why or why not?
- 31.** Write two different expressions to represent the area of each rectangle.



32. Find each quotient.

a. $\frac{12}{-3}$

b. $\frac{-12}{3}$

c. $\frac{-12}{-3}$

d. $\frac{0}{-10}$

e. $\frac{-5}{5}$

f. $\frac{5}{-5}$

g. $\frac{-5}{-5}$

33. Find the value of x that makes each equation true.

a. $3\frac{1}{2}x = \frac{3}{4}$

b. $3\frac{1}{2} = \frac{3}{4}x$

c. $\frac{7}{8}x = \frac{1}{8}$

d. $\frac{5}{6} = \frac{3}{4}x$

34. The sum S of the angles of a polygon with n sides is $S = 180(n - 2)$.

Find the angle sum of each polygon.

a. triangle

b. quadrilateral

c. hexagon

d. decagon (10-sided polygon)

e. icosagon (20-sided polygon)

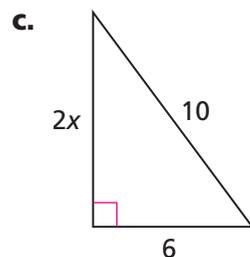
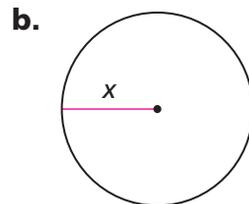
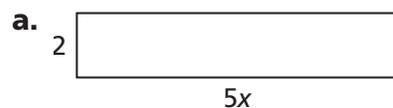
35. Suppose the polygons in Exercise 34 are regular polygons. Find the measure of an interior angle of each polygon.

36. How many sides does a polygon have if its angle sum is

a. 540 degrees

b. 1,080 degrees

37. The perimeter of each shape is 24 cm. Find the value of x .



d. Find the area of each figure in parts (a)–(c).

- 38.** World Connections long-distance phone company charges \$50 per month plus 10¢ per minute for each call.
- Write an equation for the total monthly cost C for t minutes of long-distance calls.
 - A customer makes $10\frac{1}{2}$ hours of long-distance calls in a month. How much is his bill for that month?
 - A customer receives a \$75 long-distance bill for last month's calls. How many minutes of long-distance calls did she make?
- 39.** The number of times a cricket chirps in a minute is a function of the temperature. You can use the formula

$$n = 4t - 160$$

to determine the number of chirps n a cricket makes in a minute when the temperature is t degrees Fahrenheit. If you want to estimate the temperature by counting cricket chirps, you can use the following form of the equation:

$$t = \frac{1}{4}n + 40$$

- At 60°F, how many times does a cricket chirp in a minute?
- What is the temperature if a cricket chirps 150 times in a minute?
- At what temperature does a cricket stop chirping?
- Sketch a graph of the equation with number of chirps on the x -axis and temperature on the y -axis. What information do the y -intercept and the coefficient of n give you?



- 40.** The higher the altitude, the colder the temperature. The formula $T = t - \frac{d}{150}$ is used to estimate the temperature T at different altitudes, where t is the ground temperature in degrees Celsius (Centigrade) and d is the altitude in meters.
- a.** Suppose the ground temperature is 0 degrees Celsius. What is the temperature at an altitude of 1,500 meters?
 - b.** Suppose the temperature at 300 meters is 26 degrees Celsius. What is the ground temperature?
- 41.** As a person ages beyond 30, his or her height can start to decrease by approximately 0.06 centimeter per year.
- a.** Write an equation that represents a person's height h after the age of 30. Let t be the number of years beyond 30 and H be the height at age 30.



- b.** Suppose a 60- to 70-year-old grandmother is 160 centimeters tall. About how tall was she at age 30? Explain how you found your answer.
- c.** Suppose a basketball player is 6 feet, 6 inches tall on his thirtieth birthday. About how tall will he be at age 80? (Remember, 1 inch \approx 2.54 centimeters.) Explain.

Extensions

- 42.** The Small World long-distance phone company charges 55¢ for the first minute of a long-distance call and 23¢ for each additional minute.
- Write an equation for the total cost C of an m -minute long-distance call. Explain what your variables and numbers mean.
 - How much does a 10-minute long-distance call cost?
 - Suppose a call costs $\$4.55$. How long does the call last?

- 43.** The maximum weight allowed in an elevator is 1,500 pounds.

- The average weight per adult is 150 pounds, and the average weight per child is 40 pounds. Write an equation for the number of adults A and the number of children C the elevator can hold.
- Suppose ten children are in the elevator. How many adults can get in?
- Suppose six adults are in the elevator. How many children can get in?



- 44.** Solve each equation for x . Check your answers.

- $5 - 2(x - 1) = 12$
- $5 + 2(x - 1) = 12$
- $5 - 2(x + 2) = 12$
- $5 - 2x + 2 = 12$

- 45.** Solve each equation for x . Explain what your answers might mean.

- $2(x + 3) = 3x + 3$
- $2(x + 3) = 2x + 6$
- $2(x + 3) = 2x + 3$

- 46.** Wind can affect the speed of an airplane. Suppose a plane is flying round-trip from New York City to San Francisco. The plane has a cruising speed of 300 miles per hour. The wind is blowing from west to east at 30 miles per hour.

When the plane flies into (in the opposite direction of) the wind, its speed decreases by 30 miles per hour. When the plane flies with (in the same direction as) the wind, its speed increases by 30 miles per hour.



- a.** The distance between New York City and San Francisco is 3,000 miles. Make a table that shows the total time the plane has traveled after each 200-mile interval on its trip from New York City to San Francisco and back.

Airplane Flight Times

| Distance (mi) | NYC to SF Time (h) | SF to NYC Time (h) |
|---------------|--------------------|--------------------|
| 0 | ■ | ■ |
| 200 | ■ | ■ |
| 400 | ■ | ■ |
| 600 | ■ | ■ |
| ■ | ■ | ■ |

- b.** For each direction, write an equation for the distance d traveled in t hours.
- c.** On the same set of axes, sketch graphs of the time and distance data for travel in both directions.
- d.** How long does it take a plane to fly 5,000 miles against a 30-mile-per-hour wind? With a 30-mile-per-hour wind? Explain how you found your answers.