

Lesson

3-2

Solving Equations with
Tables and Graphs

Vocabulary

solution to an equation

► **BIG IDEA** Tables and graphs lead to exact or approximate solutions to equations.

Consider an equation that contains one variable, such as $2 + x = 6$. A **solution to an equation** is a value of the variable that makes the equation true. For $2 + x = 6$, 4 is a solution because $2 + 4 = 6$.

STOP QY1

Solving with a Table and a Graph

In this lesson, you will learn two ways to solve equations: using a table and using a graph. We apply each way to solve $11 = 4x + 3$.

Mental Math

Evaluate.

- 50% of $120P$
- 5% of $120P$
- 50% of $12P$
- 5% of $12P$

Example 1

Solve $11 = 4x + 3$ using a table.

Solution Replace y with 11 and make a table of values for $y = 4x + 3$. Look in the table to the right to see what value of x gives a value of 11 for y .

Looking at the table, you can see that when $x = 2$, $y = 11$. Based on the table, you can conclude that the solution to the equation $11 = 4x + 3$ is $x = 2$.

x	$4x + 3$	y
1	$4(1) + 3$	7
2	$4(2) + 3$	11
3	$4(3) + 3$	15
4	$4(4) + 3$	19
5	$4(5) + 3$	23

► QY1

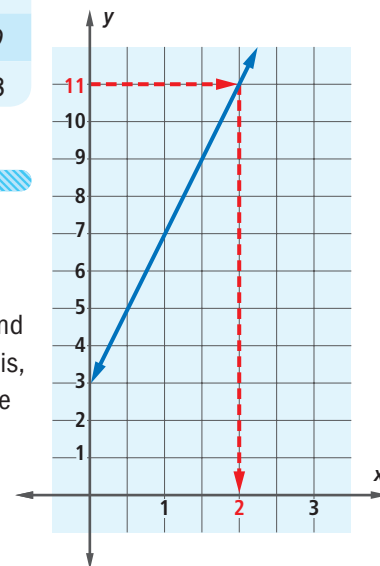
Is 5 a solution to $|-12m + 19| = 41$?

Example 2

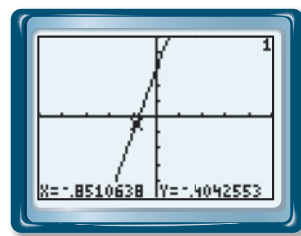
Solve $11 = 4x + 3$ using a graph.

Solution As in Example 1, replace y with 11. Then graph $y = 4x + 3$ and look for the value of x that corresponds with the value of 11 for y . To do this, start at 11 on the y -axis. Move right to the line, and then move down to the x -axis. As in Example 1, $x = 2$ is the solution.

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You can also see this on a graphing calculator. Most graphing calculators have a trace option. The trace option allows you to move a cursor along the graph. As the cursor moves, it lists the coordinates on the graph. The calculator screen at the right shows the cursor at $(-0.8510638, -0.4042553)$. Move the cursor until the y -coordinate is as close as possible to 11. Remember that the x value is only an approximation for the solution if the y value is also an approximation.



Situations Leading to Equations

Real-world situations can often be translated into relationships among numbers. If you can represent these relationships with an equation, then the methods of this and the next lesson can lead to a solution.

Example 3

Khalid lives in Alaska where there is no sales tax. He bought 3 tacos with a \$5 bill and received \$0.77 in change. Define the variable and represent the relationship with an equation.

Solution Let t represent the unknown cost of one taco. Because \$5 minus the cost of 3 tacos equals \$0.77 in change, $5 - 3t = 0.77$ is the equation.



In 2006, the states without a sales tax were Alaska, Delaware, Montana, New Hampshire, and Oregon.

Source: Federation of Tax Administrators

STOP QY2

Questions

COVERING THE IDEAS

- Determine if the value of x is a solution for the equation.
 - $11 - 9x = 47, x = 4$
 - $3x^2 + 4x = 55, x = -5$
 - $-x^3 = 64, x = -4$

In 2 and 3, solve by making a table for each equation and circling the row on the table that contains the solution.

- $6 = 2x + 2$
- $-5a + 7 = -23$

In 4 and 5, solve by making a graph for each equation and drawing lines from the y -axis to the graph, and then to the x -axis to indicate the solution.

- $y = -3x - 4, y = 2$
- $y = 5x - 18, y = -3$
- With a graphing calculator, make a table for $y = 5(5x - 2)$ using the integers from -5 to 0 .
 - Adjust the table to solve $5(5x - 2) = -26$.

► QY2

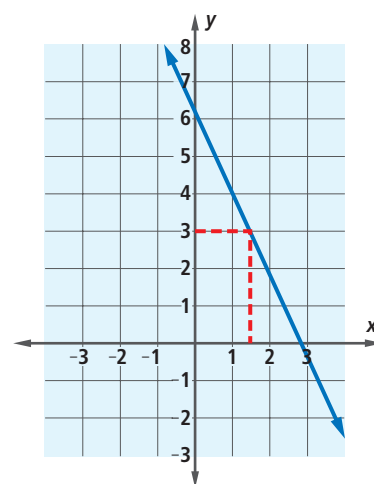
Todd has \$250 in his savings account. If he has a job that pays \$11 per hour, how many working hours will it take for him to have enough money to buy a \$481 surfboard?

In 7–9, define the variable and represent the relationship with an equation.

- Solana lives where there is no sales tax. She bought five pieces of pizza for her friends with a \$20 bill. She received \$7.65 in change. What was the price of one piece of pizza?
- Trevor is riding his bicycle across the United States. He started in a town on the East Coast and has already biked 630 miles. If he can ride 82 miles per day, how many days will it take him to complete the 3,210-mile journey?
- The Coles are saving to send their child to college. They currently have \$5,275 in the bank and are saving \$950 per year. How many years will pass before they save \$20,000?

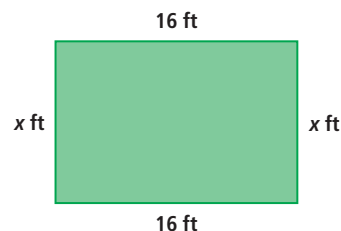
APPLYING THE MATHEMATICS

- Use a graph to solve $5 - 3t = 0.77$ from Example 3.
- Use a table to solve $250 + 11h = 481$ from QY2.
- Use a table on a graphing calculator to solve $3x + 5 = -4$.
- The graph at the right shows the equation $y = 6.2 - 2.15x$.
 - Draw dotted lines to show how to find an approximate solution to $3 = 6.2 - 2.15x$.
 - What is the approximate solution?

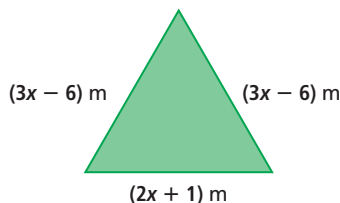


In 14 and 15, use the information provided to write an equation involving the variable. Then use any method to find the value of the variable.

- The perimeter of the rectangle at the right is 46 feet.



- The perimeter of the triangle at the right is 97 meters.



REVIEW

In 16–18, graph the equation on a calculator. Does the graph appear to be a line? You may have to adjust the window to view the graph. (Lesson 3-1)

- $y = 0.402(x - 3) + 1.97x - 0.567$
- $h = 7 - 2t^2 + t$
- $y = 4x(5 + x)$

19. Sierra redwood trees are known to be among the world's tallest trees, growing an average of 3.5 feet each year until they mature. If a redwood tree is now 28 feet tall, its height h after y years is described by $h = 28 + 3.5y$. (Lesson 3-1)
- Make a table of values for this relationship.
 - Draw a graph of this situation.
 - How tall will the tree be in 21 years?
 - How many years will it take the tree to grow to a height of 259 feet?
20. *Internet World Stats* reported in the summer of 2005 that there were about 220 million Internet users in North America. That number was growing by an average of 23 million users per year. Suppose this rate continues between 2005 and 2010. (Lessons 3-1, 1-5)
- Make a table showing the total number of millions of Internet users 0, 1, 2, 3, 4, and 5 years after 2005.
 - Let x represent the number of years after 2005. What window on your graphing calculator would be most appropriate to view the graph?
 - Draw the graph using your graphing calculator.



Many Sierra redwoods are between 250 and 300 feet tall, the tallest being about 325 feet high.

Source: California Department of Parks & Recreation

In 21 and 22, a number is given.

- Find its opposite.
- Find its reciprocal. (Lessons 2-8, 2-5)

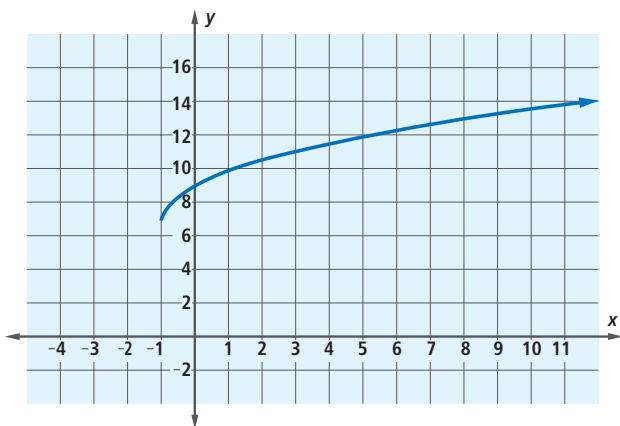
21. 8.3 22. $-\frac{26}{5}$

In 23 and 24, evaluate the expression $\frac{a+b}{3} + 3(a-b)$ for the given values of a and b . (Lesson 1-1)

23. $a = 11$ and $b = -4$ 24. $a = 11x$ and $b = 55x$

EXPLORATION

25. Use the graph below to solve $11 = 7 + 2\sqrt{x+1}$. Draw dotted lines to show your method.



QY ANSWERS

- $m = 5$ is a solution because

$$|-12 \cdot 5 + 19| =$$

$$|-60 + 19| = |-41|$$

$$= 41.$$
- 21 hr