important parts of mathematics. The skills needed for operating with numbers in arithmetic and solving equations in algebra are just that—skills. For sure, without these skills, you would not be able to solve word problems. However, they are not sufficient. That is, you need much more in the way of understanding abstract concepts to be able to solve word problems and to solve problems in your daily life. The good news is that with experience and practice all of this can be learned.

Soon you will be given a chance to solve word problems by translating English phrases into algebraic expressions and sentences into equations. The solutions to the equations are the solutions to the corresponding word problems. In this section, to help in understanding the abstract relationship between word problems and algebraic equations, we are going to reverse the process. You are going to be given an equation and asked to "make up" your own related word problem that might use this equation to find a solution. Consider the following example.

**4.** Make up a word problem which might use the equation $x + 3x = 19$ in its solution

### Example 4 Translating Equations into Word Problems

For each equation, make up your own word problem that might use the equation in its solution. Remember that the variable can be translated into something like "a number" or "some number."

**a.** $5x + 10 = -10$ **b.** $3y + 25 = 2(y + 6)$

**Solution**

**a.** Some number is multiplied by 5 and the product is increased by 10. If the result is equal to −10, what is the number?

**b.** If 25 is added to the product of 3 and a number, the result will be equal to twice the sum of the same number and 6. What is the number?

***Now work margin exercise 4.***

**Note**

In Example 4, the translations are not unique. In fact, there are many ways to make up a problem for each equation. However, all word problems should result in the same equation. You should be able to show your word problem to your classmates and have them agree that the related equation will give the solution to the problem.

***Margin Exercise Answers***

**1. a.** $7x$ **b.** $5 + n$ **c.** $4(y + 2)$ **d.** $2x + 3$ **e.** $9x - 4$ **f.** $\frac{3}{n}$ **2. a.** $12f$ **b.** $25 + 0.33x$ **3.** Answers will vary. **a.** the product of ten and a number **b.** four times a number increased by seven **c.** seven times the difference between a number and five **4.** Answers will vary. For example, a number plus three times that number is equal to nineteen. What is the number?

# 2.6 Exercises

## Concept Check

**Fill-in-the-Blank.** Complete each sentence using information found in this section.

**1.** A phrase is considered _____ if its meaning is not clear or if it has two or more possible interpretations.

**2.** Phrases such as "a number" or "the number" imply the use of a/an _____.

**3.** Key words such as "decreased by" and "minus" indicate the operation of _____.

4. The key words "cube of" and "square of" mean _____ are involved.

5. "Twice" and "three times" indicate the operation of _____.

6. "Divide" and "quotient" specify that _____ should be used.

**True/False.** Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. The order in which the values are given is particularly important when working with subtraction and division problems.

8. "More than" and "increased by" are key phrases specifying the operation of subtraction.

9. Division is indicated by the phrase "five less than a number."

10. Key phrases for parentheses can be used to limit ambiguity in English phrases.

## Practice

Write the algebraic expressions described by the English phrases. Choose your own variable. See Example 1.

1. six added to a number

2. seven more than a number

3. four less than a number

4. a number decreased by thirteen

5. the quotient of twice a number and ten

6. the difference between a number and three, all divided by seven

7. four subtracted from the product of six and a number

8. eight minus twice a number

9. the sum of four times a number and twice the same number

10. the sum of nine times a number and the same number

11. fifteen decreased by twice a number

12. twenty decreased by the product of four and a number

13. three times a number, less five times the same number

14. seven times a number, decreased by twice the number

15. nine times the sum of a number and two

16. three times the difference between a number and eight

17. thirteen less than the product of four and the sum of a number and one

18. four more than the product of eight and the difference between a number and six

19. eight more than the product of three and the sum of a number and six

20. six less than twice the difference between a number and seven

21. four less than the product of three and the difference between seven and a number

22. nine more than twice the sum of seventeen and a number

23. eighteen less than the quotient of a number and two

24. seven increased by the quotient of a number and five

Translate each pair of English phrases into algebraic expressions. Notice the differences between the algebraic expressions and the corresponding English phrases.

**25.** **a.** six less than a number

**b.** six less a number

**26.** **a.** twenty less than a number

**b.** twenty less a number

**27.** **a.** five less than three times a number

**b.** five less three times a number

**28.** **a.** six less than four times a number

**b.** six less four times a number

Write the algebraic expression described by the English phrases using the given variables. See Example 2.

**29.** the number of hours in $d$ days

**30.** the cost of $x$ graphing calculators if one calculator costs \$115

**31.** the cost of $x$ gallons of gasoline if the cost of one gallon is \$3.15

**32.** the number of seconds in $m$ minutes

**33.** the number of days in $y$ years (Assume 365 days in a year.)

**34.** the cost of $x$ pounds of candy priced at \$4.95 a pound

**35.** the number of days in $t$ weeks and three days

**36.** the number of minutes in $h$ hours and twenty minutes

**37.** the points scored by a football team on $t$ touchdowns and one field goal (a touchdown is 7 points and a field goal is 3 points)

**38.** the amount of vacation days an employee has after $w$ weeks if she gets 0.2 vacation days for every week she works

**39.** the cost of renting a car for one day and driving $m$ miles if the rate is \$20 per day plus 15 cents per mile

**40.** the cost of purchasing a fishing rod and reel if the rod costs $x$ dollars and the reel costs \$8 more than twice the cost of the rod

**41.** the perimeter of a rectangle if the width is $w$ centimeters and the length is three centimeters less than twice the width

**42.** the area of a square with side length of $c$ centimeters

Translate each algebraic expression into an equivalent English phrase. (There may be more than one correct translation.) See Examples 3 and 4.

**43.** $4x$

**44.** $-9x$

**45.** $x + 5$

**46.** $x - 12$

**47.** $4x - 7$

**48.** $3x + 5$

**49.** $7(x+1)$

**50.** $3(x+2)$

**51.** $-2(x-8)$

**52.** $10(x+4)$

**53.** $5(2x+3)$

**54.** $3(4x-5)$

**55.** $\dfrac{6}{x-1}$

**56.** $\dfrac{9}{x+3}$

**57.** $6x+x-1$

**58.** $5x-x+2$

**59.** $8+2(x-1)$

**60.** $5-3(x+1)$

Translate each pair of expressions into equivalent English phrases. (There may be more than one correct translation.) Notice the differences between the algebraic expressions and the corresponding English phrases.

**61.** $3x+7;\quad 3(x+7)$

**62.** $4x-1;\quad 4(x-1)$

**63.** $7x-3;\quad 7(x-3)$

**64.** $5(x+6);\quad 5x+6$

## Writing & Thinking

**65.** Explain why translating addition and multiplication problems from English into algebra may be easier than changing subtraction or division problems from English into algebra. (Consider the properties previously studied.)

**66.** Explain the difference between $5(n+3)$ and $5n+3$ when converting from algebra to English.

**67.** Make up your own word problem that might use the given equation in its solution. Be creative! Translate the variable into something like "a strange number," or "the age of a dog," or "an amount invested."

**a.** $2x+3=-4$

**b.** $3x-2=-5$

**c.** $n+(n+1)=25$

**d.** $n+(n+2)=135$

**e.** $2x+3x=x$

**f.** $x=5x-6x$