1.5 Translating Words into Mathematical Symbols

Goal

Translate words into mathematical symbols.

Key Words

- translate
- phrase
- sentence

How long were you on the phone?

In Example 6 you will translate words into an algebraic equation to find the length of a long distance phone call.

To solve real-life problems, you often need to translate words into mathematical symbols. To do this, look for words, such as *sum* or *difference*, that indicate mathematical operations.

EXAMPLE 1 Translate Addition Phrases

Write the phrase as a variable expression. Let x represent the number.

PHRASE	TRANSLATION
The *sum* of 6 and a number	$6 + x$
8 *more than* a number	$x + 8$
A number *plus* 5	$x + 5$
A number *increased* by 7	$x + 7$

EXAMPLE 2 Translate Subtraction Phrases

Write the phrase as a variable expression. Let y represent the number.

PHRASE	TRANSLATION
The *difference* between 5 and a number	$5 - y$
7 *minus* a number	$7 - y$
A number *decreased* by 9	$y - 9$
4 *less than* a number	$y - 4$

Student Help

READING ALGEBRA
Order is important for subtraction. "4 less than a number" means $y - 4$, *not* $4 - y$.

Checkpoint Translate Addition and Subtraction Phrases

Write the phrase as a variable expression. Let x represent the number.

1. 11 more than a number

2. A number decreased by 10

Student Help

VOCABULARY TIP
Quotient comes from a word meaning "how many times." When you divide you are finding how many times one quantity goes into another.

Notice that order does not matter for addition and multiplication. "The sum of 6 and a number" can be written as either $6 + x$ or $x + 6$. Order *is important* for subtraction and division. "The quotient of a number and 4" means $\frac{n}{4}$, *not* $\frac{4}{n}$.

EXAMPLE 3 Translate Multiplication and Division Phrases

Write the phrase as a variable expression. Let n represent the number.

PHRASE	TRANSLATION
The *product* of 9 and a number	$9n$
10 *times* a number	$10n$
A number *multiplied* by 3	$3n$
One fourth *of* a number	$\frac{1}{4}n$
The *quotient* of a number and 6	$\frac{n}{6}$
7 *divided* by a number	$\frac{7}{n}$

Checkpoint Translate Multiplication and Division Phrases

Write each phrase as a variable expression. Let x represent the number.

3. The quotient of 8 and a number

4. The product of 2 and a number

TRANSLATING SENTENCES In English there is a difference between a phrase and a sentence. Phrases are translated into variable expressions. Sentences are translated into equations or inequalities.

PHRASE → **EXPRESSION**

SENTENCE → **EQUATION OR INEQUALITY**

Student Help

READING ALGEBRA
The word *is* by itself means "=."

The words *is less than* mean "<."

EXAMPLE 4 Translate Sentences

Write the sentence as an equation or an inequality.

SENTENCE	TRANSLATION
The sum of a number x and 12 *is* 16.	$x + 12 = 16$
The quotient of 15 and a number x *is less than* 3.	$\frac{15}{x} < 3$

Checkpoint Translate Sentences

Write the sentence as an equation or an inequality.

5. The product of 5 and a number x is 25.

6. 10 times a number x is greater than or equal to 50.

Student Help

READING ALGEBRA
In mathematics, the word *difference* means "subtraction."

EXAMPLE 5 Write and Solve an Equation

a. Translate into mathematical symbols: "The difference between 13 and a number is 7." Let x represent the number.

b. Use mental math to solve the equation.

c. Check your solution.

Solution

a. The equation is $13 - x = 7$.

b. Using mental math, you can find that the solution is $x = 6$.

c. CHECK ✓

$13 - x = 7$ Write original equation.

$13 - 6 \stackrel{?}{=} 7$ Substitute 6 for x.

$7 = 7$ ✓ Solution checks.

Translating sentences into mathematical symbols is an important skill for solving real-life problems. Try your skills in Example 6.

EXAMPLE 6 Translate and Solve a Real-Life Problem

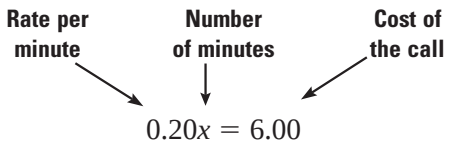
You make a long distance telephone call. The rate is \$.20 for each minute. The total cost of the call is \$6.00. How long was the call?

Student Help

SKILLS REVIEW
For help with decimal operations, see p. 759.

Solution

Let x represent the length of the call in minutes.



Ask what number times 0.2 equals 6. Use mental math to find $x = 30$.

ANSWER Your call was 30 minutes long.

Checkpoint ✓ Translate and Solve a Real-Life Problem

7. You make a long distance telephone call. The rate is \$.10 for each minute. The total cost of the call is \$5.00. How long was the call? Check to see if your solution is reasonable.

8. You make a long distance telephone call. The rate is \$.20 for each minute. The total cost of the call is \$4.00. How long was the call? Check to see if your solution is reasonable.

1.5 Exercises

Guided Practice

Vocabulary Check

Consider the phrase *seven decreased by a number n*.

1. What operation does *decreased by* indicate?

2. Translate the phrase into a variable expression.

Skill Check

Match the phrase with its variable expression. Let *x* represent the number.

3. A number increased by 11

4. The product of 11 and a number

5. The difference of a number and 11

6. The quotient of a number and 11

A. $x - 11$

B. $x + 11$

C. $\frac{x}{11}$

D. $11x$

Write the sentence as an equation or an inequality.

7. A number x increased by 10 is 24.

8. The product of 7 and a number y is 42.

9. 20 divided by a number n is less than or equal to 2.

Practice and Applications

TRANSLATING PHRASES **Write the phrase as a variable expression. Let *x* represent the number.**

10. A number decreased by 3

11. Difference of 10 and a number

12. The sum of 5 and a number

13. 9 more than a number

14. Product of 4 and a number

15. Quotient of a number and 50

16. 15 increased by a number

17. A number plus 18

18. 6 less than a number

19. A number minus 7

Student Help

HOMEWORK HELP
Example 1: Exs. 10–19
Example 2: Exs. 10–19
Example 3: Exs. 10–19
Example 4: Exs. 20–31
Example 5: Exs. 32–35
Example 6: Exs. 36–39

TRANSLATING SENTENCES **Match the sentence with its equation. Let *x* represent the number.**

20. A number increased by 2 is 4.

21. The product of 2 and a number is 4.

22. A number decreased by 4 is 2.

23. A number divided by 4 is 2.

A. $x - 4 = 2$

B. $x + 2 = 4$

C. $\frac{x}{4} = 2$

D. $2x = 4$

Student Help

HOMEWORK HELP

Extra help with problem solving in Exs. 24–31 is available at www.mcdougallittell.com

TRANSLATING SENTENCES **Write the sentence as an equation or an inequality. Let *x* represent the number.**

24. The sum of 20 and a number is 30.

25. A number increased by 10 is greater than or equal to 44.

26. 18 decreased by a number is 6.

27. 35 is less than the difference of 21 and a number.

28. The product of 13 and a number is greater than 60.

29. 7 times a number is 56.

30. A number divided by 22 is less than 3.

31. The quotient of 35 and a number is 7.

WRITING AND SOLVING EQUATIONS **Write the sentence as an equation. Let *x* represent the number. Use mental math to solve the equation. Then check your solution.**

32. The sum of a number and 10 is 15.

33. 28 decreased by a number is 18.

34. The product of a number and 25 is 100.

35. The quotient of 49 and a number is 7.

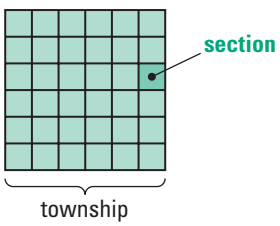
36. **Puzzler** The area of the rectangle is less than or equal to 50 square meters. Write an inequality for the area using the dimensions in the diagram.

Link to History

MICHIGAN land patterns result from the Ordinance of 1785. The Northwest Territory became the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, and part of Minnesota.

37. **PLANNING A TRIP** You want to go to an amusement park. The distance between your house and the amusement park is 110 miles. Your rate of travel is 55 miles per hour. Use the formula $d = rt$ to write an equation. Use mental math to solve the equation for the time you spend traveling.

38. **History Link** The Land Ordinance of 1785 divided the Northwest Territory into squares of land called townships. Every township was divided into 36 square sections, 1 mile on each side. How many square miles were in each township? How many acres?
HINT: 1 mi^2 = 640 acres



CHALLENGE **You want to hire a live band for a school dance. You have $175 in your budget. The live band charges $75 per hour and each student pays $2 admission.**

39. If the band is to play for 3 hours, how much extra money do you need to raise?

Standardized Test Practice

40. MULTIPLE CHOICE Translate into mathematical symbols "the difference of a number and 4 is 10." Let n represent the number.

Ⓐ $n - 4 = 10$ Ⓑ $4 - n = 10$ Ⓒ $10 - 4 = n$ Ⓓ $10 - n = 4$

41. MULTIPLE CHOICE Which is the correct algebraic translation of "Howard's hourly wage h is \$2 greater than Marla's hourly wage m?"

Ⓕ $h < m + 2$ Ⓖ $h = m + 2$ Ⓗ $m = h + 2$ Ⓙ $h > m + 2$

Mixed Review

42. Geometry Link Find the volume of a cube when each side x is 10 feet. *(Lesson 1.2)*

CHECKING SOLUTIONS OF EQUATIONS **Check to see if the given value of the variable is or is not a solution of the equation.** *(Lesson 1.4)*

43. $8k - 2 = 30$; $k = 4$

44. $15 + 2c = 5c$; $c = 5$

45. $\frac{r^2}{2} = 40$; $r = 9$

46. $50 = 3w$; $w = 15$

Maintaining Skills

PERCENTS AND DECIMALS **Write the percent as a decimal.** *(Skills Review p. 768)*

47. 28%

48. 25%

49. 40%

50. 22%

51. 45%

52. 90%

53. 17.4%

54. 6.51%

Quiz 2

Check to see if $x = 4$ is or is not a solution of the equation. *(Lesson 1.4)*

1. $10x - 5 = 35$

2. $\frac{x}{4} = 0$

3. $x^2 + 5 = 21$

Check to see if $a = 20$ is or is not a solution of the inequality. *(Lesson 1.4)*

4. $3a > 50$

5. $10 + a < 30$

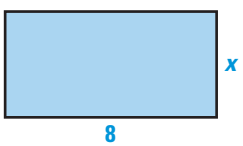
6. $40 + 3a \geq 50$

7. $\frac{a}{5} \leq 5$

8. $\frac{80}{a} \geq 5$

9. $\frac{a}{5} - 2 \leq 5$

10. Geometry Link The rectangle shown at the right has an area of 32 square units. Write an equation to find the width x. Use mental math to solve the equation. *HINT:* The area of a rectangle equals length times width. *(Lesson 1.4)*



Write the sentence as an equation or an inequality. *(Lesson 1.5)*

11. A number x divided by 9 is less than 17.

12. The product of 10 and a number x is 50.

13. A number y plus 10 is greater than or equal to 57.

14. A number y minus 6 is 15.