



4. **Reasoning** Is each statement in parts (a) and (b) *true* or *false*? If it is false, give a counterexample. If true, use properties of real numbers to show the expressions are equivalent.
- For all real numbers  $j$  and  $k$ ,  $j \cdot k = (k + 0) \cdot j$ .
  - For all real numbers  $m$  and  $n$ ,  $m(n + 1) = mn + 1$ .
  - Is the statement in part (A) of Problem 4 false for *every* pair of real numbers  $a$  and  $b$ ? Explain.



## Lesson Check

### Do you know HOW?

Name the property that each statement illustrates.

- $x + 12 = 12 + x$
- $5 \cdot (12 \cdot x) = (5 \cdot 12) \cdot x$
- You buy a sandwich for \$2.95, an apple for \$.45, and a bottle of juice for \$1.05. What is the total cost?
- Simplify  $\frac{24cd}{c}$ .

### Do you UNDERSTAND?



5. **Vocabulary** Tell whether the expressions in each pair are equivalent.
- $5x \cdot 1$  and  $1 + 5x$
  - $1 + (2t + 1)$  and  $2 + 2t$
6. Justify each step.
- $$\begin{aligned} 3 \cdot (10 \cdot 12) &= 3 \cdot (12 \cdot 10) \\ &= (3 \cdot 12) \cdot 10 \\ &= 36 \cdot 10 \\ &= 360 \end{aligned}$$



## Practice and Problem-Solving Exercises



### A Practice

Name the property that each statement illustrates.

- $75 + 6 = 6 + 75$
- $\frac{7}{9} \cdot 1 = \frac{7}{9}$
- $h + 0 = h$
- $389 \cdot 0 = 0$
- $27 \cdot \pi = \pi \cdot 27$
- $9 \cdot (-1 \cdot x) = 9 \cdot (-x)$

See Problem 1.

**Mental Math** Simplify each expression.

- $21 + 6 + 9$
- $10 \cdot 2 \cdot 19 \cdot 5$
- $0.1 + 3.7 + 5.9$
- $4 \cdot 5 \cdot 13 \cdot 5$
- $55.3 + 0.2 + 23.8 + 0.7$
- $0.25 \cdot 12 \cdot 4$

See Problem 2.

19. **Fishing Trip** The sign at the right shows the costs for a deep-sea fishing trip. How much will the total cost be for 1 adult, 2 children, and 1 senior citizen to go on a fishing trip? Use mental math.

DEEP-SEA FISHING	
Adults .....	\$33
Children (12 & under) .....	\$25
Seniors (65 & up) .....	\$27

Simplify each expression. Justify each step.

See Problem 3.

20.  $8 + (9t + 4)$       21.  $9(2x)$       22.  $(4 + 105x) + 5$       23.  $(10p)11$   
 24.  $(12 \cdot r) \cdot 13$       25.  $(2 + 3x) + 9$       26.  $4 \cdot (x \cdot 6.3)$       27.  $1.1 + (7d + 0.1)$   
 28.  $\frac{56ab}{b}$       29.  $\frac{1.5mn}{m}$       30.  $\frac{13p}{pq}$       31.  $\frac{33xy}{3x}$

Use deductive reasoning to tell whether each statement is *true* or *false*. If it is *false*, give a counterexample. If true, use properties of real numbers to show the expressions are equivalent.

See Problem 4.

32. For all real numbers  $r$ ,  $s$ , and  $t$ ,  $(r \cdot s) \cdot t = t \cdot (s \cdot r)$ .  
 33. For all real numbers  $p$  and  $q$ ,  $p \div q = q \div p$ .  
 34. For all real numbers  $x$ ,  $x + 0 = 0$ .  
 35. For all real numbers  $a$  and  $b$ ,  $-a \cdot b = a \cdot (-b)$ .

**B** Apply

36. **Error Analysis** Your friend shows you the problem at the right. He says that the Associative Property allows you to change the order in which you complete two operations. Is your friend correct? Explain.

$$\begin{aligned} (5 \cdot 11) + 9 &= 5 \cdot (11 + 9) \\ &= 5 \cdot 20 \\ &= 100 \end{aligned}$$

37. **Travel** It is 258 mi from Tulsa, Oklahoma, to Dallas, Texas. It is 239 mi from Dallas, Texas, to Houston, Texas.  
 a. What is the total distance of a trip from Tulsa to Dallas to Houston?  
 b. What is the total distance of a trip from Houston to Dallas to Tulsa?  
 c. Explain how you can tell whether the distances described in parts (a) and (b) are equal by using reasoning.

Tell whether the expressions in each pair are equivalent.

38.  $2 + h + 4$  and  $2 \cdot h \cdot 4$       39.  $9y \cdot 0$  and  $1$       40.  $3x$  and  $3x \cdot 1$   
 41.  $m(1 - 1)$  and  $0$       42.  $(9 - 7) + \pi$  and  $2\pi$       43.  $(3 + 7) + m$  and  $m + 10$   
 44.  $\frac{63ab}{7a}$  and  $9ab$       45.  $\frac{11x}{(2 + 5 - 7)}$  and  $11x$       46.  $\frac{7t}{4 - 8 + \sqrt{9}}$  and  $7t$

47. **Think About a Plan** Hannah makes a list of possible gifts for Mary, Jared, and Michael. She has two plans and can spend a total of \$75 for all gifts. Which plan(s) can Hannah afford?

- What property can you use to make it easier to find the total cost of different gifts?
- What number do you compare to the total cost of each plan to decide whether it is affordable?

Plan	Item	Cost
Same Gifts	DVD	\$22
Different Gifts	Mary: Sweater	\$29.26
	Jared: Book	\$23.99
	Michael: Cactus	\$23.74

48. **Writing** Suppose you are mixing red and blue paint in a bucket. Do you think the final color of the mixed paint will be the same whether you add the blue paint or the red paint to the bucket first? Relate your answer to a property of real numbers.

Simplify each expression. Justify each step.

49.  $25 \cdot 3.9 \cdot 4$

50.  $(4.4 \div 4.4)(x + 7)$

51.  $(7^6 - 6^5)(8 - 8)$

**Reasoning** Answer each question. Use examples to justify your answers.

52. Is subtraction commutative?

53. Is subtraction associative?

54. Is division commutative?

55. Is division associative?



**Patterns** The Commutative Property of Addition lets you rewrite addition expressions. How many different ways can you write  $a + b + c$ ? Show each way.

**Reasoning** Suppose you know that  $a(b + c) = ab + ac$  is true for all real numbers  $a$ ,  $b$ , and  $c$ . Use the properties of real numbers to prove that  $(b + c)a = ba + ca$  is true for all real numbers  $a$ ,  $b$ , and  $c$ .

## Standardized Test Prep

SAT/ACT

58. What is the simplified form of  $(1.2 + 0) + 4.6 + 3.8$ ?

(A) 1.2

(B) 8.0

(C) 8.4

(D) 9.6

59. Which expression is equal to  $3 \cdot 3 \cdot 8 \cdot 8 \cdot 3$ ?

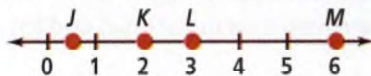
(F)  $3 \cdot 8$

(G)  $3^8$

(H)  $3^3 \cdot 8^2$

(I)  $3 \cdot 3 + 2 \cdot 8$

60. There are four points plotted on the number line below.



Which expression represents the greatest amount?

(A)  $M \div L$

(B)  $M - L$

(C)  $J + K$

(D)  $L - K$

61. Lane 1 at your local track is 0.25 mi long. You live 0.5 mi away from the track. Which of the following results in the shortest jog?

(F) jogging 6 times around the track in Lane 1

(G) jogging to the track and then 5 times around the track in Lane 1

(H) jogging to the track, 3 times around the track in Lane 1, and then home

(I) jogging 8 times around the track in Lane 1

## Mixed Review

Order the numbers in each exercise from least to greatest.

See Lesson 1-3.

62.  $-6, 6^3, 1.6, \sqrt{6}$

63.  $\frac{8}{5}, 1.4, -17, 10^2$

64.  $1.75, -4.5, \sqrt{4}, 14^1$

**Get Ready!** To prepare for Lesson 1-5, do Exercises 65–68.

Find each sum or difference.

See p. 803.

65.  $3 + 11$

66.  $\frac{3}{8} + \frac{5}{8}$

67.  $9.7 - 8.6$

68.  $\frac{5}{9} - \frac{5}{10}$