

Write an algebraic expression for each word phrase.

1. 11 more than
- y

$$y + 11$$

2. 5 less than
- n

$$n - 5$$

3. the sum of 15 and
- w

$$w + 15$$

4. 22 minus
- k

$$22 - k$$

5. a number
- b
- divided by 8

$$\frac{b}{8}$$

- 6.
- q
- multiplied by 2

$$2q$$

7. the product of 3.3 and a number
- x

$$3.3x$$

8. one third of a number
- m

$$\frac{1}{3}m$$

Write a word phrase for each algebraic expression.

- 9.
- $8 - a$

8 minus a number a

- 10.
- $v + 9$

the sum of a number v and 9

- 11.
- $\frac{y}{5} - 10$

the quotient of a number y and 5 minus 10

- 12.
- $1.9 + n$

the sum of 1.9 and a number n

- 13.
- $5h + 3k$

the sum of 5 times a number h and 3 times a number k

- 14.
- $2x + 1$

the sum of 2 times number x and 1

Write a rule in words and as an algebraic expression to model the relationship.

15. The cost of beverages in a vending machine is shown.
- $y = 1.25x$

Beverages	Cost
1	\$1.25
2	\$2.50
3	\$3.75

Variables and Expressions

16. Jordan gets paid to mow his neighbor's lawn. For every week that he mows the lawn, he earns \$20. Write a rule as an algebraic expression to model the relationship.

$$y = 20x$$

Write an algebraic expression for each word phrase.

17. 14 minus the quotient of 25 and p

$$14 - \frac{25}{p}$$

18. a number w tripled plus t quadrupled

$$3w + 4t$$

19. the product of 13 and m plus the product of 2.7 and n

$$13m + 2.7n$$

20. the product of 2 times a and 5 times b

$$2a(5b), \text{ or } 10ab$$

21. **Error Analysis** A student writes *the sum of 7 times a number n plus 5* to describe the expression $7(n + 5)$. Explain the error.

It should be 7 times the sum of a number n plus 5.

22. Sarah is going to pay for an item using gift cards. The clerk tells her that she will need 2 gift cards and an additional \$3 to pay for the item. Write an algebraic expression to model the situation using the variable g for the amount of the gift cards to pay her total bill, t .

$$t = 2g + 3$$

Order of Operations and Evaluating Expressions

Simplify each expression.

1. 9^2 81

2. 8^3 512

3. $\left(\frac{7}{8}\right)^2$ $\frac{49}{64}$

4. $(4 + 3)^2$ 49

5. $8 + 5(7)$ 43

6. $\left(\frac{21}{3}\right) - 2(3)$ 1

7. $11(3) - 3^2$ 24

8. $\left(\frac{15}{5}\right)^3 - 6(2)^2$ 3

9. $(3(4))^3$ 1728

10. $3^4 - 2^4 \div 2^2$ 77

Evaluate each expression for $x = 3$ and $y = 2$.

11. $x + 7$ 10

12. $8 - y$ 6

13. $\frac{x^3}{3} - 8$ 1

14. $5(y)^3 - 6$ 34

15. $-6(x)^2 + y^3 - 8$ -54

16. $\left(\frac{x+1}{y^2}\right)^2$ 1

Order of Operations and Evaluating Expressions

17. George is driving at an average speed of 62 miles per hour. Write an expression that would give his distance traveled for h hours. Make a table that records his distance for 3, 5.5, 7, and 8.5 hours.

$$d = 62h$$

Time (hr)	Distance (mi)
3	186
5.5	341
7	434
8.5	527

Simplify each expression.

18. $5[(4 + 8) - 3^3]$
-75

19. $2[(7 - 10)^2 + 5]^2$
392

20. $[(32 \div 4)^3 - 500]^3$
1728

21. $\left(\frac{2(-2)(4)}{12 - 4(2)}\right)^3$
-64

22. The cost to rent a car is \$30 per day. Write an expression for the cost of renting a car for d days. Make a table to find how much it will cost to rent a car for 3, 5, 7, and 10 days.

$$c = 30d$$

Time (days)	Cost (\$)
3	90
5	150
7	210
10	300

Evaluate each expression for the given values of the variables.

23. $2(m + 1) - n^3; m = -2, n = 3$
-29

24. $-3[(a - 3)^2 + b]^2; a = 4, b = 6$
-147

25. $-1\left[x^3 - \left(\frac{2y}{4}\right)^2\right]; x = 5, y = -2$
-124

26. $t[v^2 - (23 - v^2) + 3]; t = -2, v = 2$
24

27. Reasoning Show that the expressions $3m^2n^2$ and $5m^3 + 13m^2n$ are equal when $m = 2$ and $n = 5$.

$$3m^2n^2 = 3(2^2)(5^2) = 3(4)(25) = 300$$

$$5m^3 + 13m^2n = 5(2^3) + 13(2^2)(5) = 5(8) + 13(4)(5) = 300$$

Simplify each expression.

1. $\sqrt{144}$ 12

2. $\sqrt{25}$ 5

3. $\sqrt{169}$ 13

4. $\sqrt{49}$ 7

5. $\sqrt{256}$ 16

6. $\sqrt{400}$ 20

7. $\sqrt{\frac{9}{49}}$ $\frac{3}{7}$

8. $\sqrt{\frac{196}{144}}$ $\frac{7}{6}$

9. $\sqrt{0.01}$ 0.1

10. $\sqrt{0.49}$ 0.7

Estimate the square root. Round to the nearest integer.

11. $\sqrt{38}$ 6

12. $\sqrt{65}$ 8

13. $\sqrt{99}$ 10

14. $\sqrt{145.5}$ 12

15. $\sqrt{23.75}$ 5

16. $\sqrt{64.36}$ 8

Find the approximate side length of each square figure to the nearest whole unit.

17. a tabletop with an area 25 ft^2
5 ft

18. a wall that is 105 m^2
10 m

Name the subset(s) of the real numbers to which each number belongs.

19. $\frac{3}{4}$

rational

20. -8

rational, integer

21. 2π

irrational

22. 45,368

rational, natural,
whole, integer

23. $\sqrt{11}$

irrational

24. $-\frac{2}{3}$

rational

Compare the numbers in each exercise using an inequality symbol.

25. $\sqrt{36}, \sqrt{49}$

$\sqrt{36} < \sqrt{49}$

26. $\frac{1}{3}, \sqrt{1.25}$

$\frac{1}{3} < \sqrt{1.25}$

27. $\sqrt{100}, -\sqrt{169}$

$\sqrt{100} > -\sqrt{169}$

28. $\frac{34}{19}, 1.8$

$\frac{34}{19} < 1.8$

Order the numbers in each exercise from least to greatest.

29. 2.75, $\sqrt{25}$, $-\sqrt{36}$

$-\sqrt{36}, 2.75, \sqrt{25}$

30. 1.25, $-\frac{1}{3}$, $\sqrt{1.25}$

$-\frac{1}{3}, \sqrt{1.25}, 1.25$

31. $\frac{3}{5}$, -0.6 , $\sqrt{1}$

$-0.6, \frac{3}{5}, \sqrt{1}$

32. $\frac{80}{25}$, $\sqrt{9}$, $\frac{30}{9}$

$\sqrt{9}, \frac{80}{25}, \frac{30}{9}$

33. Kate, Kevin, and Levi are comparing how fast they can run. Kate was able to run 5 miles in 47.5 minutes. Kevin was able to run 8 miles in 74 minutes. Levi was able to run 4 miles in 32 minutes. Order the friends from the fastest to the slowest.

Levi, Kevin, Kate

Properties of Real Numbers

Use deductive reasoning to tell whether each statement is *true* or *false*. If it is false, give a counterexample.

22. For all real numbers a and b , $a - b = -b + a$. **true**
23. For all real numbers p , q and r , $p - q - r = p - r - q$. **true**
24. For all real numbers x , y and z , $(x + y) + z = z + (x + y)$. **true**
25. For all real numbers m and n , $\frac{m}{n} \cdot n = \frac{n}{m} \cdot m$. **false**; $\frac{5}{3} \times 3 \neq \frac{3}{5} \times 5$
26. **Writing** Explain why the commutative and associative properties don't hold true for subtraction and division but the identity properties do.
Examples: $5 - 0 = 5$; $5 \div 1 = 5$; **Counterexamples:**
 $5 - 3 \neq 3 - 5$; $(5 - 3) - 2 \neq 5 - (3 - 2)$; $6 \div 3 \neq 3 \div 6$; $(24 \div 6) \div 2 \neq 24 \div (6 \div 2)$
27. **Reasoning** A recipe for brownies calls for mixing one cup of sugar with two cups of flour and 4 ounces of chocolate. They are all to be mixed in a bowl before baking. Will the brownies taste different if you add the ingredients in different orders? Relate your answer to a property of real numbers.
no; Like the Comm. Prop. of Add., the order doesn't matter. Like the Assoc. Prop. of Add., it doesn't matter if the flour and sugar are added and then the chocolate, or if the sugar and chocolate are added and then the flour or any other combination.

Simplify each expression. Justify each step.

28. $(6^7)(5^3 + 2)(2 - 2)$ **0**

29. $(m - 16)(-7 \div -7)$ **$m - 16$**

30. **Open-Ended** Provide examples to show the following.
- The associative property of addition holds true for negative integers.
 - The commutative property of multiplication holds true for non-integers.
 - The multiplicative property of negative one holds true regardless of the sign of the number on which the operation is performed.
 - The commutative property of multiplication holds true if one of the factors is zero.

Answers may vary. Samples:

a. $[-3 + (-4)] + (-1) = -7 + (-1) = -8$; $-3 + [-4 + (-1)] = -3 + (-5) = -8$

b. $(\frac{1}{2} \cdot \frac{2}{3}) \cdot \frac{3}{4} = \frac{1}{4}$; $\frac{1}{2} \cdot (\frac{2}{3} \cdot \frac{3}{4}) = \frac{1}{4}$

c. $-1 \cdot 5 = \text{the opposite of } 5 = -5$; $-1 \cdot -5 = \text{the opposite of } -5 = 5$

d. $3 \cdot 0 = 0 \cdot 3 = 0$

Properties of Real Numbers

Name the property that each statement illustrates.

- $12 + 917 = 917 + 12$
Commutative Property of Addition
- $74.5 \cdot 0 = 0$
Zero Property of Multiplication
- $35 \cdot x = x \cdot 35$
Commutative Property of Multiplication
- $3 \cdot (-1 \cdot p) = 3 \cdot (-p)$
Multiplication Property of -1
- $m + 0 = m$
Identity Property of Addition
- $53.7 \cdot 1 = 53.7$
Identity Property of Multiplication

Use mental math to simplify each expression.

- $36 + 12 + 4$ 52
- $19.2 + 0.6 + 12.4 + 0.8$ 33
- $2 \cdot 16 \cdot 10 \cdot 5$ 1600
- $12 \cdot 18 \cdot 0 \cdot 17$ 0

Simplify each expression. Justify each step.

- $$\begin{aligned} 6 + (8x + 12) &= 6 + (12 + 8x) && \text{Comm. Prop. of Add.} \\ &= (6 + 12) + 8x && \text{Assoc. Prop. of Add.} \\ &= 18 + 8x && \text{Combine like terms.} \end{aligned}$$
- $$\begin{aligned} 5(16p) &= (5 \cdot 16)p && \text{Assoc. Prop. of Mult.} \\ &= 80p && \text{Simplify.} \end{aligned}$$
- $$\begin{aligned} (2 + 7m) + 5 &= (7m + 2) + 5 && \text{Comm. Prop. of Add.} \\ &= 7m + (2 + 5) && \text{Assoc. Prop. of Add.} \\ &= 7m + 7 && \text{Combine like terms.} \end{aligned}$$
- $$\begin{aligned} \frac{12st}{4t} &= \frac{12}{4} \cdot s \cdot \frac{1}{t} \cdot t && \text{Prop. of Mult.} \\ &= \frac{12}{4} \cdot s \cdot 1 && \text{Mult. Ident.} \\ &= \frac{12}{4} \cdot 1 \cdot s && \text{Assoc. Prop. of Mu} \\ &= 3s && \text{Simplify.} \end{aligned}$$

Tell whether the expressions in each pair are equivalent.

- $7x$ and $7x \cdot 1$
Equivalent
- $4 + 6 + x$ and $4 \cdot x \cdot 6$
Not equivalent
- $(12 - 7) + x$ and $5x$
Not equivalent
- $p(4 - 4)$ and 0
Equivalent
- $\frac{24xy}{2x}$ and $12y$
Equivalent
- $\frac{27m}{(3 + 9 - 12)}$ and $27m$
Not equivalent
- You have prepared 42 mL of distilled water, 18 mL of vinegar and 47 mL of salt water for an experiment.
 - How many milliliters of solution will you have if you first pour the distilled water, then the salt water, and finally the vinegar into your beaker? 107 ml
 - How many milliliters of solution will you have if you first pour the salt water, then the vinegar, and finally the distilled water into your beaker? 107 ml
 - Explain why the amounts described in parts (a) and (b) are equal. Assoc. Prop. of Add.

The Distributive Property

Use the Distributive Property to simplify each expression.

1. $3(h - 5)$
 $3h - 15$

2. $7(-5 + m)$
 $7m - 35$

3. $(6 + 9v)6$
 $54v + 36$

4. $(5n + 3)12$
 $60n + 36$

5. $20(8 - a)$
 $-20a + 160$

6. $15(3y - 5)$
 $45y - 75$

7. $21(2x + 4)$
 $42x + 84$

8. $(7 + 6w)6$
 $36w + 42$

9. $(14 - 9p)1.1$
 $-9.9p + 15.4$

10. $(2b - 10)3.2$
 $6.4b - 32$

11. $\frac{1}{3}(3z + 12)$
 $z + 4$

12. $4\left(\frac{1}{2}t - 5\right)$
 $2t - 20$

13. $(-5x - 14)(5.1)$
 $-25.5x - 71.4$

14. $1\left(-\frac{1}{2}r - \frac{5}{7}\right)$
 $-\frac{1}{2}r - \frac{5}{7}$

15. $10(6.85j + 7.654)$
 $68.5j + 76.54$

16. $\frac{2}{3}\left(\frac{2}{3}m - \frac{2}{3}\right)$
 $\frac{4}{9}m - \frac{4}{9}$

Write each fraction as a sum or difference.

17. $\frac{3n + 5}{7}$ $\frac{3n}{7} + \frac{5}{7}$

18. $\frac{14 - 6x}{19}$ $\frac{14}{19} - \frac{6x}{19}$

19. $\frac{3d + 5}{6}$ $\frac{d}{2} + \frac{5}{6}$

20. $\frac{9p - 6}{3}$ $3p - 2$

21. $\frac{18 + 8z}{6}$ $3 + \frac{4z}{3}$

22. $\frac{15n - 42}{14}$ $\frac{15n}{14} - 3$

23. $\frac{56 - 28w}{8}$ $7 - \frac{7w}{2}$

24. $\frac{81f + 63}{9}$ $9f + 7$

Simplify each expression.

25. $-(14 + x)$
 $-14 - x$

26. $-(-8 - 6t)$
 $8 + 6t$

27. $-(6 + d)$
 $-6 - d$

28. $-(-r + 1)$
 $r - 1$

29. $-(4m - 6n)$
 $-4m + 6n$

30. $-(5.8a + 4.2b)$
 $-5.8a - 4.2b$

31. $-(-x + y - 1)$
 $x - y + 1$

32. $-(f + 3g - 7)$
 $-f - 3g + 7$

Use mental math to find each product.

33. 3.2×3 **9.6**

34. 5×8.2 **41**

35. 149×2 **298**

36. 6×397 **2382**

37. 4.2×5 **21**

38. 4×10.1 **40.4**

39. 8.25×4 **33**

40. 11×4.1 **45.1**

41. You buy 75 candy bars at a cost of \$0.49 each. What is the total cost of 75 candy bars? Use mental math. **\$36.75**

42. The distance around a track is 400 m. If you take 14 laps around the track, what is the total distance you walk? Use mental math. **5600 m**

43. There are 32 classmates that are going to the fair. Each ticket costs \$19. What is the total amount the classmates spend for tickets? Use mental math. **\$608**

1-7

Practice (continued)

The Distributive Property

Simplify each expression by combining like terms.

44. $4t + 6t$ **10t**

45. $17y - 15y$ **2y**

46. $-11b^2 + 4b^2$ **$-7b^2$**

47. $-2y - 5y$ **$-7y$**

48. $14n^2 - 7n^2$ **$7n^2$**

49. $8x^2 - 10x^2$ **$-2x^2$**

50. $2f + 7g - 6 + 8g$
 $2f + 15g - 6$

51. $8x + 3 - 5x - 9$
 $3x - 6$

52. $-5k - 6k^2 - 12k + 10$
 $-6k^2 - 17k + 10$

Write a word phrase for each expression. Then simplify each expression.

53. $2(n + 1)$

two times the sum of a number and one; **$2n + 2$**

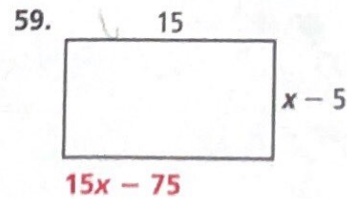
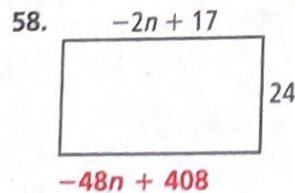
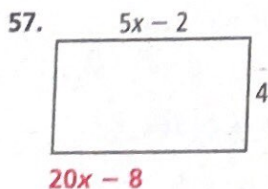
54. $-5(x - 7)$

negative five times the difference of a number and seven; **$-5x + 35$**

55. $\frac{1}{2}(4m - 8)$

one-half the difference of four times a number and eight; **$2m - 4$** 56. The tax a plumber must charge for a service call is given by the expression $0.06(35 + 25h)$ where h is the number of hours the job takes. Rewrite this expression using the Distributive Property. What is the tax for a 5 hour job and a 20 hour job? Use mental math. **$2.1 + 1.5h$; \$9.60; \$32.10**

Geometry Write an expression in simplified form for the area of each rectangle.



Simplify each expression.

60. $4jk - 7jk + 12jk$ **$9jk$**

61. $-17mn + 4mn - mn + 10mn$ **$-4mn$**

62. $8xy^4 - 7xy^3 - 11xy^4$ **$-3xy^4 - 7xy^3$**

63. $-2(5ab - 6)$ **$-10ab + 12$**

64. $z + \frac{2z}{5} - \frac{4z}{5}$ **$\frac{3z}{5}$**

65. $7m^2n + 4m^2n^2 - 4m^2n - 5m^3n^2 - 5mn^2$
 $3m^2n + 4m^2n^2 - 5m^3n^2 - 5mn^2$

66. Reasoning Demonstrate why $\frac{12x - 6}{6} \neq 2x - 6$. Show your work.

$\frac{12x - 6}{6} = \frac{1}{6}(12x - 6) = \frac{1}{6}(12x) - \frac{1}{6}(6) = 2x - 1; 2x - 1 \neq 2x - 6$

Simplify each expression.

67. $4(2h + 1) + 3(4h + 7)$
 $20h + 25$

68. $5(n - 8) + 6(7 - 2n)$
 $-7n + 2$

69. $7(3 + x) - 4(x + 1)$
 $3x + 17$

70. $6(y + 5) - 3(4y + 2)$
 $-6y + 24$

71. $-(a - 3b + 27)$
 $-a + 3b - 27$

72. $-2(5 - 4s + 6t) - 5s + t$
 $3s - 11t - 10$