

1-1 Expressions and Formulas

Evaluate each expression if $a = -2$, $b = 3$, and $c = 4.2$.

1. $a - 2b + 3c$

ANSWER:

4.6

2. $2a + (b + 3)^2$

ANSWER:

32

3. $a + 3[b^2 - (a + c)]$

ANSWER:

18.4

4. $5c - 2[(b - a) + c]$

ANSWER:

2.6

5. $4(2a + 3b) - 2c$

ANSWER:

11.6

6. $\frac{a^2 + 4c}{3b + 2a}$

ANSWER:

4.16

7. $\frac{b^3 + ac}{ab + 2bc}$

ANSWER:

0.96875

8. $\frac{3b + 2a}{5 - c}$

ANSWER:

6.25

9. $\frac{3a - 2c}{4ab}$

ANSWER:

0.6

10. **VOLLEYBALL** A player's attack percentage A is calculated using the formula $A = \frac{k - e}{t}$, where k

represents the number of kills, e represents the number of attack errors including blocks, and t represents the total attacks attempted. Find the attack percentage given each set of values.

a. $k = 22, e = 11, t = 35$

b. $k = 33, e = 9, t = 50$

ANSWER:

a. about 0.314 or 31.4%

b. 0.48 or 48%

Evaluate each expression if

$w = -3, x = 4, y = 2.6$, and $z = \frac{1}{3}$.

11. $y + x - z$

ANSWER:

$$6\frac{4}{15}$$

12. $w - 2x + y \div 2$

ANSWER:

-9.7

13. $4(x - w)$

ANSWER:

28

14. $6(y + x)$

ANSWER:

39.6

15. $9z - 4y + 2w$

ANSWER:

-13.4

16. $3y - 4z + x$

ANSWER:

$$10\frac{7}{15}$$

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17. **GAS MILEAGE** The gasoline used by a car is measured in miles per gallon and is related to the distance traveled by the following formula.
miles per gallon \times number of gallons = distance traveled

a. During a trip your car used a total of 46.2 gallons of gasoline. If your car gets 33 miles to the gallon, how far did you travel?

b. Your friend has decided to buy a hybrid car that gets 60 miles per gallon. The gasoline tank holds 12 gallons. How far can the car go on one tank of gasoline?

ANSWER:

- a. 1524.6 mi
b. 720 mi

Evaluate each expression if

$$a = -4, b = -0.8, c = 5, \text{ and } d = \frac{1}{5}.$$

18. $\frac{a+b}{c-d}$

ANSWER:

-1

19. $\frac{a-b}{bd}$

ANSWER:

20

20. $\frac{ac}{d+b}$

ANSWER:

$33\frac{1}{3}$

21. $\frac{b^2c^2}{ad}$

ANSWER:

-20

22. $\frac{b+6}{4(d+c)}$

ANSWER:

0.25

23. $\frac{5(d+a)}{2ab^2}$

ANSWER:

≈ 3.71

24. **SENSE-MAKING** The formula

$C = \frac{5(F-32)}{9}$ can be used to convert temperatures in degrees Fahrenheit to degrees Celsius.

a. Room temperature commonly ranges from 64°F to 73°F . Determine room temperature range in degrees Celsius.

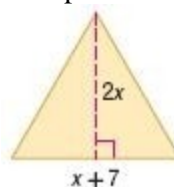
b. The normal average human body temperature is 98.6°F . A temperature above this indicates a fever. If your temperature is 42°C , do you have a fever? Explain your reasoning.

ANSWER:

a. 17.8°C to 22.8°C

b. Yes; Sample answer: $98.6^\circ\text{F} = 37^\circ\text{C}$, so a temperature above 37°C indicates a fever.

25. **GEOMETRY** The formula for the area A of a triangle with height h and base b is $A = \frac{1}{2}bh$. Write an expression to represent the area of the triangle.



ANSWER:

$$\frac{1}{2}(x+7)(2x)$$

1-1 Expressions and Formulas

26. **FINANCIAL LITERACY** The profit that a business made during a year is \$536,897,000. If the business divides the profit evenly for each share, estimate how much each share made if there are 10,995,000 shares.

ANSWER:

\$48.83

27. **REASONING** The radius of Earth's orbit is 93,000,000 miles.
- Find the circumference of Earth's orbit assuming that the orbit is a circle. The formula for the circumference of a circle is $2\pi r$.
 - Earth travels at a speed of 66,698 miles per hour around the Sun. Use the formula $T = \frac{C}{V}$, where T is time in hours, C is circumference, and V is velocity to find the number of hours it takes Earth to revolve around the Sun.
 - Did you prove that it takes 1 year for Earth to go around the Sun? Explain.

ANSWER:

a. 584,336,233.6 mi

b. 8761 h

c. Yes; $\frac{8761}{24} = 365$ days or 1 year

28. **ANCIENT PYRAMID** The Great Pyramid in Cairo, Egypt, is approximately 146.7 meters high, and each side of its base is approximately 230 meters.

a. Find the area of the base of the pyramid.

Remember $A = \ell w$.

b. The volume of a pyramid is $\frac{1}{3}Bh$, where B is the area of the base and h is the height. What is the volume of the Great Pyramid?

ANSWER:

a. $52,900 \text{ m}^2$

b. $2,586,810 \text{ m}^3$

Evaluate each expression if

$$w = \frac{3}{4}, x = 8, y = -2, \text{ and } z = 0.4.$$

29. $x^3 + 2y^4$

ANSWER:

544

30. $(x - 6z)^2$

ANSWER:

31.36

31. $2(6w - 2y) - 8z$

ANSWER:

13.8

32. $\frac{(y+z)^2}{xw}$

ANSWER:

≈ 0.427

33. $\frac{12w - 6y}{z^2}$

ANSWER:

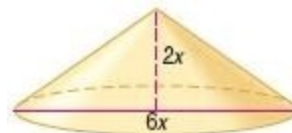
131.25

34. $\frac{wx + yz}{wx - yz}$

ANSWER:

≈ 0.765

35. **GEOMETRY** The formula for the volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$. Write an expression for the volume of the cone shown.



ANSWER:

$6\pi x^3$

1-1 Expressions and Formulas

36. **SEARCH ENGINES** Page rank is a numerical value that represents how important a page is on the Web. One formula used to calculate the page rank for a page is $PR = 0.15 + 0.85L$, where L is the page rank of the linking page divided by the number of outbound links on the page. Determine the page rank of a page in which $L = 10$.

ANSWER:

8.65

37. **WEATHER** In 1898, A.E. Dolbear studied various species of crickets to determine their “chirp rate” based on temperatures. He determined that the

formula $t = 50 + \frac{n - 40}{4}$, where n is the number of

chirps per minute, could be used to find the temperature t in degrees Fahrenheit. What is the temperature if the number of chirps is 120?

ANSWER:

70°F

38. **FOOTBALL** The following formula can be used to calculate a quarterback efficiency rating.

$$\left(\frac{C - 0.3}{A} + \frac{Y - 3}{4} + \frac{T}{0.05} + \frac{0.095 - I}{0.04} \right) \cdot \frac{100}{6}$$

- C is the number of passes completed.
- A is the number of passes attempted.
- Y is passing yardage.
- T is the number of touchdown passes.
- I is the number of interceptions.

Find Peyton Manning’s efficiency rating to the nearest tenth for the season statistics shown.

Peyton Manning	
2008 Quarterback Indianapolis Colts	
STATISTICS	
Passes Completed	371
Passes Attempted	555
Passing Yardage	4002
Touchdown Passes	27
Interceptions	12

ANSWER:

79.0

39. **MOVIES** The average price for a movie ticket can be represented by $P = \frac{y^2}{400} + \frac{7y}{100} + 2.96$ where y is the number of years since 1980.

a. Find the average price of a ticket in 1990, 2000, and 2010.

b. Another equation that can be used to represent

ticket prices is $P = \frac{y^3}{2500} - \frac{y^2}{100} + \frac{6y}{25} + 2.62$. Find the

price of a ticket in 1990, 2000, and 2010. How do these values compare to those you found in part a?

ANSWER:

a. \$3.91; \$5.36; \$7.31

b. \$4.42; \$6.62; \$11.62; Sample answer: The average prices found in part (a) become increasingly higher with time.

1-1 Expressions and Formulas

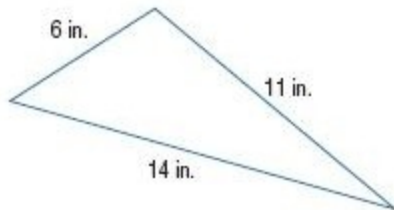
40. **GEOMETRY** The area of a triangle can be found using Heron's Formula,

$$A = \sqrt{s(s-a)(s-b)(s-c)},$$

where a , b , and c are the lengths of the three sides of the triangle, and

$$s = \frac{a+b+c}{2}.$$

Find the area of the triangle at the right.



ANSWER:

$$31.5 \text{ in}^2$$

41. Evaluate $y = \sqrt{b^2 \left(1 - \frac{x^2}{a^2}\right)}$ if $a = 6$, $b = 8$, and $x = 3$.

Round to the nearest tenth.

ANSWER:

$$6.9$$

42. **MULTIPLE REPRESENTATIONS** You will write expressions using the formula for the volume of a cylinder. Recall that the volume of a cylinder can be found using the formula $V = \pi r^2 h$, in which V = volume, r = radius, and h = height.

a. GEOMETRIC Draw two cylinders of different sizes.

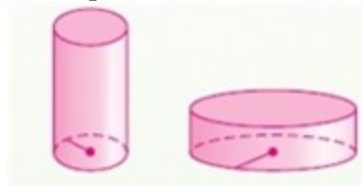
b. TABULAR Use a ruler to measure the radius and height of each cylinder. Organize the measures for each cylinder into a table. Include a column in your table to calculate the volume of each cylinder.

c. VERBAL Write a verbal expression for the difference in volume of the two cylinders.

d. ALGEBRAIC Write and solve an algebraic expression for the difference in volume of the two cylinders.

ANSWER:

a. Sample answer:



b. Sample answer:

cylinder	radius	height	volume
1	2 in.	5 in.	$20\pi \approx 62.8 \text{ in}^3$
2	4 in.	1 in.	$16\pi \approx 50.3 \text{ in}^3$

c. Sample answer: π times 2 squared times 5 minus π times 4 squared times 1.

d. Sample answer:

$$\pi(2)^2(5) - \pi(4)^2(1) = 4\pi \approx 12.5 \text{ cm}^3$$

1-1 Expressions and Formulas

43. **CRITIQUE** Lauren and Rico are evaluating $\frac{-3d - 4c}{2ab}$ for $a = -2$, $b = -3$, $c = 5$, and $d = 4$. Is either of them correct? Explain your reasoning.

$$\begin{array}{l} \text{Lauren} \\ \frac{-3d - 4c}{2ab} = \frac{-3(4) - 4(5)}{2(-2)(-3)} \\ = \frac{-12 - 20}{12} = \frac{-32}{12} = \frac{8}{3} \end{array}$$

$$\begin{array}{l} \text{Rico} \\ \frac{-3d - 4c}{2ab} = \frac{-3(4) - 4(5)}{2(-2)(-3)} \\ = \frac{-12 - 20}{12} = \frac{8}{12} = \frac{2}{3} \end{array}$$

ANSWER:

Lauren; $-12 - 20 = -32$

44. **CHALLENGE** For any three distinct numbers a , b , and c , $a\$b\c is defined as $a\$b\$c = \frac{-a - b - c}{c - b - a}$. Find $-2\$(-4)\5 .

ANSWER:

$$\frac{1}{11}$$

45. **REASONING** The following equivalent expressions represent the height in feet of a stone thrown downward off a bridge where t is the time in seconds after release. Which do you find most useful for finding the maximum height of the stone? Explain.
- $-4t^2 - 2t + 6$
 - $-2(2t + 1) + 6$
 - $-2(t - 1)(2t + 3)$

ANSWER:

Sample answer: b; Since t is time, it must be nonnegative. So $-2t(2t + 1)$ will be negative for all values of t other than 0. The maximum value of $-2t(2t + 1)$ is 0, which occurs when $t = 0$. Thus, the maximum value of $-2t(2t + 1) + 6$ is 6.

46. **CHALLENGE** Let m , n , p , and q represent nonzero positive integers. Find a number in terms of m , n , p , and q that is halfway between $\frac{m}{n}$ and $\frac{p}{q}$.

ANSWER:

Halfway between $\frac{m}{n}$ and $\frac{p}{q}$ is the average of the two:

$$\frac{1}{2} \left(\frac{m}{n} + \frac{p}{q} \right) = \frac{qm + pn}{2nq}$$

47. **OPEN ENDED** Write an algebraic expression using $x = -2$, $y = -3$, and $z = 4$ and all four operations for which the value of the expression is 10.

ANSWER:

Sample answer: $y \left(\frac{-4z}{x^2} - x \right) + z$

48. **WRITING IN MATH** Provide an example of a formula used in everyday situations. Explain the usefulness of this formula and what happens if the formula is not used correctly.

ANSWER:

Sample answer: A formula is used to calculate the price of filling a gasoline tank in which the price = number of gallons \times price per gallon. If calculated incorrectly, you may underestimate or overestimate how much you will need to pay.

49. **WRITING IN MATH** Use the information for on-base percentage given at the beginning of the lesson to explain how formulas are used in baseball to calculate a player's stats. Explain why a formula for on-base percentage is more useful than a table of specific percentages.

ANSWER:

A table of on-base percentages is limited to those situations listed, while a formula can be used to find any on-base percentage.

1-1 Expressions and Formulas

50. **SAT/ACT** If the area of a square with side x is 9, what is the area of a square of side $4x$?

A 36
 B 144
 C 212
 D 324
 E 1296

ANSWER:

B

51. **SHORT RESPONSE** A coffee shop owner wants to open a second shop when his daily customer average reaches 800 people. He has calculated the daily customer average in the table below for each month since he has opened.

Month	Daily Customer Average
1	225
2	298
3	371
4	444

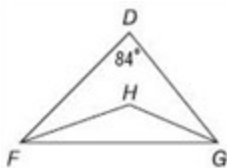
If the trend continues, during what month can he open a second shop?

ANSWER:

month 9

52. **GEOMETRY** In $\triangle DFG$, \overline{FH} and \overline{HG} are angle bisectors and $m\angle D = 84$. How many degrees are in $\angle FHG$?

F 96
 G 132
 H 145
 J 192



ANSWER:

G

53. A skydiver in a computer game free-falls from a height of 3000 m at a rate of 55 meters per second. Which equation can be used to find h , the height of the skydiver after t seconds of free fall?

A $h = -55t - 3000$
 B $h = -55t + 3000$
 C $h = 3000t - 55$
 D $h = 3000t + 55$

ANSWER:

B

54. The lengths of the three sides of a triangle are 10, 14, and 18 inches. Determine whether this triangle is a right triangle.

ANSWER:

no

55. The legs of a right triangle measure 6 centimeters and 8 centimeters. Find the length of the hypotenuse.

ANSWER:

10 cm

56. **MAPS** On a map of the U.S., the cities Milwaukee, Wisconsin, and Charlotte, North Carolina are

$6\frac{1}{2}$ inches apart. The actual distance between

Milwaukee and Charlotte is 670 miles. If Birmingham, Alabama and St. Petersburg Florida are 465 miles apart, how far apart are they on the map?

ANSWER:

about $4\frac{1}{2}$ in.

57. Factor $6x^2 + 12x$.

ANSWER:

$6x(x + 2)$

58. Find the product of $(a + 2)(a - 4)$.

ANSWER:

$a^2 - 2a - 8$

1-1 Expressions and Formulas

59. **NUMBER** An integer is 2 less than a number, and another integer is 1 greater than double that same number. What are the two integers if their sum is 14?

ANSWER:

3 and 11

Evaluate each expression.

60. $\sqrt{4}$

ANSWER:

2

61. $\sqrt{25}$

ANSWER:

5

62. $\sqrt{81}$

ANSWER:

9

63. $\sqrt{121}$

ANSWER:

11

64. $-\sqrt{9}$

ANSWER:

-3

65. $-\sqrt{16}$

ANSWER:

-4

66. $\sqrt{\frac{49}{100}}$

ANSWER:

$\frac{7}{10}$

67. $\sqrt{\frac{25}{64}}$

ANSWER:

$\frac{5}{8}$