

1-1 Expressions and Formulas

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

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

SOLUTION:

$$\begin{aligned}\frac{b^3 + ac}{ab + 2bc} &= \frac{3^3 + (-2)(4.2)}{(-2)(3) + 2(3)(4.2)} \\ &= \frac{27 - 8.4}{-6 + 25.2} \\ &= \frac{18.6}{19.2} \\ &= 0.96875\end{aligned}$$

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

SOLUTION:

$$\begin{aligned}\frac{3a - 2c}{4ab} &= \frac{3(-2) - 2(4.2)}{4(-2)(3)} \\ &= \frac{-6 - 8.4}{-24} \\ &= \frac{-14.4}{-24} \\ &= 0.6\end{aligned}$$

Evaluate each expression if

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

11. $y + x - z$

SOLUTION:

Substitute $x = 4$, $y = 2.6$ or $\frac{13}{5}$, and $z = \frac{1}{3}$ in the expression $y + x - z$.

$$\begin{aligned}y + x - z &= \frac{13}{5} + 4 - \frac{1}{3} \\ &= \frac{13(3) + 4(15) - 1(5)}{15} \\ &= \frac{39 + 60 - 5}{15} \\ &= \frac{94}{15} \\ &= 6\frac{4}{15}\end{aligned}$$

13. $4(x - w)$

SOLUTION:

$$\begin{aligned}4(x - w) &= 4(4 - (-3)) \\ &= 4(4 + 3) \\ &= 4(7) \\ &= 28\end{aligned}$$

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

SOLUTION:

$$\begin{aligned}9z - 4y + 2w &= 9\left(\frac{1}{3}\right) - 4(2.6) + 2(-3) \\ &= 3 - 10.4 - 6 \\ &= 3 - 16.4 \\ &= -13.4\end{aligned}$$

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?

SOLUTION:

a. miles per gallon \times number of gallons = distance traveled
 $33 \times 46.2 =$ distance traveled
 $1524.6 =$ distance traveled
Distance traveled was 1524.6 miles.

b. distance traveled = 60×12 or 720 miles.

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Evaluate each expression if

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

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

SOLUTION:

$$\begin{aligned}\frac{a-b}{bd} &= \frac{-4 - (-0.8)}{(-0.8)\left(\frac{1}{5}\right)} \\ &= \frac{-4 + 0.8}{\left(-\frac{0.8}{5}\right)} \\ &= \frac{-3.2}{-0.16} \\ &= 20\end{aligned}$$

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

SOLUTION:

$$\begin{aligned}\frac{b^2c^2}{ad} &= \frac{(-0.8)^2(5)^2}{(-4)\left(\frac{1}{5}\right)} \\ &= \frac{(0.64)(25)}{\left(-\frac{4}{5}\right)} \\ &= \frac{16}{\left(-\frac{4}{5}\right)} \\ &= 16\left(-\frac{5}{4}\right) \\ &= -\frac{(16)(5)}{4} \\ &= -\frac{80}{4} \\ &= -20\end{aligned}$$

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

SOLUTION:

$$\begin{aligned}\frac{5(d+a)}{2ab^2} &= \frac{5\left(\frac{1}{5} + (-4)\right)}{2(-4)(-0.8)^2} \\ &= \frac{5\left(\frac{1}{5} - 4\right)}{(-8)(0.64)} \\ &= \frac{5\left(\frac{1-4(5)}{5}\right)}{-5.12} \\ &= \frac{5\left(\frac{1-20}{5}\right)}{-5.12} \\ &= \frac{5\left(-\frac{19}{5}\right)}{-5.12} \\ &= \frac{-19}{-5.12} \\ &\approx 3.71\end{aligned}$$

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.

SOLUTION:

a. Substitute 64 for F in the formula $C = \frac{5(F-32)}{9}$.

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$$\begin{aligned}C &= \frac{5(64-32)}{9} \\ &= \frac{5(32)}{9} \\ &= \frac{160}{9} \\ &\approx 17.8\end{aligned}$$

Substitute 73 for F in the formula $C = \frac{5(F-32)}{9}$.

$$\begin{aligned}C &= \frac{5(F-32)}{9} \\ &= \frac{5(73-32)}{9} \\ &= \frac{5(41)}{9} \\ &= \frac{205}{9} \\ &\approx 22.8\end{aligned}$$

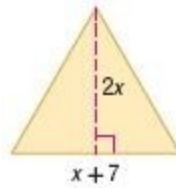
The room temperature range is about 17.8°C to 22.8°C .

b. Substitute 98.6 for F in the formula

$$\begin{aligned}C &= \frac{5(F-32)}{9} \\ C &= \frac{5(F-32)}{9} \\ &= \frac{5(98.6-32)}{9} \\ &= \frac{5(66.6)}{9} \\ &= \frac{333}{9} \\ &= 37\end{aligned}$$

So, $98.6^{\circ}\text{F} = 37^{\circ}\text{C}$. Since $42 > 37$, this temperature 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.



SOLUTION:

$$\begin{aligned}A &= \frac{1}{2}bh \\ &= \frac{1}{2}(x+7)(2x)\end{aligned}$$

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?

SOLUTION:

a. Substitute $\ell = 230$ and $w = 230$ in the formula

$$\begin{aligned}A &= \ell w \\ A &= \ell w \\ &= (230)(230) \\ &= 52,900\end{aligned}$$

The base area of the pyramid is $52,900 \text{ m}^2$.

b. Substitute $B = 52,900$ and $h = 146.7$ in the formula

$$\begin{aligned}V &= \frac{1}{3}Bh \\ V &= \frac{1}{3}(52900)(146.7) \\ &= \frac{7760430}{3} \\ &= 2,586,810\end{aligned}$$

The volume of the pyramid is about $2,586,810 \text{ m}^3$.

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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.

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

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

SOLUTION:

Lauren and Rico each wrote the equation correctly but Lauren is correct. She properly evaluated $-12 - 20 = -32$ while Rico evaluated this expression as 8.