

## Unit 2: Powers and Exponent Laws

Name: \_\_\_\_\_

**Lesson 2.3: Order of Operations with Powers****1. Evaluate.**

$$\begin{aligned} \text{a) } 5^2 + 3 \\ = 25 + 3 \\ = 28 \end{aligned}$$

$$\begin{aligned} \text{b) } 5^2 - 3 \\ = 25 - 3 \\ = 22 \end{aligned}$$

$$\begin{aligned} \text{c) } 5 + 3^2 \\ = 5 + 9 \\ = 14 \end{aligned}$$

$$\begin{aligned} \text{d) } 5 - 3^2 \\ = 5 - 9 \\ = -4 \end{aligned}$$

$$\begin{aligned} \text{e) } (5 + 3)^2 \\ = 8^2 \\ = 64 \end{aligned}$$

$$\begin{aligned} \text{f) } (5 - 3)^2 \\ = 2^2 \\ = 4 \end{aligned}$$

$$\begin{aligned} \text{g) } 5^2 + 3^2 \\ = 25 + 3^2 \\ = 25 + 9 \\ = 34 \end{aligned}$$

$$\begin{aligned} \text{h) } 5^2 - 3^2 &= 25 - 3^2 \\ &= 25 - 9 \\ &= 16 \end{aligned}$$

**2. Evaluate.**

$$\begin{aligned} \text{a) } 4^3 \times 2 \\ = 64 \times 2 \\ = 128 \end{aligned}$$

$$\begin{aligned} \text{b) } 4^3 \div 2 \\ = 64 \div 2 \\ = 32 \end{aligned}$$

$$\begin{aligned} \text{c) } 4 \times 2^3 \\ = 4 \times 8 \\ = 32 \end{aligned}$$

$$\begin{aligned} \text{d) } 4 \div 2^3 \\ = 4 \div 8 \\ = 0.5 \end{aligned}$$

$$\begin{aligned} \text{e) } (4 \times 2)^3 \\ = 8^3 \\ = 512 \end{aligned}$$

$$\begin{aligned} \text{f) } (4 \div 2)^3 \\ = 2^3 \\ = 8 \end{aligned}$$

$$\begin{aligned} \text{g) } 4^3 \times 2^3 \\ = 64 \times 8 \\ = 512 \end{aligned}$$

$$\begin{aligned} \text{h) } 4^3 \div 2^3 \\ = 64 \div 8 \\ = 8 \end{aligned}$$

3. Evaluate.

$$\begin{array}{lcl}
 \text{a) } (18 \div 3^2 + 1)^4 - 4^2 & \text{b) } 3^3 \div 9(3^0 - 2^2) & \text{c) } (12^2 + 5^3)^0 - 2[(-3)^3] \\
 = (18 \div 9 + 1)^4 - 4^2 & = 3^3 \div 9(1 - 4) & = 1 - 2(-27) \\
 = (2 + 1)^4 - 4^2 & = 3^3 \div 9(-3) & = 1 + 54 \\
 = 3^4 - 4^2 & = 27 \div 9(-3) & = 55 \\
 = 81 - 16 & = 3(-3) & \\
 = 65 & = -9 & 
 \end{array}$$

$$\begin{array}{lcl}
 \text{d) } (7 - 5)^3 \times (8 + 2)^4 & \text{e) } (4^2 \times 1^5)^2 & \text{f) } [(-3)^4 - (-2)^3]^0 \div [(-4)^3 - (-3)^2]^0 \\
 = (2)^3 \times (10)^4 & = (16 \times 1)^2 & 1 \div 1 \\
 = 8 \times 10000 & = 16^2 & 1 \\
 = 80000 & = 256 & 
 \end{array}$$

4. Insert brackets to make each statement true.

a)  $15 \div [3 + 2] \times 4^2 - 5 = 43$

b)  $15 \div 3 + 2 \times [4^2 - 5] = 27$

c)  $(15 \div 3 + 2) \times 4^2 - 5 = 107$

d)  $15 \div 3 + (2 \times 4^2 - 5) = 64$

5. The formula for the volume,  $V$ , of a cylinder with height,  $h$ , and radius,  $r$ , is  $V = \pi r^2 h$ . Janet made 3 L of salsa and stores it in jars with a radius of 4 cm and a height of 10 cm.

She uses this expression to determine the number of jars she will need:  $\frac{3000}{\pi(4)^2 \times 10}$

About how many jars will Janet need for the salsa?

$$\frac{3000}{\pi(4)^2 \times 10} = \frac{3000}{\pi(16) \times 10} = \frac{3000}{502.65} = 5.97$$

So Janet need approx.  
6 jars.

6. Aftab, Shane, and Kyra got different answers when they evaluated this expression:  
 $(-4)^2 - 3[(-9) \div 3]^2$

Aftab's answer was 97, Shane's answer was 43, and Kyra's answer was 19.

a) Show the correct solution.

$$\begin{aligned} & (-4)^2 - 3[(-9) \div 3]^2 \\ &= 16 - 3[-3]^2 \\ &= 16 - 3(9) \\ &= 16 - 27 \\ &= -11 \end{aligned}$$

b) Show and explain how the students who got the wrong answer may have evaluated.  
Where did each student go wrong?

Shane:

$$(-3)^2 \neq -9$$

Aftab:  
mult. -3 and -9  
before evaluating  
brackets and applying exp.

Kyra:  
Squared 3  
before doing  
any other operation