Lesson 2.3: Order of Operations with Powers

1. Evaluate.

a) $5^2 + 3$ **b)** $5^2 - 3$ **c)** $5 + 3^2$ **d)** $5 - 3^2$

e) $(5 + 3)^2$ **f)** $(5 - 3)^2$ **g)** $5^2 + 3^2$ **h)** $5^2 - 3^2$

2. Evaluate.

a) $4^3 \times 2$ **b)** $4^3 \div 2$ **c)** 4×2^3 **d)** $4 \div 2^3$

e) $(4 \times 2)^3$ **f)** $(4 \div 2)^3$ **g)** $4^3 \times 2^3$ **h)** $4^3 \div 2^3$

3. Evaluate.

a) $(18 \div 3^2 + 1)^4 - 4^2$ **b)** $3^3 \div 9(3^0 - 2^2)$ **c)** $(12^2 + 5^3)^0 - 2[(-3)^3]$

d) $(7 - 5)^3 \times (8 + 2)^4$ **e)** $(4^2 \times 1^5)^2$ **f)** $[(-3)^4 - (-2)^3]^0 \div [(-4)^3 - (-3)^2]^0$

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?

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.

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

ANSWER KEY for Lesson 2.3

1. **a)** 28 **b)** 22 **c)** 14
d) –4 **e)** 64 **f)** 4
g) 34 **h)** 16

2. **a)** 128 **b)** 32 **c)** 32 **d)** $\frac{1}{2}$
e) 512 **f)** 8 **g)** 512 **h)** 8

3. **a)** 65 **b)** –9 **c)** 55
d) 80 000 **e)** 256 **f)** 1

4. **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. About 6 jars

6. **a)** The correct solution:
$(-4)^2 - 3[(-9) \div 3]^2 = (-4)^2 - 3(-3)^2 = 16$
$- 3(9) = 16 - 27 = -11$
b) Shane probably thought that $(-3)^2 = -9$; here is a possible incorrect solution:
$(-4)^2 - 3[(-9) \div 3]^2 = (-4)^2 - 3(-3)^2 = 16$
$- 3(-9) = 16 + 27 = 43$
Aftab probably multiplied –3 and –9 before evaluating in the brackets and applying the exponent. Here is a possible incorrect solution:
$(-4)^2 - 3[(-9) \div 3]^2 = 16 + (27 \div 3)^2 =$
$16 + 9^2 = 16 + 81 = 97$
Kyra probably squared the 3 before doing any other operation. Here is a possible incorrect solution:
$(-4)^2 - 3[(-9) \div 3]^2 = 16 - 3[(-9) \div 9]$
$= 16 - 3(-1) = 16 + 3 = 19$