2.3 Order of Operations with Powers
or, How to Add 'em Up!

Connect

To avoid getting different answers when we evaluate an expression, we use this order of operations:

- Evaluate the expression in brackets first.
- Evaluate the powers.
- Multiply and divide, in order, from left to right.
- Add and subtract, in order, from left to right.

Example 1 Adding and Subtracting with Powers

Evaluate.

a) $3^3 + 2^3$ b) $3 - 2^3$ c) $(3 + 2)^3$

A Solution

a) Evaluate the powers before adding.

$$\begin{aligned} 3^3 + 2^3 &= (3)(3)(3) + (2)(2)(2) \\ &= 27 + 8 \\ &= 35 \end{aligned}$$

b) Evaluate the power, then subtract.

$$\begin{aligned} 3 - 2^3 &= 3 - (2)(2)(2) \\ &= 3 - 8 \\ &= -5 \end{aligned}$$

c) Add first, since this operation is within the brackets. Then evaluate the power.

$$\begin{aligned} (3 + 2)^3 &= 5^3 \\ &= (5)(5)(5) \\ &= 125 \end{aligned}$$

Example 2 Multiplying and Dividing with Powers

Evaluate.

a) $[2 \times (-3)^3 - 6]^2$ b) $(18^2 + 5^0)^2 \div (-5)^3$

A Solution

a) Follow the order of operations.

Do the operations in brackets first: evaluate the power $(-3)^3$

$[2 \times (-3)^3 - 6]^2 = [2 \times (-27) - 6]^2$ Then multiply: $2 \times (-27)$

$= [-54 - 6]^2$ Then subtract: $-54 - 6$

$= (-60)^2$ Then evaluate the power: $(-60)^2$

$= 3600$

b) $(18^2 + 5^0)^2 \div (-5)^3$

$= (324 + 1)^2 \div (-5)^3$

$= (325)^2 \div (-5)^3$

$= 105625 \div (-125)$

$= -845$

Practice Problems

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3 a,c,e
4 a,c,e,g
5 e,g
7

} For Tommorrow

8 a,f
10 b,d,f
13, 15, 24