

B: Exponent Laws Continued**Powers raised to an Exponent**

$$(a^m)^n = a^{m \times n}$$

$$(3^2)^3 = 3^{2 \times 3} = 3^6$$

$$(3 \times 3)^3$$

$$(3 \times 3) \times (3 \times 3) \times (3 \times 3)$$

$$= 3^6$$

Examples:

1. Write as a single power & evaluate.

a. $(4^3)^4$

$$= (4)^{3 \times 4}$$

$$= 4^{12}$$

$$= 16777216$$

b. $((-8)^2)^3$

$$= (-8)^{2 \times 3}$$

$$= (-8)^6$$

$$= 262144$$

2. Write as a power raised to an exponent.

a. $(3 \times 3 \times 3) \times (3 \times 3 \times 3) \times (3 \times 3 \times 3) \times (3 \times 3 \times 3)$

$$= (3^3) \times (3^3) \times (3^3) \times (3^3)$$

$$= (3^3)^4$$

b. $(4 \times 4) \times (4 \times 4) \times (4 \times 4)$

$$= (4^2) \times (4^2) \times (4^2)$$

$$= (4^2)^3$$

Quotients Raised to an Exponent

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

Bring the exponent onto everything in the brackets!

Examples:

1. Write as a quotient of two powers & evaluate.

a. $\left(\frac{4}{5}\right)^3$

$$= \frac{4^3}{5^3}$$

$$= \frac{64}{125}$$

Reduce if you can!

$$b. \left(\frac{-2}{3}\right)^6$$

$$= \frac{(-2)^6}{3^6}$$

$$= \frac{64}{729}$$

Reduce if you can!

Product Raised to an exponent

$$(a \times b)^m = a^m \times b^m$$

$$(4 \times 5)^3 = 4^3 \times 5^3$$

Examples:

1. Write as the product of two powers and evaluate.

a. $[6 \times (-2)]^4$

Bring the exponent onto everything in the brackets!

$$= 6^4 \times (-2)^4$$

$$= 1296 \times 16$$

$$= 20736$$

b. $(2 \times 3)^3$

$$= 2^3 \times 3^3$$

$$= 8 \times 27$$

$$= 216$$

c. $(-5 \times 4)^2$

$$= (-5)^2 \times 4^2$$

$$= 25 \times 16$$

$$= 400$$

Combining Laws

Examples:

1. Express as a single power & evaluate.

a. $(2^2)^4 \times 2^3$

$= 2^{2 \times 4} \times 2^3$

$= 2^8 \times 2^3$

$= 2^{8+3}$

$= 2^{11}$

$= 2048$

b. $\frac{((-3)^2)^4 \times (-3)^4}{(-3)^3}$

$= \frac{(-3)^{2 \times 4} \times (-3)^4}{(-3)^3}$

$= \frac{(-3)^8 \times (-3)^4}{(-3)^3}$

$= \frac{(-3)^{8+4}}{(-3)^3}$

$= \frac{(-3)^{12}}{(-3)^3}$

$= (-3)^{12-3}$

$= (-3)^9 = -19683$

c. $(-3^3)^4$

$= (-1 \times 3^3)^4$

$= (-1)^4 \times (3^3)^4$

$= 1 \times 3^{3 \times 4}$

$= 1 \times 3^{12}$

$= 1 \times 531441$

$= 531441$

***If you forget about the negative sign
your answer may have the wrong sign!***

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