

Laws of Exponents [Review - Laws of Exponents.pdf](#)

exponent
(or index,
or power)

8²

base

The exponent of a number says **how many times to multiply** the number.

In this example: $8^2 = 8 \times 8 = 64$

- In words: 8^2 could be called "8 to the second power", "8 to the power 2" or simply "8 squared"

Product Law: The law that $x^m x^n = x^{m+n}$

With $x^m x^n$, how many times will you end up multiplying "x"? Answer: first "m" times, then by another "n" times, for a total of "m+n" times.

Example: $x^2 x^3 = (xx) \times (xxx) = xxxxx = x^5$

So, $x^2 x^3 = x^{(2+3)} = x^5$

The multiplication law states that when multiplying two powers with the same base we add the exponents.

$$(y^3)(y^2) = y^5$$

These have the same base.

$$(y^3)(y^2) = y^5$$

The five comes from the addition of three and two... ($2 + 3 = 5$)

Why Add?

y × y × y × y × y

5

1. Simplify the following using the multiplication law.

a. $(x^2)(x^3)$

$$x^5$$

b. $(2x^4)(3x^2)$

$$6x^6$$

c. $(-2x^2)(4x^3)(2x^4)$

$$-16x^9$$

Quotient Law: The law that $x^m/x^n = x^{m-n}$

Like the previous example, how many times will you end up multiplying "x"? Answer: "m" times, then **reduce that** by "n" times (because you are dividing), for a total of "m-n" times.

Example: $x^{4-2} = x^4/x^2 = (xxxx) / (xx) = xx = x^2$

(Remember that $x/x = 1$, so every time you see an x "above the line" and one "below the line" you can cancel them out.)

The division law states that when dividing powers with the same base we subtract the exponents.

Same Base

Division $\frac{y^4}{y^3} = y^1$

Subtract
 $4 - 3 = 1$

Why does this work?

2. Simplify each of the following using the division law.

a. $\frac{x^8}{x^5}$

x^3

b. $\frac{y^7}{y^9}$

y^{-2}
 $\frac{1}{y^2}$

c. $\frac{15x^5}{3x^2}$

$5x^3$

d. $\frac{100x^{13}}{25x^7}$

$4x^6$

What about these?

$$\frac{15m^9}{4m^3}$$

$$\frac{15m^6}{4}$$

$$\frac{(4x^3)(3x^4)}{4x^2}$$

$$\frac{12x^7}{4x^2}$$

$$3x^5$$

$$\frac{24a^{10}b^6}{4a^2b^{12}}$$

$$\frac{6a^8}{b^6}$$

Power Law of Exponents

The power of a power rule states that when a power is placed to an exponent we multiply the two exponents.

$$(y^3)^2 = (y \times y \times y)(y \times y \times y)$$
$$(y^3)^2 = y^6$$

Multiply $3 \times 2 = 6$

Why does this work?

Examples...

Power Law:

$$\textcircled{1} (m^6)^4$$

$$m^{24}$$

$$\textcircled{2} (3^2)^5$$

$$3^{10}$$

$$\textcircled{3} (x^6 y)^4$$

$$x^{24} y^4$$

$$\textcircled{4} (2x^3)^3$$

$$2^3 x^9$$

$$8x^9$$

$$\textcircled{5} (3x^4 y^5)^2$$

$$3^2 x^8 y^{10}$$

$$9x^8 y^{10}$$

$$\textcircled{6} (x^2)^3 x^7$$

$$x^6 x^7$$

$$x^{13}$$

$$\textcircled{7} m^7 \times (m^2)^4 \div (m^3)^2$$

$$m^7 \times m^8 \div m^6$$

$$\textcircled{8} \frac{(2x^3)^3 (4x)^2}{(2x^3)^5 (x^2)^7}$$

$$m^{15} \div m^6$$

$$m^9$$

$$\frac{2^3 x^9 \cdot 4^2 x^2}{2^5 x^{15} \cdot x^{14}}$$

$$\frac{8x^9 \cdot 16x^2}{32x^{15} \cdot x^{14}}$$

$$\frac{128x^{11}}{32x^{29}}$$

$$\frac{4}{x^{18}}$$

Attachments

Image (19).jpg

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Worksheet - Simplifying Radicals (Square Roots).pdf

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Review Solutions - Laws of Exponents (Grade 9).pdf

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