Laws of Exponents

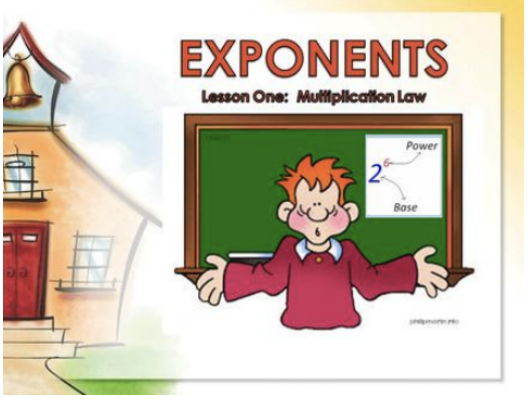
$$x^a x^b = x^{a+b}, \quad (x^a)^b = x^{ab}$$

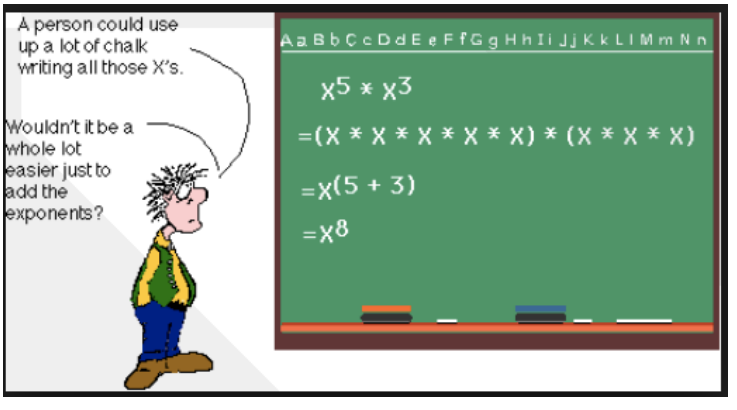
$$\frac{x^a}{x^b} = x^{a-b}, \quad (xy)^a = x^a y^a$$

$$x^0 = 1, \quad x^1 = x, \quad x^{-a} = \frac{1}{x^a}$$

SEMINAR NOTES

Learning Guide 4





SEMINAR NOTES for LG 4

Exponent Laws

Exponent Law For Multiplication

$$a^m \times a^n = a^{m+n}$$

Be sure to watch for like bases. First rewrite the like base, then add the exponents together.

Ex. Write the following product as a single power.

$$4^3 \times 4^2 = (4 \times 4 \times 4) \times (4 \times 4)$$
$$= 4^{3+2} = 4^5$$

Write as repeated multiplication. Rewrite the base. Add the exponents.

Rewrite the base. That was easier! Add the exponents.

Ex. Write the following product as a single power.

$$5^2 \times 5^4 = 5^{2+4} = 5^6$$

Try Simplify: $6^3 \times 6^6 =$

1. Write each of the following products as a single power:

$3^2 \times 3^4$ $\quad$ $7^3 \times 7^5$ $\quad$ $2^6 \times 2^3$ $\quad$ 9×9^4

Exponent Law For Division

$$a^m \div a^n = a^{m-n}$$

Be sure to watch for like bases. First rewrite the like base, then subtract the exponents.

Ex. Write the following quotient as a single power.

$$6^4 \div 6^2 = \frac{(6\times6\times6\times6)}{(6\times6)}$$

$$= 6^{4-2} = 6^2$$

Write as repeated multiplication.
Rewrite the base.
Subtract exponents.
Rewrite the base.
That was easier!
Subtract exponents.

Ex. Write the following quotient as a single power.

$$2^{10} \div 2^7 = 2^{10-7} = 2^3$$

Try Simplify: $6^8 \div 6^3 =$

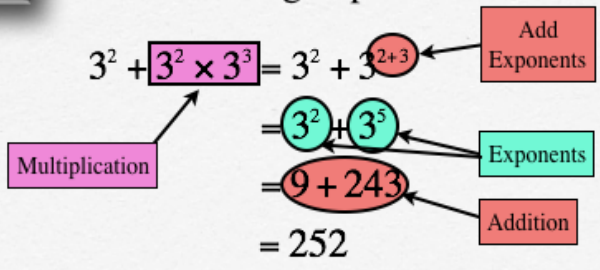
2. Write each of the following quotients as a single power:

$$\frac{7^6}{7^4} = \qquad \frac{3^4}{3^2} = \qquad \frac{6^{12}}{6^9} = \qquad \frac{(-5)^7}{(-5)^3} =$$

Order of Operations Using Exponent Laws

You must know in which order you need to evaluate each expression.
Use the mnemonic BEDMAS to decide the order of operations.

Ex. Use BEDMAS to evaluate the following expression.



Try Simplify: $2^4 + 2^8 \div 2^5 =$

Exponent Law For a Power of a Power

$$(a^m)^n = a^{mn}$$

To raise a power to a power, multiply the exponents

Ex. Write the following power of a power as a single power.

$$(7^2)^3 = 7^2 \times 7^2 \times 7^2$$
$$= 7^{2\times 3} = 7^6$$

Write as repeated multiplication.
Rewrite the base.
Multiply the exponents.
Rewrite the base.
Multiply the exponents.

Ex. Write the following power of a power as a single power.

$$(5^4)^6 = 5^{4\times 6} = 5^{24}$$

Try Simplify: $(3^5)^2 =$

Write each of the following power of powers as a single power:

$(8^3)^9$ $(3^4)^2$ $(2^5)^3$ $(11^2)^7$

Exponent Law For a Power of a Product

$$(ab)^m = a^m b^m$$

When there is a product to a power, each base can be written with that power.

Ex. Write the following power of a product as a single power.

$$(2\times5)^3 = (2\times5)\times(2\times5)\times(2\times5)$$
$$= 2^3 \times 5^3$$

Write as repeated multiplication. Rewrite the bases. Put the exponents on all bases.

Ex. Write the following power of a product as a single power.

$$(3\times4)^5 = 3^5 \times 4^5 \text{ or } = (12)^5$$

Try Simplify: $(2\times5)^2 =$

Write each of the following power of products as individual powers:

$(-2\times8)^3$ $(3\times5)^2$ $(2\times9)^3$ $(6\times4)^7$

Exponent Law For a Power of a Quotient

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

When there is a quotient to a power, each base can be written with that power.

Ex. Write the following power of a quotient as a single power.

$$\left(\frac{3}{4}\right)^4 = \left(\frac{3}{4}\right)\times\left(\frac{3}{4}\right)\times\left(\frac{3}{4}\right)\times\left(\frac{3}{4}\right)$$

$$= \left(\frac{3^4}{4^4}\right)$$

Note It may be easier to evaluate inside the brackets instead.

Rewrite the bases.
Multiplication.
Power the bases.
Put the exponents on all bases.

$$\left(\frac{14}{7}\right)^5 = (2)^5 = 32$$

Ex. Write the following power of a quotient as a single power.

$$\left(\frac{1}{5}\right)^2 = \left(\frac{1^2}{5^2}\right)$$

Try Simplify: $\left(\frac{2}{7}\right)^4 =$

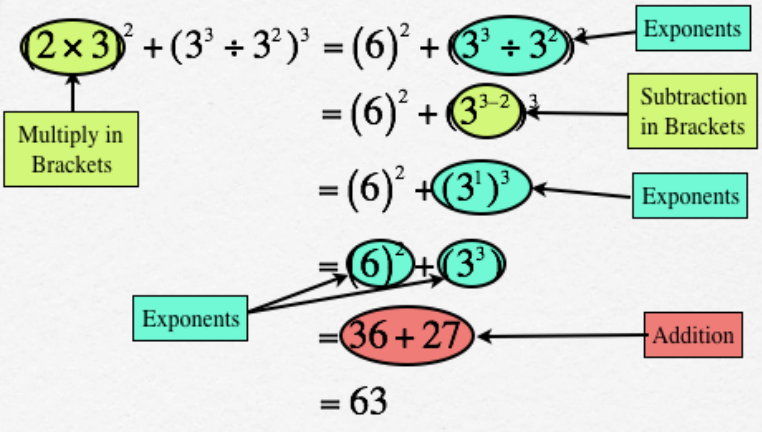
Write each of the following power of quotients as a individual powers:

$\left(\frac{2}{3}\right)^5 =$ $\left(\frac{6}{7}\right)^2 =$ $\left(\frac{9}{2}\right)^3 =$ $\left(\frac{3}{8}\right)^4 =$

Order of Operations Using Exponent Laws

Use the mnemonic BEDMAS to decide the order of operations.

Ex. Use BEDMAS to evaluate the following expression.



Try Simplify: $(6\div 3)^4 - (2^5\times 2^4)^4 =$

Simplify, then evaluate

$10^3\div 10^2+10^2=$

$10^3-10^2\times 10^2=$

$\dfrac{10^3\times 10^4}{10^2}=$