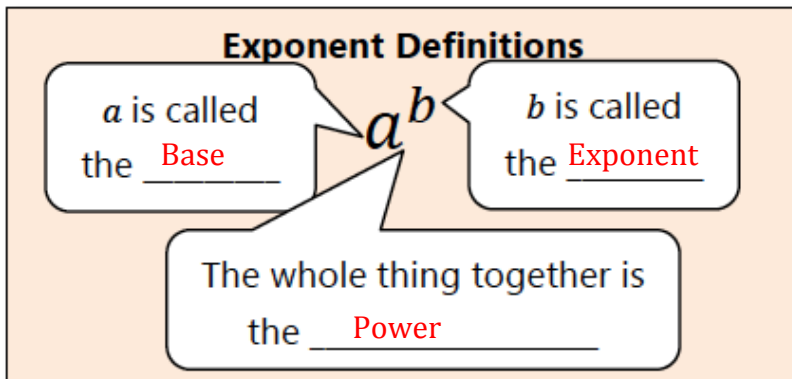


Exponents

An exponential function is a function that has a variable as an exponent.



$$2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$$

The **exponent** tells us how many times the base is multiplied together.

Unwritten Exponents

If a number or a variable does not have a written exponent, then the exponent is 1.

$$7 = 7^1$$

$$xy^2z = x^1y^2z^1$$

Exponent Rules

- Remember, you can only use Exponent Rules with Like Bases.
- Combining Like Terms

Like Terms have the same variables and the same exponents.

If you have LIKE terms, you can combine them by adding or subtracting their coefficients.

The variables and exponents do NOT change.

Simplify.

$$(2x^2 + 3x + 5) + (x^2 - x - 1)$$

$$2x^2 + x^2 + 3x - x + 5 - 1$$

$$3x^2 + 2x + 4$$

Simplify.

$$6x + 7x - x + 9y - y - 2x$$

$$6x + 7x - x - 2x + 9y - y$$

$$10x + 8y$$

What is the difference between $3x$ and x^3 ?

$3x$ means 3 times x

x^3 means x times x times x

If $x = 2$, then $3x = 3(2) = 6$, but $x^3 = 2^3 = 8$.

Combine each expression into a single term.

a. $a + a + a + a$

$4a$

b. $2b + 5b$

$7b$

Add the coefficients.

c. $a \cdot a \cdot a \cdot a$

a^4

d. $b^2 \cdot b^5$

b^7

Add the exponents.

♦ Product Rule

$$x^a \cdot x^b = x^{a+b}$$

When you MULTIPLY powers with the **same base**, ADD their exponents.

The coefficients are multiplied as usual.

Fill out the table.

Product	Repeated Multiplication	Power of the Form a^b
$2^2 \cdot 2^3$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^5
$5^1 \cdot 5^4 \cdot 5^3$	$5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$	5^8
$x^2 \cdot x^7$	$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^9

Use the Product Rule to simplify each of the following.

a. $x^4 \cdot x^3$

$x^{4+3} = x^7$

b. $a^2 \cdot a^3 \cdot a^5$

$a^{2+3+5} = a^{10}$

c. $b^7 \cdot c^6 \cdot b$

$b^{7+1}c^6 = b^8c^6$

♦ Quotient Rule

$$\frac{x^a}{x^b} = x^{a-b}$$

When you DIVIDE powers with the **same base**, SUBTRACT their exponents.

Think of it as “canceling”.

The leftover exponent remains where the bigger exponent was originally.

Fill out the table.

Quotient	Repeated Multiplication That Cancels Out	Power of the Form a^b
$\frac{2^3}{2^2}$	$\frac{2 \cdot 2 \cdot 2}{2 \cdot 2}$	$2^1 = 2$
$\frac{3^7}{3^4}$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3 \cdot 3}$	3^3
$\frac{x^4}{x^{10}}$	$\frac{x \cdot x \cdot x \cdot x}{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}$	$\frac{1}{x^6}$

Use the Quotient Rule to simplify each of the following.

a. $\frac{x^{12}}{x^4}$

$$x^{12-4} = x^8$$

b. $\frac{4x^7y^3}{2x^3y^6}$

$$\frac{4}{2} \cdot x^{7-3} \cdot y^{3-6} = 2x^4y^{-3} = \frac{2x^4}{y^3}$$

c. $\frac{27s^5}{54s}$

$$\frac{s^{5-1}}{2} = \frac{s^4}{2}$$