

Law of Exponents

For $a \neq 0, b \neq 0$

Product	$a^x \times a^y = a^{x+y}$
Quotient	$a^x \div a^y = a^{x-y}$
Power	$(a^x)^y = a^{xy}$
Zero Exponent	$a^0 = 1$
Negative Exponent	$a^{-x} = \frac{1}{a^x}$

Exponent of 1

$$a^1 = a$$

Exponents with negative bases

6^2	-6^2	$(-6)^2$
2^3	-2^3	$(-2)^3$
5^4	-5^4	$(-5)^4$
4^1	-7^1	$(-12)^1$
7^0	-5^0	$(-14)^0$

Negative Exponents

$$1. \quad 6^{-2} = \frac{1}{6^2} = \frac{1}{36}$$

$$2. \quad 4^{-5} = \frac{1}{4^5} = \frac{1}{1024}$$

$$3. \quad y^{-7} = \frac{1}{y^7}$$

1. Base & Exponent move to the denominator.
2. Exponent becomes positive.
3. Evaluate.

The negative sign does NOT indicate a negative base or power. It means the inverse.

Which is equal to 2^{-6} ?

$\frac{1}{2^{-6}}$	$\frac{1}{(-2)^{-6}}$	$-(2)^6$	$\frac{1}{2^6}$
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Which is equal to $\frac{1}{8^2}$?

-8^2	8^{-2}	$\frac{1}{(-8)^{-2}}$	8^2
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Write the expression as a whole number with a negative exponent. Do not evaluate the expression.

$$\frac{1}{9^2}$$

9^{-2}

Write the expression as a fraction with a positive exponent

$$93^{-329}$$

$$93^{-329}$$

$\frac{1}{93^{329}}$

EXPONENT LAWS

	Example	Expanded	Simplified	Exponent Rule
Multiplication	$a^3 \times a^5$	$(a \cdot a \cdot a) \times (a \cdot a \cdot a \cdot a \cdot a)$	a^8	$a^m \cdot a^n = a^{m+n}$
Division	$\frac{a^6}{a^2}$	$\cancel{a} \cdot \cancel{a} \cdot a \cdot a \cdot a \cdot a$ $\cancel{a} \cdot \cancel{a}$	a^4	$\frac{a^m}{a^n} = a^{m-n}$
Power Law	$(a^2)^4$	$a \cdot a \times a \cdot a \times a \cdot a \times a \cdot a$	a^8	$(a^m)^n = a^{m \times n}$
Power of a Product	$(a^2 b)^3$	$a^2 b \cdot a^2 b \cdot a^2 b$	$a^6 b^3$	$(a^x b^y)^m = a^{xm} b^{ym}$
Power of a Quotient	$\left(\frac{a}{b^3}\right)^5$	$\frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3}$	$\frac{a^5}{b^{15}}$	$\left(\frac{a^x}{b^y}\right)^m = \frac{a^{xm}}{b^{ym}}$

Multiplying with Exponents

$$470^6 \cdot 470^3$$

$$788^9 \cdot 788^9$$

$$898^6 \cdot 898^4$$

$$470^{77} \cdot 470^3 \cdot 470^3$$

When multiplying with the same base,
add the exponents.

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Multiplication	$a^3 \times a^5$	$(a \cdot a \cdot a) \times (a \cdot a \cdot a \cdot a \cdot a)$	a^8	$a^m \cdot a^n = a^{m+n}$
Division	$\frac{a^6}{a^2}$	$\cancel{a} \cdot \cancel{a} \cdot a \cdot a \cdot a \cdot a$ $\cancel{a} \cdot \cancel{a}$	a^4	$\frac{a^m}{a^n} = a^{m-n}$
Power Law	$(a^2)^4$	$a \cdot a \times a \cdot a \times a \cdot a \times a \cdot a$	a^8	$(a^m)^n = a^{m \times n}$
Power of a Product	$(a^2 b)^3$	$a^2 b \cdot a^2 b \cdot a^2 b$	$a^6 b^3$	$(a^x b^y)^m = a^{xm} b^{ym}$
Power of a Quotient	$\left(\frac{a}{b^3}\right)^5$	$\frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3}$	$\frac{a^5}{b^{15}}$	$\left(\frac{a^x}{b^y}\right)^m = \frac{a^{xm}}{b^{ym}}$

Dividing with Exponents

$$\frac{729^7}{729^2}$$

$$\frac{121^9}{121^5}$$

$$\frac{821^5}{821^7}$$

$$\frac{873^3}{873^9}$$

$$\frac{678^8}{678^8}$$

When dividing with
the same base,
_____ the
exponents.

EXPONENT LAWS

	Example	Expanded	Simplified	Exponent Rule
Multiplication	$a^3 \times a^5$	$a \cdot a \cdot a \times a \cdot a \cdot a \cdot a \cdot a$	a^8	$a^m \cdot a^n = a^{m+n}$
Division	$\frac{a^6}{a^2}$	$\cancel{a} \cdot \cancel{a} \cdot a \cdot a \cdot a \cdot a$ $\cancel{a} \cdot \cancel{a}$	a^4	$\frac{a^m}{a^n} = a^{m-n}$
Power Law	$(a^2)^4$	$(a \cdot a) \times (a \cdot a) \times (a \cdot a) \times (a \cdot a)$	a^8	$(a^m)^n = a^{m \times n}$
Power of a Product	$(a^2 b)^3$	$a^2 b \cdot a^2 b \cdot a^2 b$	$a^6 b^3$	$(a^x b^y)^m = a^{xm} b^{ym}$
Power of a Quotient	$\left(\frac{a}{b^3}\right)^5$	$\frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3} \cdot \frac{a}{b^3}$	$\frac{a^5}{b^{15}}$	$\left(\frac{a^x}{b^y}\right)^m = \frac{a^{xm}}{b^{ym}}$

Power Rule

$$(8^5)^2$$

$$(4^8)^7$$

$$(12^4)^4$$

$$(8^6)^{15}$$

When raising a power
to a power,
_____ the
exponents).

$$(5^2)^0$$

$$(1^{20})^9$$