## Laws of Exponents

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The continued product of a number multiplied with itself a number of times can be written as the number raised to the power a natural number, equal to the number of times the number is multiplied with itself.

To make calculations easier, we have few rules or laws of exponents:

- Multiplying Powers with the same base
- Dividing Powers with the same base
- Power with Exponent zero
- Power of a Power
- Multiplying Powers with the same exponents
- Dividing Powers with the same exponents

Let's discuss each one of them in detail:

## Law 1: Multiplying Powers with the same base

If ' $a$ ' is any non - zero rational number and $m, n$ are natural numbers, then
$a^{m} \times a^{n}=a^{m+n}$

Also, If ' $a$ ' is any non - zero rational number and $m, n, p$ are natural numbers, then $a^{m} \mathrm{xa}^{\mathrm{n}} \mathrm{xa}^{\mathrm{p}}=\mathrm{a}^{\mathrm{m}+\mathrm{n}+\mathrm{p}}$

Example: Simplify: $3^{2} \times 3^{5}$
$=3^{2+5}$
$=3^{7}$

## Law 2: Dividing Powers with the same base

If ' $a$ ' is any non - zero rational number and $m, n$ are natural numbers such that $m>n$, then

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

Example: Simplify: $9^{12} \div 9^{10}$
$=9^{12-10}$
$=9^{2}$

## Law 3: Power with exponent zero

If ' $a$ ' is any non - zero rational number raise to power 0 , then it is equal to 1
$a^{0}=1$
Example: $7^{3} \div 7^{3}$
$=7^{3-3}$
$=7^{0}$
$=1$

## Law 4: Power of a Power

If ' $a$ ' is any rational number different from zero and $m, n$ are natural numbers, then $\left(a^{m}\right)^{n}=a^{m x n}=\left(a^{n}\right)^{m}$

Example: Simplify: $\left(2^{3}\right)^{4}=2^{3 \times 4}=2^{12}$

## Law 5: Multiplying Powers with the same exponents

If $\mathrm{a}, \mathrm{b}$ are non - zero rational numbers and n is a natural number, then
$a^{n} x^{n}=(a b)^{n}$
Also, If $\mathrm{a}, \mathrm{b}, \mathrm{c}$ are non - zero rational numbers and n is a natural number, then
$a^{n} \mathrm{Xb}^{\mathrm{n}} \times \mathrm{c}^{\mathrm{n}}=(\mathrm{abc})^{\mathrm{n}}$
Example: $2^{5} \times 3^{5}$
$=(2 \times 3)^{5}$
$=6^{5}$

## Law 6: Dividing Powers with the same exponents

If a and b are non - zero rational numbers and n is a natural number, then

$$
a^{n}=a_{n}{ }^{n}
$$


$\mathrm{b}=\mathrm{b}$

Example: $(2 / 3)^{2}$
$=(2 \times 2) /(3 \times 3)$
$=4 / 9$

Now try it yourself! Should you still need any help,click here to schedule live online session with e Tutor!

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## Reference Links:

- http://en.wikipedia.org/wiki/Exponentiation
- http://en.wikipedia.org/wiki/Natural_number
- http://en.wikipedia.org/wiki/Rational_number

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