REVIEW

Powers

of Ten

POWERS OF TEN

It is often useful to use powers of ten when expressing large and small numbers.

Positive exponents:

$10^2 =$ $10 \cdot 10 = 100$

$10^3 =$ $10^3 = 1000$

$10^6 =$ $1,000,000$

What is a trillion?

$(\text{billion} = 10^9)$

$\text{trillion} = 10^{12} = 1,000,000,000,000$

Negative exponents:

$10^{-2} =$ $\dfrac{1}{10^2} = \dfrac{1}{100} = 0.01$

$10^{-3} =$ $\dfrac{1}{1000} = 0.001$

$10^{-6} =$ 0.000001

How do you write one-trillionth?

$10^{-12} = \dfrac{1}{10^{12}} = 0.000000000001$

> NOTE:
>
> A positive exponent tells how many zeros follow the 1.
>
> A negative exponent tells how many places are to the right of the decimal point, including the 1.

Multiplying and Dividing Powers of 10.

$10^4 \times 10^9 = 10^{4+9} = 10^{13}$

$10^5 \times 10^{-4} = 10^{5+-4} = 10^1 = 10$

$10^{-7} \times 10^{-3} = 10^{-7+-3} = 10^{-10}$

Rules of exponents:

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

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

$(a^m)^n = a^{m \times n}$

$10^4 \div 10^9 = \dfrac{10^4}{10^9} = \dfrac{10^4}{10^4 10^5} = \dfrac{1}{10^5} = 10^{-5}$ or $10^4 \div 10^9$

$= 10^4 \cdot 10^{-9} = 10^{-5}$

$10^5 \div 10^{-4} = 10^5 \cdot 10^4 = 10^{5+4} = 10^9$

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

$10^{-7} \cdot 10^3 = 10^{-7+3} = 10^{-4}$

Adding and Subtracting Powers of 10

If the powers of 10 are not the same, one must write them in decimal notation.

$10^4 + 10^3 = 10000 + 1000 = 11000$

$10^5 + 10^{-4} = 100,000 + 0.0001 = 100,000.0001$

$10^{-7} + 10^{-3} = 0.0000001 + 0.001$

$= 0.0010001$

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