Applying the Properties of Exponents

In exponential expression such as$4^{7}$, the number 4 is called the **base**. The number 7 is called the **exponent**. It tells how many times the base is used as a factor.

So, $4^{7}=4×4×4×4×4×4×4$

If the exponent is negative, put the exponential expression in the denominator of a fraction with a numerator of 1. So $4^{-7}=\frac{1}{4^{7}}$

To multiply exponential expressions with the same base, add the exponents.

 $5^{3}×5^{2}=5^{3+2}=5^{5}$

Why this works:

 $5^{3}×5^{2}=\left(5×5×5\right)×\left(5×5\right)$

 $ =\left(5×5×5×5×5\right)$

 $=5^{5}$

To find the value of an exponential expression with an exponent, multiply the exponents. $\left(3^{2}\right)^{3}=3^{2×3}=3^{6}$

Why this works

 $\left(3^{2}\right)^{3}=3^{2}×3^{2}×3^{2}$

 $=\left(3×3\right)×\left(3×3\right)×\left(3×3\right)$

 $=\left(3×3×3×3×3×3\right)$

 $=3^{6}$

To divide exponential expressions with the same bases, subtract the exponents.

 $\frac{4^{5}}{4^{3}}=4^{5-3}=4^{2}$

Why this works:

 $\frac{4^{5}}{4^{3}}=\frac{4×4×4×4×4}{4×4×4}$

 $=\frac{4×4}{4}$

 $ =4^{2}$

When a product has an exponent, the exponent applies to each factor.

 $\left(9x\right)^{3}=\left(9^{3}\right)\left(x^{3}\right)=729x^{3}$

Why this works:

 $\left(9x\right)^{3}=9x∙9x∙9x$

 $=\left(9∙9∙9\right)\left(x∙x∙x\right)$

 $=9^{3}∙x^{3}$

 $=729x^{3}$