

# Exponent Rules

**Exponent:  
Definition**

$x^n$  means  $x$  multiplied  
by itself  $n$  times

$$\begin{aligned}4^3 &= 4 * 4 * 4 = 64 \\ (-2)^3 &= (-2)(-2)(-2) = -8 \\ (-2)^2 &= (-2)(-2) = 4\end{aligned}$$

**Zero Rule:**

$$x^0 = 1$$

$$8^0 = 1$$

**Negative Rule:**

$$x^{-n} = \frac{1}{x^n}$$

$$9^{-2} = \frac{1}{9^2} = \frac{1}{81}$$

$$\frac{1}{x^{-n}} = x^n$$

$$\frac{1}{2^{-3}} = 2^3 = 8$$

**Product Rule:**

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

$$x^2(x^3) = x^{2+3} = x^5$$

**Power Rule:**

$$(x^m)^n = x^{(mn)}$$

$$(5^3)^8 = 5^{(3*8)} = 5^{24}$$

**Quotient Rule:**

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

$$\frac{x^9}{x^4} = x^{9-4} = x^5$$

**Product Raised  
to a Power:**

$$(xy)^n = x^n y^n$$

$$(7y)^2 = 7^2 y^2 = 49y^2$$

**Quotient Raised  
to a Power:**

$$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$$

$$\left(\frac{x}{8}\right)^3 = \frac{x^3}{8^3} = \frac{x^3}{512}$$

**Rational Exponent:**

$$x^{\frac{m}{n}} = \sqrt[n]{x^m}$$

$$4^{\frac{3}{2}} = \sqrt[2]{4^3} = \sqrt[2]{64} = 8$$

$$x^{\frac{m}{n}} = \left(\sqrt[n]{x}\right)^m$$

$$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = (3)^2 = 9$$