

# Exponents & Radicals

**Zero exponent:**

$$a^0 = 1; \quad a \neq 0$$

**Negative exponents:**

$$a^{-n} = \frac{1}{a^n}; \quad a \neq 0$$

**Multiplication with common bases:**

$$a^x a^y = a^{x+y}$$

**Division with common bases:**

$$\frac{a^x}{a^y} = a^{x-y}; \quad a \neq 0$$

**Raising an exponent to another exponent:**

$$(a^x)^y = a^{xy}$$

**Raising a product to an exponent:**

$$(ab)^n = a^n b^n$$

**Raising a quotient to an exponent:**

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}; \quad b \neq 0$$

**Fractional exponents:**

$$a^{\frac{x}{y}} = \sqrt[y]{a^x}$$

**nth root of a product:**

$$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$$

**nth root of a quotient:**

$$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$$

**Taking the root of a root:**

$$\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$$

**Properties of nth roots:**

$$\sqrt[n]{a^n} = a, \text{ if } n \text{ is odd}$$

$$\sqrt[n]{a^n} = |a|, \text{ if } n \text{ is even}$$