

## Exponent Rules

For  $a \neq 0, b \neq 0$

Product Rule	$a^x \times a^y = a^{x+y}$
Quotient Rule	$a^x \div a^y = a^{x-y}$
Power Rule	$(a^x)^y = a^{xy}$
Power of a Product Rule	$(ab)^x = a^x b^x$
Power of a Fraction Rule	$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
Zero Exponent	$a^0 = 1$
Negative Exponent	$a^{-x} = \frac{1}{a^x}$
Fractional Exponent	$a^{\frac{x}{y}} = \sqrt[y]{a^x}$

**Laws of Radicals.** If  $n$  is even, assume  $a, b \geq 0$ .

$$1] \quad (\sqrt[n]{a})^n = a$$

$$2] \quad \sqrt[n]{ab} = \sqrt[n]{a} \sqrt[n]{b}$$

$$3] \quad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$$

$$4] \quad \sqrt[n]{a^m} = (\sqrt[n]{a})^m$$

$$5] \quad \sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$$

$$i^0 = 1$$

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = -i$$

$$i^4 = 1$$

Equivalence:

$$a^x = y \leftrightarrow \log_a y = x$$

$$e^x = y \leftrightarrow \ln y = x$$

Log of a product:

$$\log_a x \cdot y = \log_a x + \log_a y$$

$$\ln x \cdot y = \ln x + \ln y$$

Log of a quotient:

$$\log_a \frac{x}{y} = \log_a x - \log_a y$$

$$\ln \frac{x}{y} = \ln x - \ln y$$

Log of a power:

$$\log_a x^n = n \log_a x$$

$$\ln x^n = n \ln x$$

Log of a reciprocal:

$$\log_a \frac{1}{x} = -\log_a x$$

$$\ln \frac{1}{x} = -\ln x$$

Log of the base:

$$\log_a a = 1$$

$$\ln e = 1$$

Log of 1:

$$\log_a 1 = 0$$

$$\ln 1 = 0$$