Logarithmic Properties

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

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

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

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

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

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

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

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

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

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

$$\log_a a = 1$$

$$\ln e = 1$$

$$\log_a 1 = 0$$

$$\ln 1 = 0$$

$$\log_a a^x = x$$

$$\log x = \log_{10} x$$

$$a^{\log_a x} = x$$

$$\ln x = \log_e x$$

$$\log_b x = \frac{\log_a x}{\log_a b}$$