Error Analysis Equation Sheet
Compiled: August 31, 2011 by Michael Olson

Mean

$$\bar{x} = \frac{1}{N} \sum_{i=1}^{N} x_i.$$

Uncertainty of Measurements/Standard Deviation

$$\delta x = \sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} (x_i - \bar{x})^2}$$

Uncertainty of the Mean/Standard Deviation of the Mean

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{N}}$$

Propagation of Error (Addition and Subtraction)

$$q = x_1 + x_2 + \cdots - y_1 - y_2 - \ldots$$

$$\delta q = \sqrt{(\delta x_1)^2 + (\delta x_2)^2 + \cdots + (\delta y_1)^2 + (\delta y_2)^2 + \ldots}$$

Propagation of Error (Products and Quotients)

$$q = \frac{x_1 x_2 \ldots}{y_1 y_2 \ldots}$$

$$\frac{\delta q}{q} = \sqrt{\left(\frac{\delta x_1}{x_1}\right)^2 + \left(\frac{\delta x_2}{x_2}\right)^2 + \cdots + \left(\frac{\delta y_1}{y_1}\right)^2 + \left(\frac{\delta y_2}{y_2}\right)^2 + \ldots}$$

Propagation of Error (Powers)

$$q = x^n$$

$$\frac{\delta q}{q} = |n| \left| \frac{\delta x}{x} \right|$$