

# Useful Information

- **Derivative of Cosine**  $\frac{d}{dt} \cos(kt) = -k \sin(kt)$
- **Derivative of Sine**  $\frac{d}{dt} \sin(kt) = k \cos(kt)$
- **Fourier Transform:**  $F(\omega) = \int_{-\infty}^{\infty} f(t) e^{-i\omega t} dt$
- **Gravitational Constant:**  $G = 6.6 \times 10^{-11} \text{ N(m/kg)}^2$
- **Gravitational Time Dilation:**  $t_0 = t_f \sqrt{1 - \frac{2GM}{rc^2}}$
- **Newtons 2nd Law:**  $F = m \frac{d^2x}{dt^2}$
- **Small Angle Approximation:**  $\sin(\theta) \approx \theta$  for  $\theta \ll 1$
- **Snell's Law:**  $\frac{v_1}{v_2} = \frac{n_2}{n_1}$
- **Speed of light:**  $c = 3.0 \times 10^8 \text{ m/s}$
- **Time Dilation:**  $\Delta t' = \frac{\Delta t}{\sqrt{1 - \frac{v^2}{c^2}}}$
- **Uncertainty of N Averages:**  $\sigma_{ave} = \frac{\sigma}{\sqrt{N}}$
- **Velocity Formula:**  $v = \frac{x}{t}$