

Kinematics

Linear

$$v_f = v_i + at \qquad \Delta x = \frac{1}{2}(v_i + v_f)t$$

$$v_f^2 = v_i^2 + 2a\Delta x \qquad \Delta x = v_i t + \frac{1}{2}at^2$$

Rotational

$$\omega = \omega_i + \alpha t \qquad \theta = \frac{1}{2}(\omega_f + \omega_i)t$$

$$\omega^2 = \omega_i^2 + 2\alpha\theta \qquad \theta = \omega_i t + \frac{1}{2}\alpha t^2$$

Work and Energy

Potential Energy

$$U_{gravity} = mgh \qquad U_{spring} = \frac{1}{2}kx^2$$

Kinetic Energy

$$K = \frac{1}{2}mv^2 \qquad K_{rotational} = \frac{1}{2}I\omega^2$$

Conservation of Energy

$$\Delta K + \Delta U = 0$$

Projectile Motion

$$v_x = v \cos \theta$$

$$v_y = v \sin \theta$$

$$\theta = \tan^{-1} \frac{v_y}{v_x}$$

$$\text{max height } h = \frac{v_{yi}^2}{2g}$$

$$\text{max range } r = \frac{v_{xi}^2 \sin(2\theta)}{g}$$

$$\text{distance } d = \frac{1}{2}a_x t^2$$

Circular Motion

$$F = m \frac{v^2}{r} = m\omega^2 r$$

$$\omega = 2\pi f = \frac{v}{r}$$

$$\alpha = \frac{v^2}{r} = \frac{a}{r}$$

$$f = \frac{rev}{sec}$$

$$1 \frac{rev}{sec} = 2\pi \frac{rad}{sec}$$