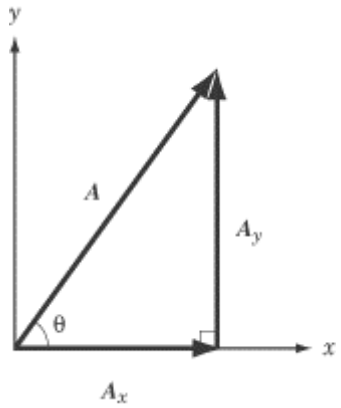
PHYS 310 Formulas

Vectors

$\vec{A} = A_x\hat{\imath} + A_y\hat{\jmath}$ $\quad A_x = Acos(\theta)$ $\quad A_y = Asin(\theta)$

$|A| = \sqrt{A_x^2 + A_y^2}$ $\quad \theta = tan^{-1}(A_y/A_x)$



Equations of Motion for Constant Acceleration

$v = v_i + at$ $\quad x = \frac{1}{2}(v + v_i)\cdot t$

$x = v_{ix}t + \frac{1}{2}at^2$ $\quad v^2 = v_i^2 + 2ax$

$a_x = 0\ and\ a_y = -9.8\ {}^{m}/_{s^2}\ \ for\ projectile$

Forces and Newton's Laws of Motion

$g = 9.8{}^{m}/_{s^2}$ (free fall acceleration) $\quad \sum\vec{F} = m\vec{a}$

$\sum F_x = ma_x \quad \sum F_y = ma_y$

$\vec{F}_{AonB} = -\vec{F}_{BonA}$

$F_g = \frac{Gm_1m_2}{r^2}$ (Gravitational Force)

$G = 6.673 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$

$W = mg$ (Weight)

$F_s \leq \mu_s \cdot N$ (Static Friction)

$F_k = \mu_k \cdot N$ (Kinetic Friction)

$\vec{F} = -k\vec{x}$ (Spring)

Oscillations and Rotational Motion

$v_T = r\omega$ (Tangential velocity)

$a_c = \frac{v^2}{r}$ (Centripetal acceleration)

$F_c = \frac{mv^2}{r}$ (Centripetal force)

$\omega = \omega_i + \alpha t$

$\Delta\theta = \frac{1}{2}(\omega_i + \omega) \cdot t$

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

$\omega^2 = \omega_i^2 + 2\alpha\Delta\theta$

$a_T = r\alpha$ (Tangential acceleration)

$\omega = 2\pi f = \frac{2\pi}{T}$

$T = \frac{1}{f}$

Energy, Work and Momentum

$KE_i + PE_i = KE_f + PE_f$

$KE = 1/2mv^2$ (Kinetic energy)

$PE_{grav} = mgh$ (Grav. potential energy)

$PE_{elastic} = \frac{1}{2}kx^2$ (Elastic potential energy)

$W_{total} = \Delta KE$

$|W| = |F||d|\cos\theta|$

$\vec{p} = m\vec{v}$ (Momentum)

Rotation of a Rigid Body

$F_c = \frac{mv^2}{r}$ (Centripetal force)

$a_c = \frac{v^2}{r}$ (Centripetal acceleration)

$\sum \tau = I\alpha$

$\tau = rF\sin\theta$ (Torque)

$T = \frac{1}{f}$

$\omega = 2\pi f = \frac{2\pi}{T}$

$\vec{L} = I\vec{\omega}$ (Angular Momentum)

$\vec{\tau} = \frac{d\vec{L}}{dt}$

Fluid Statics and Dynamics

$\rho = \frac{m}{v}$ (Density)

$p = \frac{F}{A}$ (Pressure)

$p = p_0 + \rho g d$

$v_1 A_1 = v_2 A_2$

$p_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = p_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2$