Formula Sheet for phys101 major exam #1

$$y = x^n \qquad \frac{dy}{dx} = nx^{n-1}$$

Motion in One Dimension

$$v = \frac{dx}{dt} \qquad a = \frac{dv}{dt} \qquad v_{avg} = \frac{\Delta x}{\Delta t} \qquad a_{avg} = \frac{\Delta v}{\Delta t}$$

Motion with Constant Acceleration

$v = v_o + a\,t$		$x - x_o = v_o t + \frac{1}{2} a\,t^2$
$v^2 = v_o^2 + 2a(x - x_o)$	$x - x_o = \frac{1}{2}(v + v_o)t$	$x - x_o = v\,t - \frac{1}{2} a\,t^2$

Free Fall

$$a = -g \qquad g = 9.80 m/s^2$$

Vector Multiplications

$$\vec{a} \cdot \vec{b} = ab\cos\phi \qquad \left|\vec{a} \times \vec{b}\right| = ab\sin\phi$$

Motion in Two Dimensions

$$\vec{v} = \frac{d\vec{r}}{dt}; \qquad \vec{a} = \frac{d\vec{v}}{dt}$$

$$\vec{r} = x\,\hat{i} + y\,\hat{j} \qquad \vec{r} - \vec{r}_o = \vec{v}_o t + \frac{1}{2}\vec{a}t^2; \qquad \vec{v} = \vec{v}_o + \vec{a}t$$

Projectile Motion

$a_x = 0$	$a_y = -9.80 m/s^2$
$v_x = v_o \cos\theta_o$	$v_y = v_o \sin\theta_o - g\,t$
$x - x_o = v_o \cos\theta_o\, t$	$y - y_o = v_o \sin\theta_o\, t - \frac{1}{2}\mathrm{g}\,t^2$

Uniform Circular Motion

$a_r = \frac{v^2}{r}$	$T = \frac{2\pi r}{v}$

Relative Motion

$\vec{v}_{PA} = \vec{v}_{PB} + \vec{v}_{BA}$	$\vec{v}_{AB}$ = velocity of A relative to B $= -\vec{v}_{BA}$

Newton's Second Law

$$\sum \vec{F} = m\vec{a} \quad \Leftrightarrow \quad \sum F_x = \mathrm{ma}_x; \quad \sum F_y = \mathrm{ma}_y$$

Friction

$$f_{s,\max} = \mu_s N; \quad f_k = \mu_k N$$