Formula Sheets (PHY111)

Vectors and Vector Components (angle is counterclockwise from positive x-axis)

$A_x = A \cos \theta$

$A_y = A \sin \theta$

$A = \sqrt{(A_x{}^2 + A_y{}^2)}$

$\theta = tan^{-1}\left(\frac{A_y}{A_x}\right)$

Linear Equations of Motion (x and y are interchangeable)

$v_x = \frac{\Delta x}{\Delta t}$

$a = \frac{\Delta v}{\Delta t}$

$v_y = v_0 + at$

$\Delta y = \left(\frac{v_0 + v}{2}\right) t$

$\Delta y = v_0 t + ½at^2$

$v^2 = v_0{}^2 + 2a\,\Delta x$

Range = $\frac{v_0{}^2 sin2\theta_0}{g}$

Work Energy and Power

$K.E._{lin} = \frac{1}{2}mv^2$

$U_g = mgy$

$F = kx$

$U_e = \frac{1}{2}kx^2$

$W = F.s = F\ s\ cos\theta$

$P = \frac{W}{t} = Fv$

$f_k = \mu_k n$

$f_s \leq \mu_s n$

Momentum

$p = mv$

Newton's law

$\sum F = ma$

Impulse

$J = F\Delta t$

Elastic collisions only

$v_{bf} - v_{af} = -(v_{bi} - v_{ai})$

Rotational motion equations

$$\boldsymbol{\omega = \frac{\Delta\theta}{\Delta t}}$$

$$\boldsymbol{\alpha = \frac{\Delta\omega}{\Delta t}}$$

$$\boldsymbol{\omega = \omega_0 + \alpha t}$$

$$\boldsymbol{\Delta\theta = \left(\frac{(\omega_0+\omega)}{2}\right) t}$$

$$\boldsymbol{\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2}$$

$$\boldsymbol{\Delta\theta = \omega t - \frac{1}{2}\alpha t^2}$$

$$\boldsymbol{\omega^2 = \omega_0{}^2 + 2\alpha\Delta\theta}$$

$$\boldsymbol{v_{lin} = \omega r}$$

$$\boldsymbol{a_{tan} = r\alpha}$$

$$\boldsymbol{a_{rad} = \omega^2 r}$$

$$\boldsymbol{a_{linear} = \sqrt{a_{tan}{}^2 + a_{rad}{}^2}}$$

$$\boldsymbol{K.E._{rot} = \frac{1}{2} I\omega^2}$$

$$\boldsymbol{I = mr^2}$$

$$\boldsymbol{\mathrm{W} = \tau\Delta\theta}$$

$$\boldsymbol{\Sigma\tau = I\alpha}$$

$$\boldsymbol{\tau = Fl}$$

$$\boldsymbol{P = \tau\omega}$$

$$\boldsymbol{L = I\omega}$$

Falling mass (m) from solid cylinder (M) only

$$\boldsymbol{a = \frac{g}{1 + \frac{M}{2m}}}$$

$$\boldsymbol{\alpha = \frac{a}{r}}$$