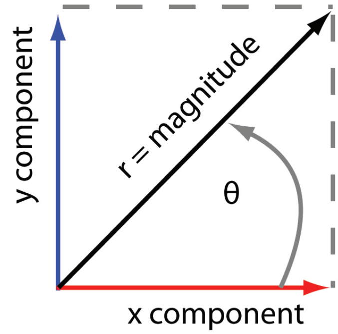
Equations

Linear Kinematics

$$V = \frac{P_f - P_i}{\Delta t} \qquad \Delta P = \int_{t_0}^{t_1} V\,dt \qquad P_f = \int (V \times dt) + P_i$$

$$A = \frac{V_f - V_i}{\Delta t} \qquad V = \int_{t_0}^{t_1} A\,dt \qquad V_f = \int (A \times dt) - V_i$$

Vectors



$$x = r\cos\theta$$

$$y = r\sin\theta$$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$

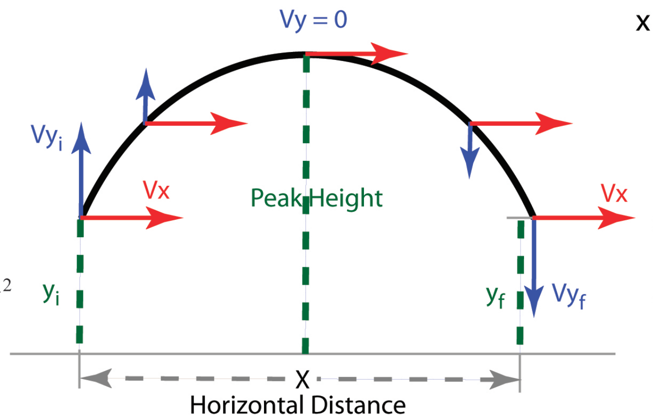
Projectiles

$$Vy_f = Vy_i + at$$

$$(Vy_f)^2 = (Vy_i)^2 + at$$

$$y_f = y_i + Vy_i(t) + \frac{1}{2}at^2$$

$$x = Vx(t)$$



Angular Kinematics

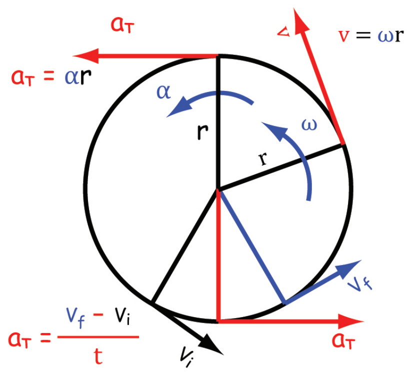
$$\omega = \frac{\theta f - \theta i}{\Delta t} \qquad v = \omega r$$

$$a_T = \alpha r$$

$$\alpha = \frac{\omega_f - \omega_i}{\Delta t} \qquad a_T = \frac{V_f - V_i}{t}$$

$$a_C = \frac{V^2}{r} \qquad a_C = r\omega^2$$

$$F_C = m\frac{V^2}{r} \qquad F_C = mr\omega^2$$

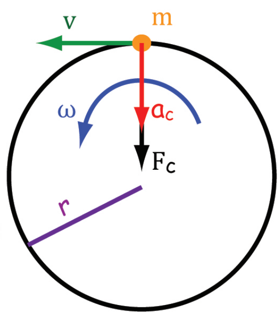


F = m a

$F_c = m\,a_c$

$a_c = r\omega^2$

$F_c = mr\omega^2$



F = m a

$F_c = m\,a_c$

$a_c = \frac{v^2}{r}$

$F_c = m\,\frac{v^2}{r}$

Conversions

$$rad = \frac{\deg}{57.29} \qquad kg = \frac{Lbs}{2.2046} \qquad Wt = mg$$

Equations

Force - Linear Kinetics

$\Sigma F = ma$ $\quad \Sigma Fx = ma_x$ $\quad \Sigma Fy = ma_y$ $\quad \Sigma Fz = ma_z$

Linear Momentum

$p = mv$ $\quad v_A = \frac{m_B u_B}{m_A}$ $\quad v_B = \frac{m_A u_A}{m_B}$ $\quad m_A u_A + m_B u_B = (m_A + m_B)v$

Impulse

$J = \bar{F}\Delta t$

$J = \int_{t_0}^{t_1} F\, dt$

Impulse - Momentum

$\bar{F}(\Delta t) = mV_f - mV_i$ $\quad \bar{R}x(\Delta t) = mV_f - mV_i$

$\int_{t_0}^{t_1} F\, dt = mV_f - mV_i$ $\quad (\overline{Ry + mg})(\Delta t) = mVy_f - mVy_i$

Work and Energy

$W = \frac{1}{2}m(Vy_f)^2 - \frac{1}{2}m(Vy_i)^2 + mgh_{y_f - y_i}$

$W = F(y_f - y_i)$

$W = \int_{t_0}^{t_1} F \times \Delta y$

$W = \int_{t_0}^{t_1} P\ \ dt$

$W = \int_{t_0}^{t_1} \tau \times \Delta\theta$

$KE = \frac{1}{2}mVy^2$ $\quad PE = mgh$ $\quad E = KE + PE$

$KE_R = \frac{1}{2}I\omega^2$ $\quad h = \frac{E}{mg}$

Power

$P = \frac{W}{t}$ $\quad P = F \times V$ $\quad P = \tau \times \omega$

Angular Momentum - Angular Impulse

$L = I\omega$ $\quad \Sigma\tau(t) = I\omega_f - I\omega_i$

$\int_{t0}^{t1} \tau\ dt = I\omega_f - I\omega_i$

Torque and Angular Kinetics

$\tau = |F| \times l$ $\quad \Sigma\tau = I\alpha$