Chapter 1 Equations

Percent error:

If a measurement = value ± error, the percent error $= \frac{\text{error}}{\text{value}} \times 100\ \%$.

Chapter 2 Equations

Motion:

$\bar{v} = \frac{\Delta x}{\Delta t}, \quad \Delta x = x - x_0, \quad$ slope of $x(t) = v(t)$.

$\bar{a} = \frac{\Delta v}{\Delta t}, \quad \Delta v = v - v_0, \quad$ slope of $v(t) = a(t)$.

For constant acceleration in one-dimension:

$\bar{v} = \frac{1}{2}(v_0 + v), \quad v = v_0 + at, \quad x = x_0 + v_0 t + \frac{1}{2}at^2, \quad v^2 = v_0^2 + 2a(x - x_0)$.

For free fall on earth:

$g = 9.80$ m/s^2 downward.

$v_y = v_{y0} - gt, \quad y = y_0 + v_{y0}t - \frac{1}{2}gt^2.$ Using an upward y-axis.

Chapter 3 Equations

Vectors

Written $\vec{V}$ or $\mathbf{V}$, described by magnitude=V, direction=θ or by components (V_x, V_y).

$V_x = V\cos\theta, \quad V_y = V\sin\theta,$

$V = \sqrt{V_x^2 + V_y^2}, \quad \tan\theta = \frac{V_y}{V_x}.$ θ is the angle from $\vec{V}$ to x-axis.

Addition: $\mathbf{A} + \mathbf{B}$, head to tail. Subtraction: $\mathbf{A} - \mathbf{B}$ is $\mathbf{A} + (-\mathbf{B})$, $-\mathbf{B}$ is $\mathbf{B}$ reversed.

Projectiles

$a_x = 0, \quad v_x = v_{x0}, \quad x = x_0 + v_{x0}t.$ For a horizontal x-axis.

$a_y = -g, \quad v_y = v_{y0} - gt, \quad y = y_0 + v_{y0}t - \frac{1}{2}gt^2.$ For an upward y-axis.

$R = \frac{v_0^2}{g}\sin 2\theta_0,$ (For level ground only.)

Relative Motion

$\vec{V}_{\text{BS}} = \vec{V}_{\text{BW}} + \vec{V}_{\text{WS}},$ B=Boat, S=Shore, W=Water.

BS means "boat relative to shore", etc.

Must be applied as a vector equation!

Trig summary

$\sin\theta = \frac{(\text{opp})}{(\text{hyp})}, \quad \cos\theta = \frac{(\text{adj})}{(\text{hyp})}, \quad \tan\theta = \frac{(\text{opp})}{(\text{adj})}, \quad (\text{opp})^2 + (\text{adj})^2 = (\text{hyp})^2.$

$\sin\theta = \sin(180^\circ - \theta), \quad \cos\theta = \cos(-\theta), \quad \tan\theta = \tan(180^\circ + \theta), \quad \sin^2\theta + \cos^2\theta = 1.$