UNITS AND VECTORS

1. Units and Dimensional Consistency

2. Vector Notation

3. Adding and Subtracting Vectors

1. Units and Dimensional Consistency

The basic dimensions

ℓ [meters]
t [seconds]
m [kilograms]

Equations and dimensional consistency

$$x - x_0 = v_0 t + 1/2 a t^2$$

$$(m) - (m) = \left(\frac{m}{s}\right)(s) + \frac{1}{2}\left(\frac{m}{s^2}\right)(s)^2$$

$$v^2 = v_0^2 + 2a(x - x_0)^2$$

$$\left(\frac{m}{s}\right)^2 = \left(\frac{m}{s}\right)^2 + \left(\frac{m}{s^2}\right)(m - m)^2$$

$x = 5t^3 - 2t^2 + 3t + 1$

x in metrs

t in sec

$1\ m$

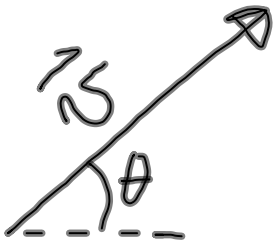
$3\ m/s$

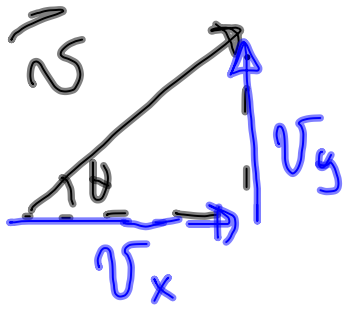
$-2\ m/s^2$

$5\ m/s^3$

2. Vector Notation

magnitude & direction vs ijk





$(v, \theta) = \vec{v}$

$(20_{m/s}, 30^\circ) = \vec{v}$

$\vec{v} = v_x \hat{i} + v_y \hat{j}$

$\vec{v} = (17.3 \hat{i} + 10 \hat{j})_{m/s}$

$\Rightarrow$

$v_x = v\cos\theta$

$v_y = v\sin\theta$

} assuming θ with X-axis

$\Leftarrow$

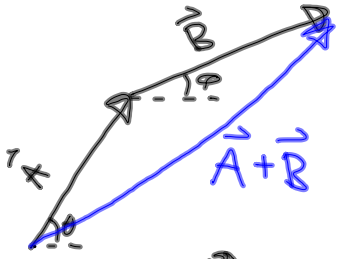
$v = \sqrt{v_x^2 + v_y^2}$

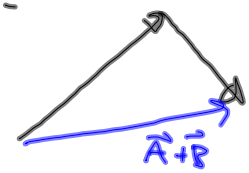
$\theta = \tan^{-1}\left(\frac{v_y}{v_x}\right)$

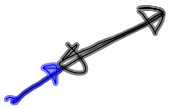
3. Adding and Subtracting Vectors

magnitude & direction vs ijk

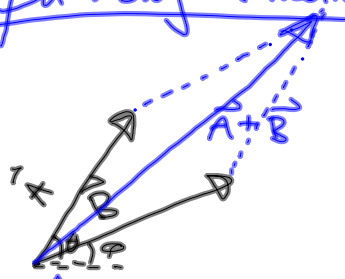
1) head-to-tail





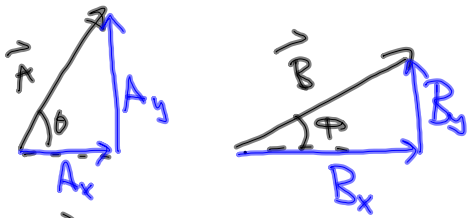


Parallelogram method



resultant

i j k



$\vec{A} = A_x \hat{i} + A_y \hat{j}$

$\vec{B} = B_x \hat{i} + B_y \hat{j}$

$\vec{A} + \vec{B} = (A_x + B_x)\hat{i} + (A_y + B_y)\hat{j}$