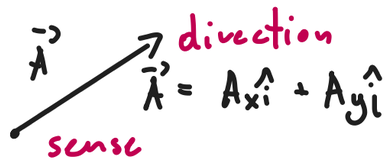
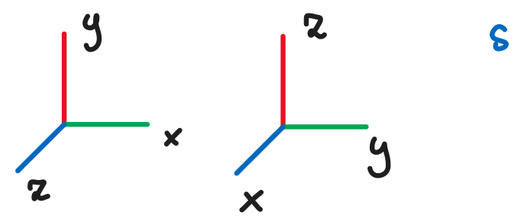
## Physics:




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

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## Vectors:

$\vec{v} = [\hat{i}, \hat{i}, \hat{k}]$

Addition
Substraction
Multiplication
Cross product:

$\vec{c} \perp \vec{a} \wedge \vec{c} \perp \vec{b}$

$\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$

$a = [a_x, a_y, a_z]$

$b = [b_x, b_y, b_z]$

$$\vec{c} = \begin{vmatrix} \hat{i} & \hat{i} & \hat{k} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix} = \begin{matrix} \hat{i}(a_y b_z - a_z b_y) \\ \hat{i}(a_z b_x - a_x b_z) \\ \hat{k}(a_x b_y - a_y b_x) \end{matrix}$$

## Lenght:

$|\vec{v}| = \sqrt{\hat{i}^2 + \hat{i}^2 + \hat{k}^2}$

$\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos(\vec{a}, \vec{b})$

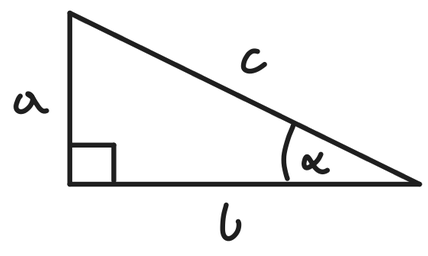
## Errors:

absolute error: $\overline{T_R} - \overline{T_c} = \Delta T$

real number — estimation

relative error: $\frac{\Delta T}{\overline{T_c}} = \delta$

## Trygonometry




$\sin\alpha = \frac{a}{c}$ $\quad \tan\alpha = \frac{a}{b}$

$\cos\alpha = \frac{b}{c}$ $\quad \cot\alpha = \frac{b}{a}$

$\sin^2\alpha + \cos^2\alpha = 1$

$1 + tg^2\alpha = \frac{1}{\cos^2\alpha}$

$1 + \cot^2\alpha = \frac{1}{\sin^2\alpha}$

$\sin(-\alpha) = -\sin\alpha$

$\cos(-\alpha) = \cos\alpha$

$\tan(-\alpha) = -\tan\alpha$

$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \sin\beta\cos\alpha$

$\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$

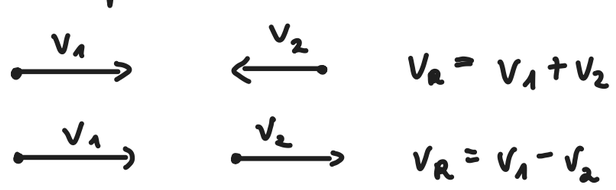
$\sin(2\alpha) = 2\sin\alpha\cos\alpha$

$\cos(2\alpha) = \cos^2\alpha - \sin^2\alpha = 2\cos^2\alpha - 1 = 1 - 2\sin^2\alpha$

## Motion:

$v = \frac{s}{t} \quad | \quad s = vt \quad | \quad t = \frac{s}{v}$

relative speed:




avarge:

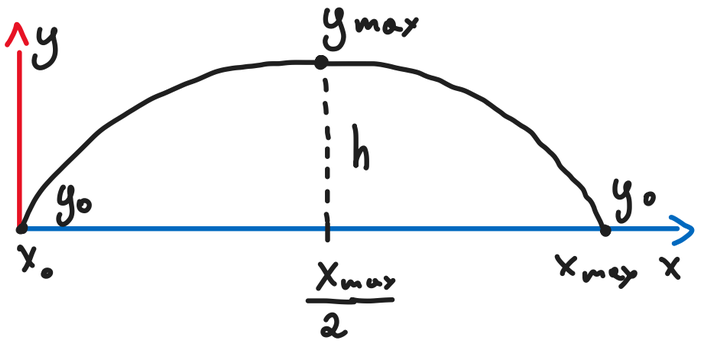
- speed $\frac{\text{total distance}}{\text{total time}}$

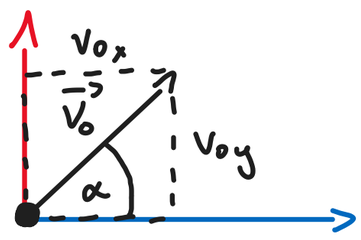
- velocity $\frac{\text{displacement}}{\text{total time}}$

$x(t) = x_0 + v_0 t + \frac{at^2}{2}$

$v(t) = v_0 + at$

throwing:




initial velocity:

$\vec{v_0} = [v_0\cos\alpha, v_0\sin\alpha]$

$h = \frac{v_0^2 \sin^2\alpha}{2g}$ $\quad [y_{max}]$

$r(t) = \left[v_0\cos\alpha\, t ; v_0\sin\alpha\, t - \frac{gt^2}{2}\right]$

$v(t) = [v_0\cos\alpha ; v_0\sin\alpha - gt]$