

## Mathematics

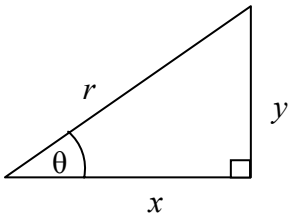
Quadratic equation:

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometry:

$$x^2 + y^2 = r^2$$



$$\sin \theta = y / r$$

$$\cos \theta = x / r$$

$$\tan \theta = y / x$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

Calculus:

$$\frac{d}{dt}(a \cdot t^n) = a \cdot n t^{n-1}$$

$$\int x^n dx = \frac{x^{n+1}}{n+1}$$

## Constants

$$c = 3.0 \times 10^8 \text{ m/s}$$

$$g = 9.80 \text{ m/s}^2$$

## Translational Kinematics

Three dimensions:

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

$$\vec{v}_{av} = \frac{\Delta \vec{r}}{\Delta t} = \frac{\vec{r}_2 - \vec{r}_1}{t_2 - t_1} \quad \vec{v} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$$

$$\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1} \quad \vec{a} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}$$

One dimension:

$$v_{x,av} = \frac{\Delta x}{\Delta t} \quad v_x = \lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$$

$$a_{x,av} = \frac{\Delta v_x}{\Delta t} \quad a_x = \lim_{\Delta t \rightarrow 0} \frac{\Delta v_x}{\Delta t} = \frac{dv_x}{dt}$$

Constant acceleration in one dimension:

$$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$$

$$v_x = v_{0x} + a_x t$$

$$v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$$