Kinematics

Equations in the left-hand column are the ones most important to memorize.

Symbols

On this page:

- a acceleration
- v velocity (const.)
- t time
- v_0 original velocity
- v_f final velocity
- s_0 original position
- s final position
- d Distance (scalar)

Constant velocity (no acceleration)

$d = vt$

Average velocity and acceleration

$v_{avg} = (s - s_0)/\Delta t$ $\quad$ $v_{avg} = \Delta d/\Delta t$

$a_{avg} = (v_f - v_0)/\Delta t$ $\quad$ $a_{avg} = \Delta v/\Delta t$

Accelerated motion

$s = s_0 + v_0 t + \frac{1}{2}at^2$ $\quad$ $d = v_0 t + \frac{1}{2}at^2$

$v_f^2 = v_0^2 + 2ad$ $\quad$ $d = \frac{1}{2}at^2$

$v_f = v_0 + at$ $\quad$ $d = \frac{1}{2}(v_f + v_0)t$

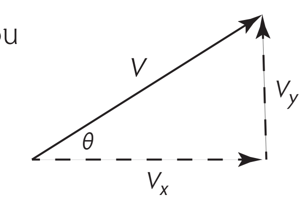
Falling objects:

Use acceleration due to gravity:

$g = -9.8 \text{ m/s}^2$

Two-dimensional Motion

Two-dimensional motion is handled using the same equations as above, but you can decompose the velocity into perpendicular components that are treated separately.



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

Projectile motion

One common case is a projectile moving in the earth's gravity. You treat the horizontal component as uniform motion (i.e., no acceleration), because it is parallel to the ground and so there's no force in that direction; you treat the vertical component as accelerated motion under the influence of gravity.

Horizontal: $x_f = x_0 + v_x t$ $\quad$ Vertical: $y_f = y_0 + v_y t + \frac{1}{2}gt^2$