Accelerated Motion

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Definitions

Average velocity

$v_{avg} = d/t$

Average acceleration

$a_{avg} = (v_f - v_0)/t$

Equations

Fundamental equations

Position, s

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

Velocity vs time

$v_f = v_0 + at$

Falling objects:

Use acceleration due to gravity:

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

Derived Equations

Displacement from velocity & time

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

Displacement vs time:

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

Distance Equations (not vector)

Velocity vs Distance

$v_f^2 = v_0^2 + 2ad$

Distance starting from rest

$d = \frac{1}{2}at^2$

Acceleration should always be positive for these equations (because they aren't vector relationships).

Symbols

On this page:

- a acceleration
- v velocity
- t time
- v_f final velocity
- s_0 original position
- s final position
- v_0 original velocity
- d Displacement

Constant velocity

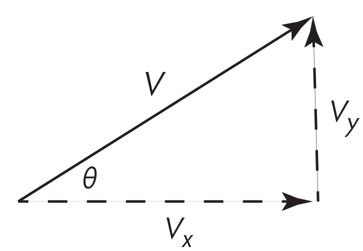
If acceleration is zero, then:

$d = vt$

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.

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



Falling

One common case is an object moving in the earth's gravity. You treat the horizontal component as uniform motion (i.e., no acceleration); you treat the vertical component as accelerated motion under the influence of gravity.

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