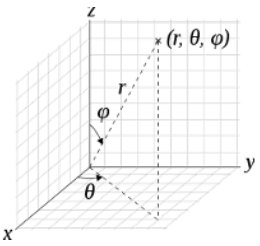
Describing Motion

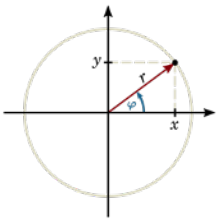
Position:

Cartesian coordinates (X, Y, Z)

Spherical coordinates (radius, angle, angle)

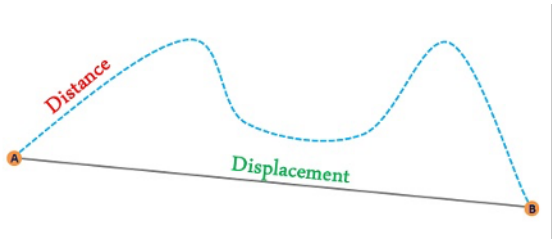


Polar coordinates (radius, angle)



Displacement-Time graph:
Plots the displacement over time.

Velocity and Speed:



$Avg.speed = distance/time$
$Avg.velocity = displacement/time$

Velocity-Time graph:
Plots the Velocity over time.

(Area under the graph gives the displacement)
(Don't draw vertical lines!!)

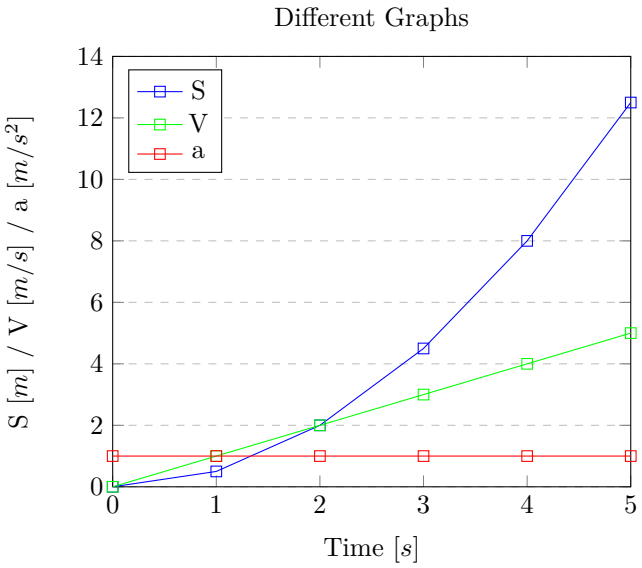
Acceleration:

$Acceleration = changeInVelocity/time$

Acceleration-Time graph:
Plots acceleration over time.

(we only use uniform acceleration with a constant a.)

Graphs:



Free Fall:

Free fall means no resistance. All object will fall at the same speed.
It works with uniform acceleration: $g \approx 10m/s^2$.

Formulary

Symbols:

Symbol for time: t
Unit: $[t] = 1s$

Symbol for displacement: S
Unit: $[S] = 1m$

Symbol for speed: V
Unit: $[V] = 1m/s$

Symbol for Acceleration: a
Unit: $[a] = 1m/s^2$

Formulas:

- $Avg.speed = distance/time$
- $Avg.velocity = displacement/time$
- $Acceleration = changeInVelocity/time$
- $S(t) = V * t$ (without acceleration)
- $S(t) = a/2 * t^2$ (with acceleration)
- $S(t) = V0 * t + a/2 * t^2$ (with initial speed)
- $V(t) = a * t$ (if there is a initial speed it has to be added: $V(t) = V0 + a * t$)
- $1m/s = 3.6km/h$
- $g = 9.81m/s^2 \approx 10m/s^2$

Formulas for constant acceleration:

Given	Unknown	Formula 1	Formula 2
a, t	v, s	$v = a * t$	$s = a/2 * t^2$
a, v	t, s	$t = v/a$	$s = v^2/2a$
a, s	v, t	$v = \sqrt{2as}$	$t = \sqrt{2s/a}$
v, s	a, t	$a = v^2/2s$	$t = 2s/v$
v, t	a, s	$a = v/t$	$s = v * t/2$
t, s	v, a	$v = 2s/t$ (only with $a > 0$)	$a = 2s/t^2$