Kinematics Review Map

Problem Solving Steps

- List givens
- Make appropriate assumptions (see chart)
- Write equation
- Substitute givens WITH UNITS
- Solve for unknown and write answer WITH UNITS

Assumptions

Action	v_i	v_f	a	d
"from rest"	= 0	≠0	≠0	≠0
"comes to rest"	≠0	= 0	≠0	≠0
"constant speed"	≠0	≠0	= 0	≠0
"dropped"	= 0	negative	= g	negative
"thrown up"	positive	0 (at top)	= g	positive
"thrown down"	negative	negative	= g	negative

Equations

$$\bar{v} = \frac{\Delta d}{t}$$

$$\bar{v} = \frac{v_1 + v_2}{2}$$

$$a = \frac{\Delta v}{t}$$

$$v_f = v_i + at$$

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

$$v_f^2 = v_i^2 + 2ad$$

vectors

magnitude and direction

displacement
velocity
acceleration

scalars

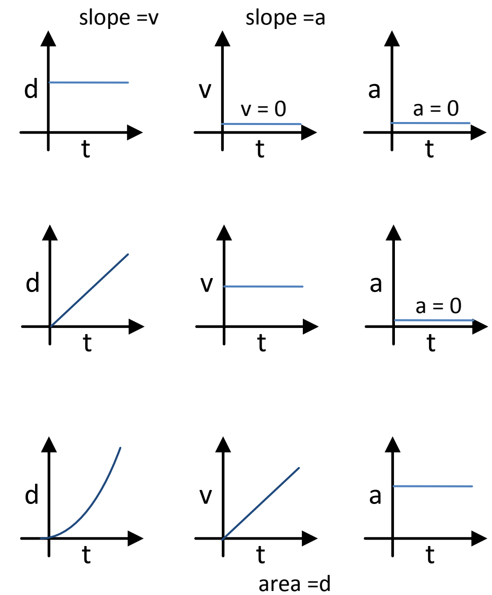
magnitude only

distance
speed
time

Constant displacement - motionless

Constant velocity – displacement changes at constant rate

Constant acceleration – velocity changes at constant rate



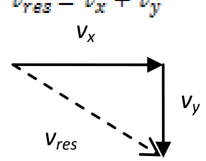
Two Dimensional Problems

Constant Velocity

$a_x = 0$

$a_y = 0$

$$v_{res}^2 = v_x^2 + v_y^2$$



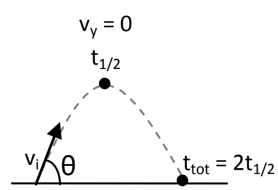
ex. River Problem

A man swims east across a 30 meter wide river at 2m/s. At the same time, a current pushes him south at 0.5 m/s.

X	Y
a = 0	a = 0
v = 2 m/s	v = 0.5 m/s
d = 30 m	

Using the x direction we can find that it will take 15s to get across. Using this we can find that the person will drift 7.5 m south before getting across.

Ground Launched Projectiles



X	Y
$a_x = 0$	$a_y = -9.81\ m/s^2$
$v_{ix} = v_i \cos\theta$	$v_{iy} = v_i \sin\theta$
	$v_y = 0$ (at top)

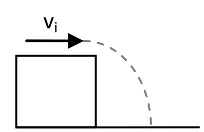
Use $0 = v_{iy} + a_y t$ to find Time to Top

Total time = 2 x Time to Top

Use $d = v_i t + ½at^2$ to find vertical or horizontal distance

***** Be careful to keep horizontal and vertical quantities separate!***

Horizontal Projectiles

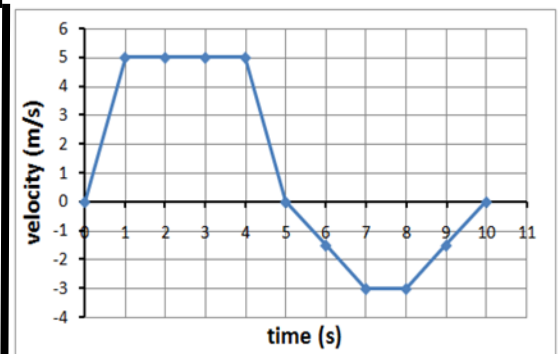


X	Y
$a_x = 0$	$a_y = -9.81\ m/s^2$
$v_{ix} = v_i$	$v_{iy} = 0$

ONLY use $d = v_i t + ½at^2$ to solve.

Time is the same in either dimension

***** Be careful to keep horizontal and vertical quantities separate!***



Displacement/Distance from v-t Graph

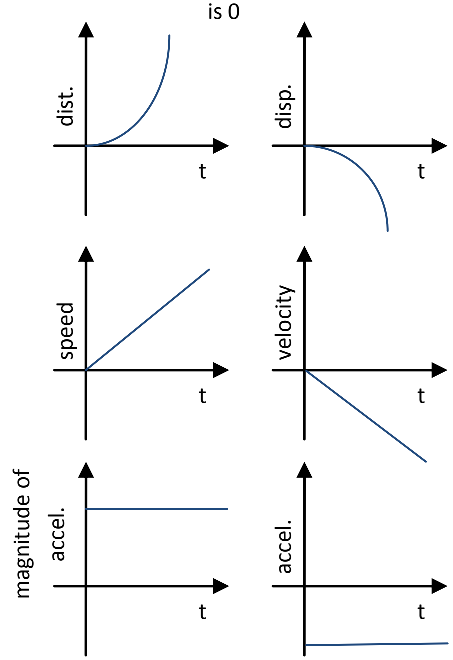
Can be calculated by looking at area under the graph!

Area on top = + displacement
Area on bottom = - displacement
Both areas = + distance

0 – 1 s	1 – 4 s	5 – 7 s	0 – 10 s
disp = +2.5 m	disp = +15 m	disp = -3 m	disp = +11 m
dist = 2.5 m	dist = 15 m	dist = 3 m	dist = 29 m

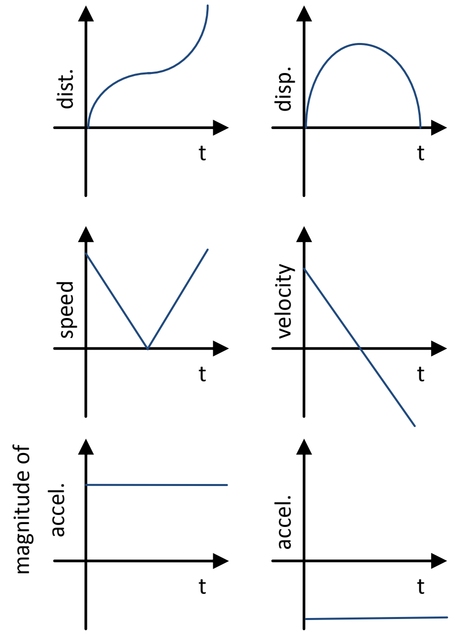
Freefall Graphs

Assuming $v_i = 0$ and starting position is 0



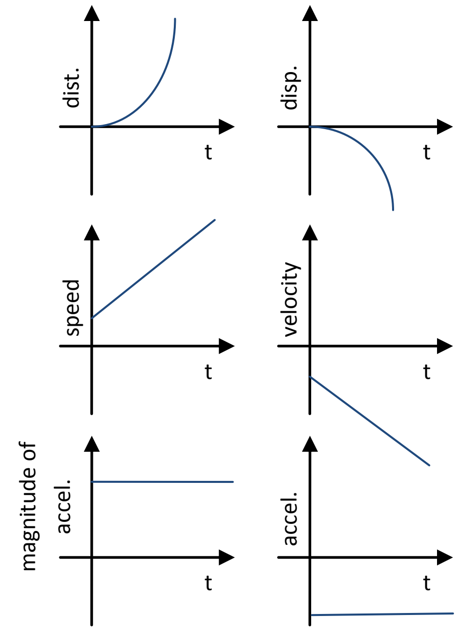
Thrown Upward Graphs

Assuming $v_i > 0$ and starting position is 0



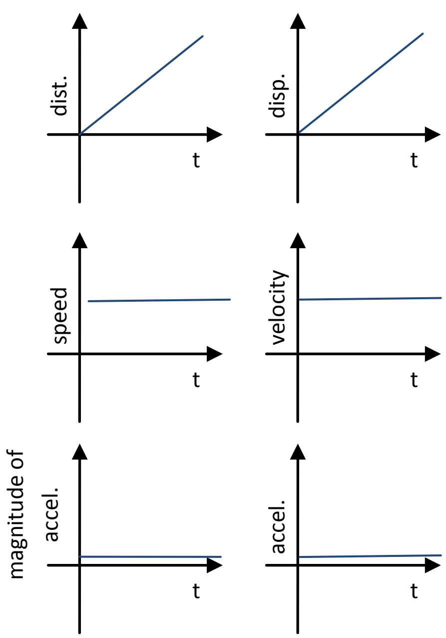
Thrown Downward Graphs

Assuming $v_i < 0$ and starting position is 0

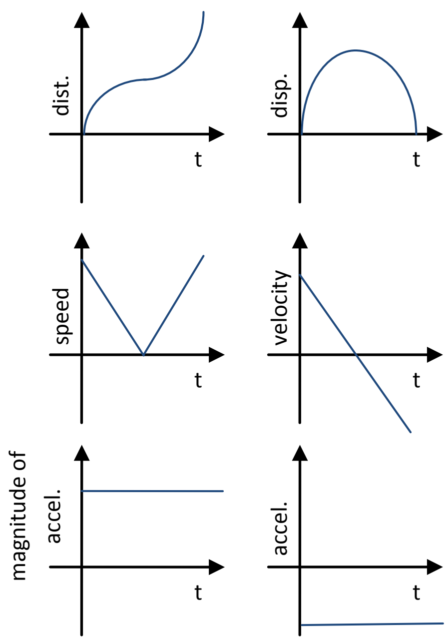


Ground Launched Projectile Graphs

Horizontal

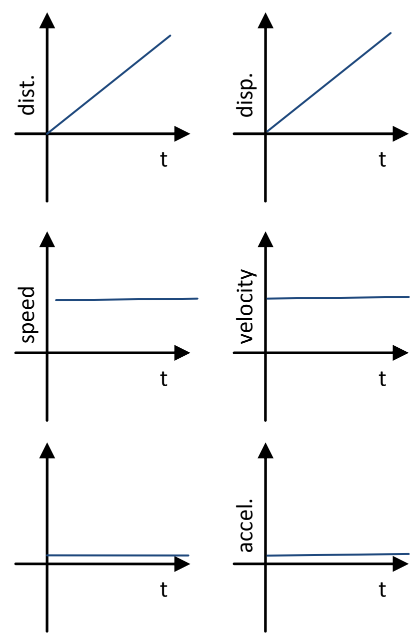


Vertical



Horizontal Projectile Graphs

Horizontal



Vertical