Lecture 7

Weds: Warm Up 2 (D2L)

Thurs: Discussion/quiz

Ex: 52, 56, 59, 61, 62, 64, 66

Free Fall Motion

Experiments indicate that near to the surface of Earth a freely falling object has a constant acceleration

$$a = -9.80\ m/s^2$$

or

$$a = -g$$

where

$$g = 9.80 m/s^2.$$

The same constant acceleration kinematics equations apply with "x" replaced by "y"

$$v_f = v_i + a\Delta t$$

$$y_f = y_i + v_i \Delta t + \frac{1}{2} a(\Delta t)^2$$

$$v_f^2 = v_i^2 + 2a(y_f - y_i)$$

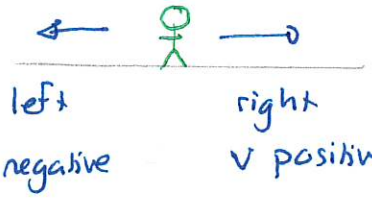
Motion in Two Dimensions

In general objects do not move back + forth along one straight line and they move in two or three dimensions.

DEMO: * Throw Ball
* PhET Projectile Motion
- launch various objects...

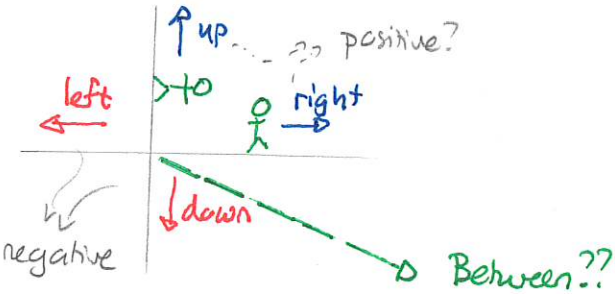
The additional dimensions bring mathematical complications.

One dimension



only need negative / positive to describe directions

Two dimensions



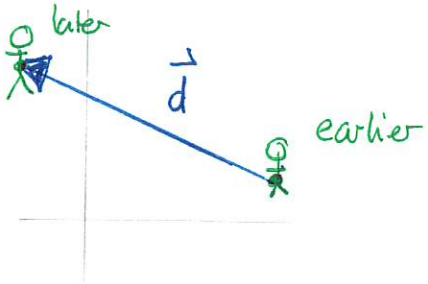
negative / positive are not enough to describe infinitely many directions

Again we have a basic notion regarding motion

Displacement (over an interval) = change in position from beginning to end of the interval

We need a new mathematical object to describe this. This is

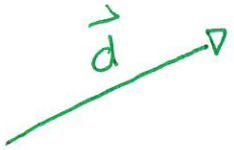
A displacement vector $\vec{d}$ is an arrow with
1) tail at earlier position
2) head at later position



We need to distinguish these from ordinary numbers and develop an algebra for them.

Schematically

VECTOR



* has length/size and direction
* symbolized with an arrow above a letter

NUMERICAL DESCRIPTION

1) magnitude of a vector
   = size/length of vector.
   * written without arrow, d
   * can never be negative
2) direction of vector = some way of describing which way it points.
   e.g. - angle from x-axis
   - compass points

The mathematics of vectors starts with:

Two vectors $\vec{A}$ and $\vec{B}$ are equal,
$\vec{A} = \vec{B}$

$\Leftrightarrow$

1) $\vec{A}$ and $\vec{B}$ have the same magnitude AND
2) $\vec{A}$ and $\vec{B}$ have the same direction

Quiz 1 20% ~~30%~~