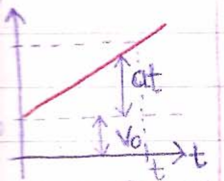
Class Notes: Lecture 5 (G. Ihas) 8 September 2009

Kinematic Equations

Describe motion of an object

Used in situations w/ uniform acceleration (a)

a. looks simple
&of constant a



= velocity @ time t

Equation #1: Velocity $v = \underbrace{v_0 + a_t}$

$$\Delta x = \left(\frac{v_0+v}{2}\right)t = \left(\frac{v_0+v_0+at}{2}\right)t = v_0t + \frac{1}{2}at^2$$

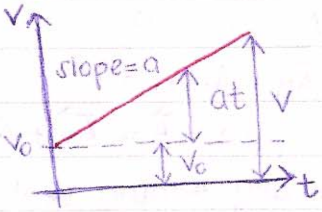
$\bar{v} = v_{avg} = \frac{v_0+v}{2}$

$\bar{v} = {}^{\Delta x}/_{t} = \frac{v_0+v}{2}$

Some Examples

Zero acceleration: $\Delta x = v_{avg}t = \left(\frac{v_0+v}{2}\right)t$

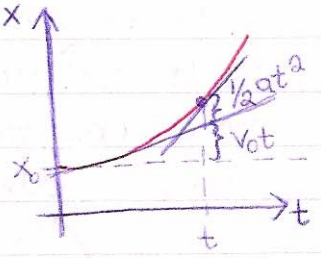
Displacement not needed: $v = v_0 + at$



Ball bearing:
$v = v_0 + at$
$= 0 + (-9.8)t$

$\Delta x = v_0t + \frac{1}{2}at^2$
$t = \sqrt{\frac{2(-\Delta x)}{g}}$
$= \sqrt{\frac{2\Delta x}{g}}$
$t^2 = \frac{2\Delta x}{g}$
$g = \frac{2\Delta x}{t^2}$ squared

Final velocity not needed: $\Delta x = v_0t + \frac{1}{2}at^2$



Time not needed: $v^2 = v_0^2 + 2a\Delta x$

Kinematic Equations 1, 2, 3

Constant a

#1) $v = v_0 + at$ or $t = \frac{v - v_0}{a}$

#2) $\Delta x = v_0t + \frac{1}{2}at^2$

#3) $v^2 = v_0^2 + 2a\Delta x$, dependent on eq's 1, 2

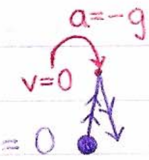
Free Fall

Only force on object falling is gravity (ignore air resistance)

use 9.80 m/s² for webassign hw

Constant $a\ (g) = 9.8\ m/s^2$

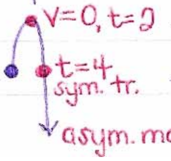
Always directed downward towards center of the earth



other forces can apply to the object before or after free fall

Options: $v_{initial} = 0$

starting & ending heights may be equal or unequal trajectory
= : symmetric
≠ : unsymmetric



throw up $v_i \neq 0$, positive & v_{inst} @ maxheight = 0

throw down $v_i < 0$