Do you understand the difference between velocity and acceleration? In each situation, state whether it ↑, ↓, or remains constant.

I. 

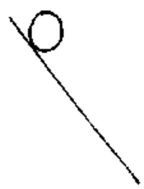
$\vec{v}$ ↑

$\vec{a}$ ↑

II. 

$\vec{v}$ ↑

$\vec{a}$ ↓

III. 

$\vec{v}$ ↑

$\vec{a}$ const.

Sample Data:

t(s)	v(m/s)	
0	0	1 m/s/s
1	1	2 m/s/s
2	3	3 m/s/s
3	6	

t(s)	v(m/s)	
0	0	5 m/s²
1	5	4 m/s²
2	9	3 m/s²
3	12	

t(s)	v(m/s)	
0	0	2 m/s²
1	2	2 m/s²
2	4	2 m/s²
3	6	

(14a)

- What must I do FIRST when using a physics eqn?

- Rearrange the eqn to solve for the one unknown
- DO NOT PLUG #'S IN FIRST!
- This allows you to calculate in one step and eliminates over-rounding.
- This also lowers your chances of making errors.

Practice:

1. $F = ma$ (solve for "a")
   $\frac{F}{m} = \frac{ma}{m}$ $a = \frac{F}{m}$
2. $v = \frac{\Delta x}{t}$ (solve for "t") $t \cdot v = \frac{\Delta x}{t} \cdot t$ $\frac{t \cdot v}{v} = \frac{\Delta x}{v}$ $t = \frac{\Delta x}{v}$
3. $\Delta x = vt + 0.5at^2$ (solve for "a")
   $-vt \quad -vt$
   $\frac{\Delta x - vt}{.5t^2} = \frac{.5at^2}{.5t^2}$ $a = \frac{\Delta x - vt}{.5t^2}$
4. $d^2 \cdot F = \frac{Gm_1m_2}{d^2} \cdot d^2$ (solve for "d")
   $\frac{d^2 \cdot F}{F} = \frac{Gm_1m_2}{F}$ $\sqrt{d^2} = \sqrt{\frac{Gm_1m_2}{F}}$
   $d = \sqrt{\frac{Gm_1m_2}{F}}$

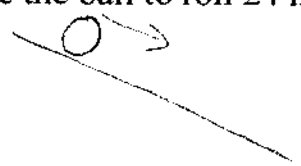
14b

- What are some common phrases used in physics problems?
  - How fast was it going? ==> means $V_i = ?$
  - How fast will it go? ==> means $V_f = ?$
  - Object starts at rest ==> means $V_i = 0$ m/s
  - Object slows down ==> means a is negative
  - Object comes to a stop ==> means $V_f = 0$ m/s
  - Object moves at a constant velocity ==> $a = 0$ m/s²

- What are the steps required to solve physics problems?
  - Step 1: Draw a pic and/or graph
  - Step 2: List variables/given information
  - Step 3: Do algebra to solve for the unknown (if anything equals 0, eliminate from the eqn before doing the algebra)
  - Step 4: Plug #'s in (be consistent with units and be sure they cancel to give the appropriate unit!!)

Practice:

1. Starting from rest, a ball rolls down a hill, uniformly accelerating at 3.2 m/s². How long does it take the ball to roll 24 meters?



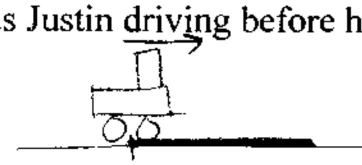
$\vec{v}_i = 0$ m/s
$\vec{a} = +3.2$ m/s²
$t = ?$
$\vec{\Delta x} = +24$ m

v_f is not mentioned so use the eqn that doesn't have v_f in it: $\Delta x = v_i t + \frac{1}{2}at^2$

$$\frac{\Delta x}{\frac{1}{2}a} = \frac{\frac{1}{2}at^2}{\frac{1}{2}a} \qquad \sqrt{t^2} = \sqrt{\frac{\Delta x}{\frac{1}{2}a}} \qquad t = \sqrt{\frac{\Delta x}{\frac{1}{2}a}}$$

$$t = \sqrt{\frac{24\,m}{\frac{1}{2}(3.2\,\frac{m}{s^2})}} = \boxed{3.87\,s}$$

2. Skid marks at the scene of an accident show that Justin Time's car moved 64 m before it stopped. If the car decelerated at a rate of 8.0 m/s², how fast was Justin driving before he applied the brakes?



$\vec{\Delta x} = +64$ m
$\vec{v}_f = 0$ m/s
$\vec{a} = -8$ m/s²
$\vec{v}_i = ?$

t isn't mentioned so use the eqn that doesn't have t in it: $v_f^2 = v_i^2 + 2a\Delta x$

$$0 = v_i^2 + 2a\Delta x \qquad \sqrt{-2a\Delta x} = \sqrt{v_i^2}$$

$$\vec{v}_i = \sqrt{-2a\Delta x}$$

$$\vec{v}_i = \sqrt{-2(-8\,\frac{m}{s^2})(64\,m)}$$

$$\boxed{\vec{v}_i = +32\,\frac{m}{s}}$$

More on your own:

1. $KE = 0.5mv^2$ (solve for "m")
2. solve #1 for v
3. $V_f^2 = v_i^2 + 2a\Delta x$ (solve for "Δx")
4. solve # 3 for v_i

skipped these in class

- How do I know what symbol I am solving for?

- "How far?" means solve for Δx
- "How fast" means solve for V
- "How long?" means solve for t

Uniform Motion Review Problem:
Anita Break and Earl E. Byrd drive 48 km east. Anita drives at a constant 88 km/hr while Earl drives at a constant 92 km/h. How long will Earl have to wait on Anita at their destination?

I skipped this problem in the notes.

- What are the kinematic eqns for uniformly accelerated motion? (Write these in your gems of wisdom)

Acceleration Eqn	Missing variable
$v_f = v_i + at$	$\Delta\vec{x}$
$\Delta x = v_i t + \frac{1}{2} at^2$	$\vec{v}_f$
$\Delta x = v_f t - \frac{1}{2} at^2$	$\vec{v}_i$
$v_f^2 = v_i^2 + 2a\Delta x$	t
$\Delta x = \frac{1}{2}(v_f + v_i)t$	$\vec{a}$

That is a "v_f" → Final velocity

*There are 5 possible variables: Δx, vi, vf, a, t
*A typical problem won't mention one of these
*Find this "missing variable" in the table to determine the eqn you will use.
*Note: We will assume direction of motion is always positive unless otherwise stated.

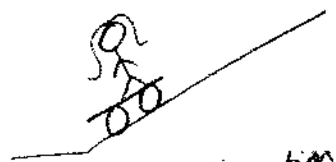
p. 69 (in text) # 26

* Solve it 2 ways:

1. use algebra
2. use a v-t graph

(You should get the same answer both ways)

Algebra method



changes direction at the top of the ramp ⇒ $\vec{v}_f = 0\ m/s$

$\vec{v}_i = +1.75\ m/s$

$\vec{a} = -.2\ m/s^2$

$t = ?$

This problem did not mention Δx:

$$v_f = v_i + at$$

$$0 = v_i + at$$

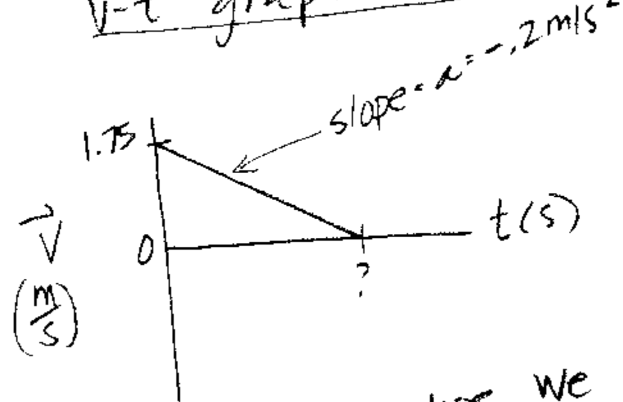
$$-v_i = at$$

$$t = \frac{-v_i}{a}$$

$$t = \frac{-1.75\ m/s}{-.2\ m/s^2}$$

$$\boxed{t = 8.75\ s}$$

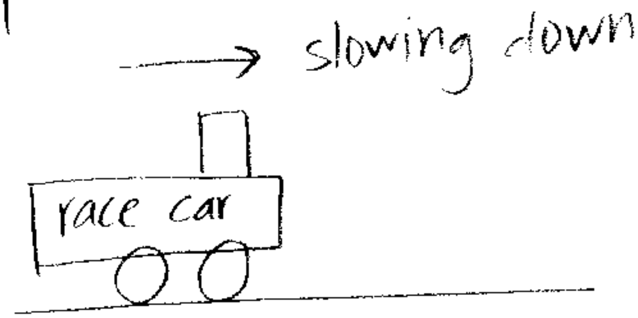
v-t graph method



we know rise & slope. We need to solve for "run". That will be the time.

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

P. 69 #27



$\vec{v}_i = +44\ m/s$

$\vec{v}_f = +22\ m/s$

$t = 11 s$

$\Delta\vec{x} = ?$

Algebra method

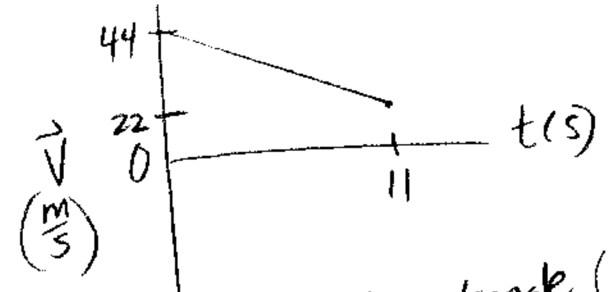
$$\Delta\vec{x} = \frac{1}{2}(v_f + v_i)t$$

$$\Delta\vec{x} = \frac{1}{2}\left(22\frac{m}{s} + 44\frac{m}{s}\right)(11s)$$

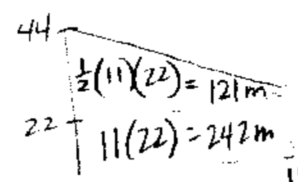
$$\boxed{\Delta\vec{x} = +363m}$$

V-t graph method

$\Delta x = \text{area} = ?$



Area = area of rectangle (b·h)
+
area of triangle ($\frac{1}{2}bh$)



$\Delta\vec{x} = \text{area} = 121m + 242m$

$$\boxed{\Delta\vec{x} = 363m}$$