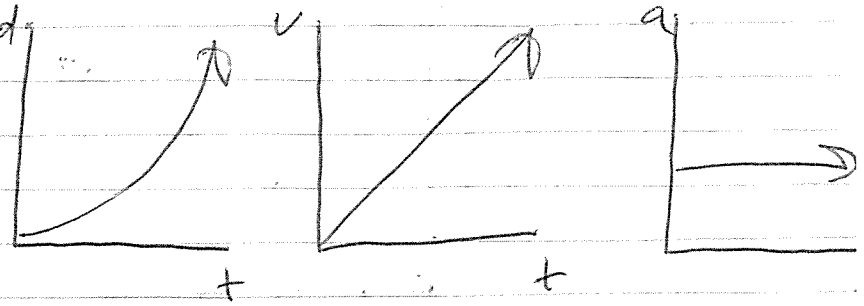
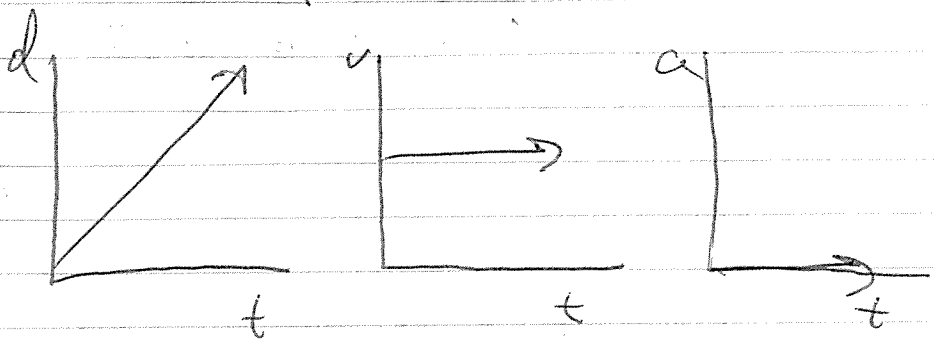
Reviewing Graphing for Midterm (Notes #1)

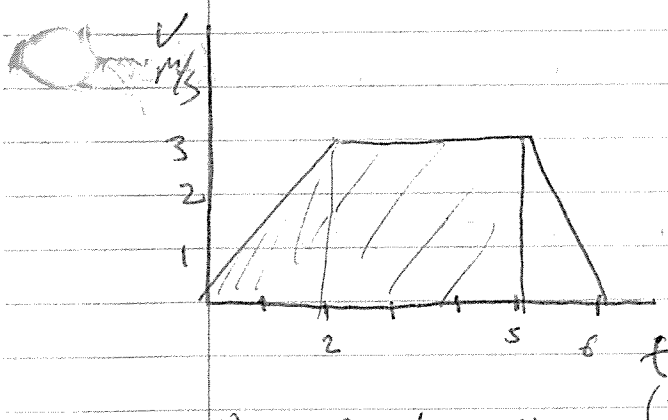
Graph an object that has a positive accel



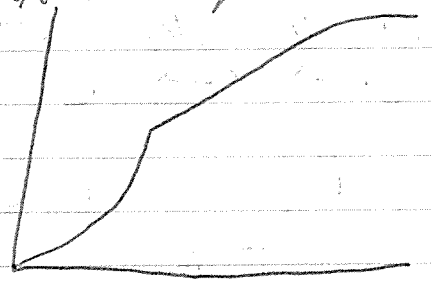
Graph an object w/ a constant velocity



Given



find/fill-in Graph



How far has the object traveled?

Find area under the curve

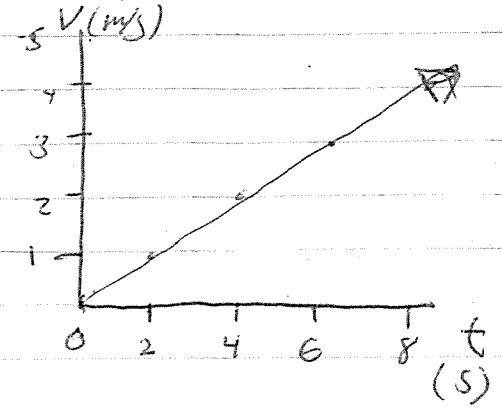
$A = \frac{1}{2}(2)(3) = 3$ $\quad A = 3\frac{m}{s} \cdot 3s = 9m$ $\quad A = \frac{1}{2}(3\frac{m}{s})(1s) = 1.5m$

$3 + 9 + 1.5 = 13.5$

Input Graph - Characteristics

- What is the significance of the slope?
  - accel. $\frac{m/s}{s} = \frac{v}{s} = a$

Given



Find the acceleration

$accel = \frac{\Delta v}{\Delta t} \quad \frac{2 m/s - 0 m/s}{4 s - 0 s} = \frac{1}{2}$

How far has the object gone in 4 sec.

$A = \frac{1}{2} bh = \frac{1}{2} (4s)(2m) = 4m$

Key: Find the area under the the curve, you shift down $a \rightarrow v \rightarrow d$

Find the slope of the curve, you shift up $d \rightarrow v \rightarrow a$

(Use $d \Big|_t$ curve as an example)

Midterm Review Do Now

- Wiley E. Coyote and the road runner are in a 10 km race. The Road Runner runs at a constant velocity of 36 m/s. The WEC builds an Acme Rocket in 3 minutes and then accelerates at $2\ m/s^2$ at constant rate. Who wins, and by how much time?

Road Runner

$$\bar{v} = \frac{d}{t} \qquad 36\ m/s = \frac{10000\ m}{t} = 278\ s$$

W. E. Coyote

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

$$10{,}000\ m = \frac{1}{2}\left(2\frac{m}{s^2}\right)t^2$$

$$\sqrt{10{,}000\ m} = \sqrt{t^2}$$

$$100 = t$$

3 minutes = 180 s

$+ 100\ s$

$280\ s$

Road Runner Wins, by a beat

Review Momentum & Impulse

Momentum: product of mass × velocity $p = mv$ $\frac{kg \cdot m}{s}$ units
(Vector Quantity)

Impulse: product of force and the time the force acts
$J = F\Delta t$ $N \cdot s$

$J = \Delta p$ change in

Impulse = Momentum

$F\Delta t = m\Delta v$

Ex. A 1 kg ball is ~~thrown~~ traveling at 4 m/s & strikes a wall & bounces back at 2.0 m/s

A) What is the change in momentum b) Impulse applied to the wall

$\Delta p = p_f - p_i$

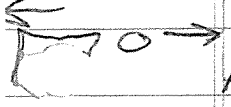
$mv_f - mv_i$ $J = 6\ N \cdot s$

$1\text{ kg}(2\text{ m/s}) - 1\text{ kg}(-4\text{ m/s})$

$2\frac{kg \cdot m}{s} + 4\frac{kg \cdot m}{s} = 6\frac{kg \cdot m}{s}$

Conservation of Momentum

If 2 objects are not subject to an external force, the total momentum before the interaction must be the same after the interaction



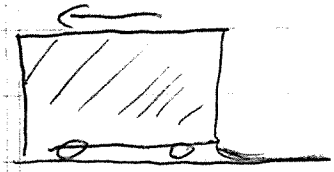
A 5 kg Gun fires a 0.002 kg bullet. If the bullet exits the gun at 800 m/s E, calculate the recoil velocity of the gun

$P_{B_i}^{0} + P_{G_i}^{0} = P_{B_f} + P_{G_f}$

$(.002\text{ kg})(800\text{ m/s}) + 5\text{ kg}(x\text{ m/s})$ $.32\text{ m/s}$

Midterm IIB Review - Momentum Review

A train car is loaded w/ sand & is coasting at a constant speed. A hole develops & the sand spills out at a constant rate. Talk about the trains speed & momentum



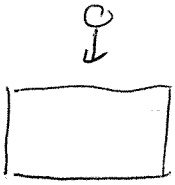
* No Δ change in sands horiz speed

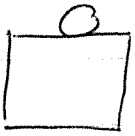
Vi = Initial

$$m_T^{Tran} v_I + \cancel{m_s^{Sand} v_I} = m_T^{Tran} v_F + \cancel{m_s^{Sand} v_I} \qquad v_I = v_f \text{ sand}$$

- Since momtm of the sand is the same so is the train

Ran falls into a train car, what happens to its velocity





Horiz velocity

$$m_T^{Train} v_I + m_{Ran} \cancel{v_I}^{0} = m_T v_F + m_{Ran} v_f$$

$$m_T v_I = (m_{Train} + m_{Ran}) v_f$$

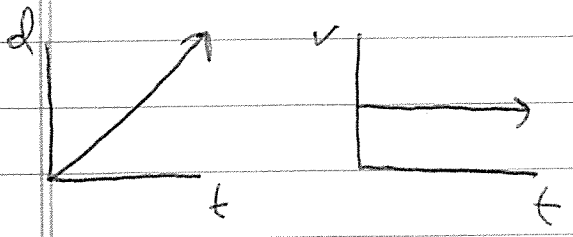
If ↑m then ↓v

Lab Review

Rolling Bowl - Determine Instaneous & Avg Velocity of a ball in Hall

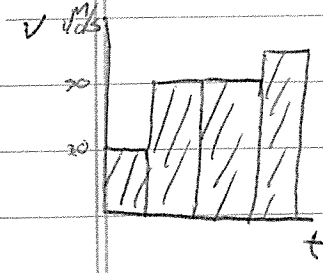
- Put Beans against crate
- Measure out 6 places
- Start watch when when ball ~~passes~~ touches floor & stop when it passes your point

Pass	Time	d	$v=\frac{d}{t}$
1	1 sec	2.5m	2.5 m/s
2	2 sec	5m	2.5 m/s
3	3 sec	7.5m	2.5 m/s
4	4 sec	10m	2.5 m/s



Driving Lab - Determine distance traveled by a car w/o an odometer

- Take velocity readig every 30 sec



Area $v \cdot t$ ⓜ/s = d

Time	Vel.	
30s	20mph	$20\text{mph} \times 30/3600\text{ hrs} = .16$ mi
60sec	30mph	$30 \times 30/3600\text{ hrs} = .25$ mi
90sec	30mph	$30 \times 30/3600\text{ hrs} = .25$ mi
120 sec	35mph	$35 \times 30/3600\text{ hrs} = .29$ mi
		.95mi

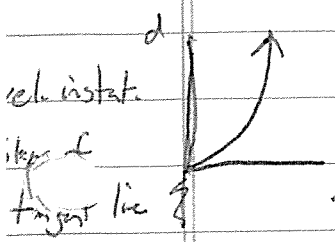
Motion on An Incline - Findig the accerate of a Marble down an incline

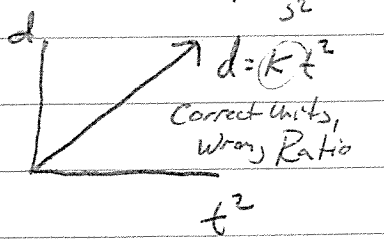
★ Take t^2 for Accel

- Mark 5 distances on the incline
- Take time from start to whe marble passes each point

Distance	Time	time^2
.2m	.9s	$.81s^2$
.4m	1.5s	$2.1s^2$
.6m	2.2s	$3.5s^2$

Slope = $\frac{m}{s^2}$ Accel





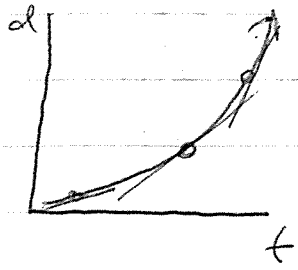
2 times Slope is accel.

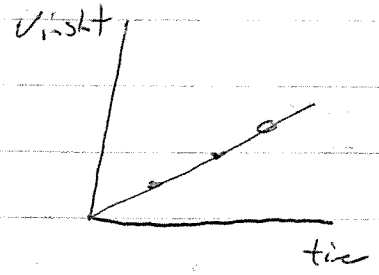
How does the vel. to accel?

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

$d = \frac{1}{2} a t^2$ slope is half of accel.

Instantaneous Velocity - Find slope of the tangent line





Plot points to find the accel.

Lab Review

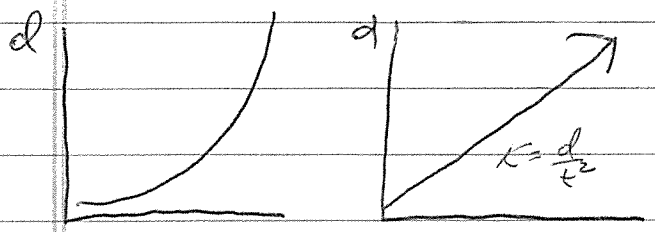
Lab — Measuring Accel Due to Gravity - Dot Timer

- Drop weight horizontally for the
- Time put dot every 1/60 of a sec.
- Wt not slack in tape before release

Tape: 0 1/60 2/60 3/60 4/60

T (sec)	d	t^2 (sec)^2
0	0	
1/60		
2/60	0.2	
3/60	0.3	

Goal Find G



$d = Kt^2$ Units are same as accel, be ratio

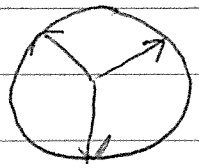
d vs. t^2 - Do we have a eqn.

$d = v_i t + \frac{1}{2} a t^2$ $d = \frac{1}{2} g t^2$ $2(K) = 2(\frac{1}{2} g)$ $2K = g$

Double Slope = g

1 Lab Force Vectors - Relationship between the 3 forces on a force board.

Forceboard, ruler, protractor, graph paper

Set Facboard 

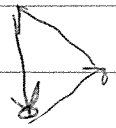
a) Pick to vects add the graphically

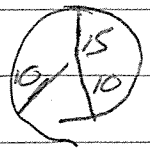
How does the result compare to the third vect,

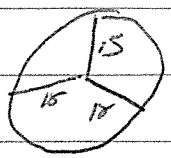
- Equal magnitude opp direct

b) Add all 3 vects graphically what is the result

- None exist Why - Net force = 0 object is in equil.



c) 



Make Wider requires more force,

Ex gym class 

- See vertical force but have to fight each other horizontally

(Force now acts horizontally)