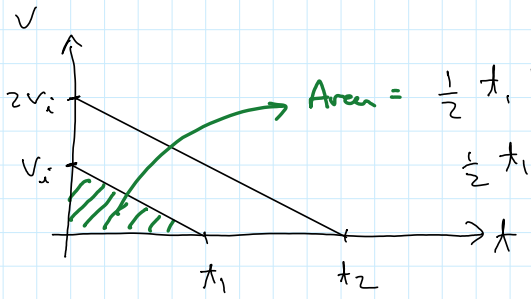
Phy 4A 9/28

Wednesday, September 28, 2016 9:19 AM

Goals for the Lecture:

1) Given one of the following three graphs: x vs t, v vs t, and a vs t, be able to draw the other two
2) Be able to solve 1-D kinematics problems (constant acceleration) using the equations and a graphical approach

Book Prob 2-24



$\frac{1}{2} t_1 \left(15.5 \frac{m}{s}\right) = 14\ m$

$t_1 = \frac{28}{15.5} = 1.81\ s$

$\text{acceleration} = \text{slope} = \frac{\Delta v}{\Delta t} = \frac{15.5}{1.81} = 8.58 \frac{m}{s^2}$

Find t_2: $\quad a = \frac{2v_i}{t_2}$

$t_2 = 3.61\ s$

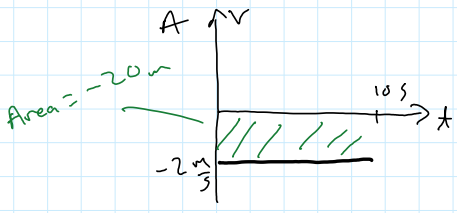
$\Delta x_2 = \frac{1}{2}(2v_i)\, t_2 = 56\ m$

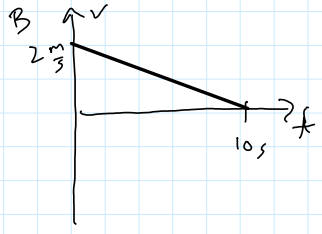
Worksheet p. 37

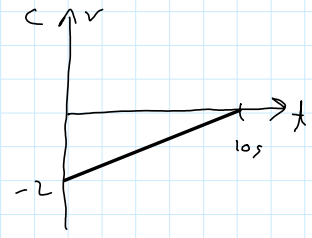
given v vs t

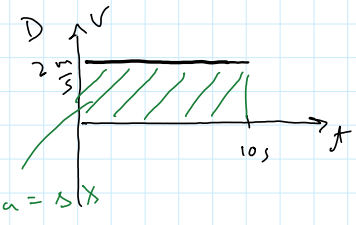
plot a vs t

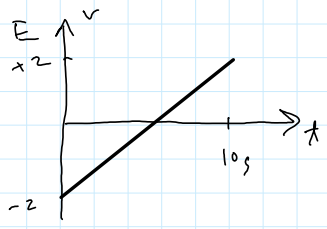
and x vs t (let $x=0$ at $t=0$)

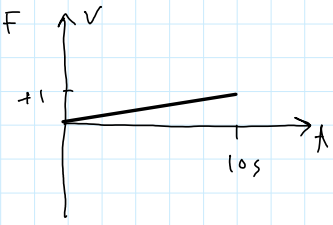


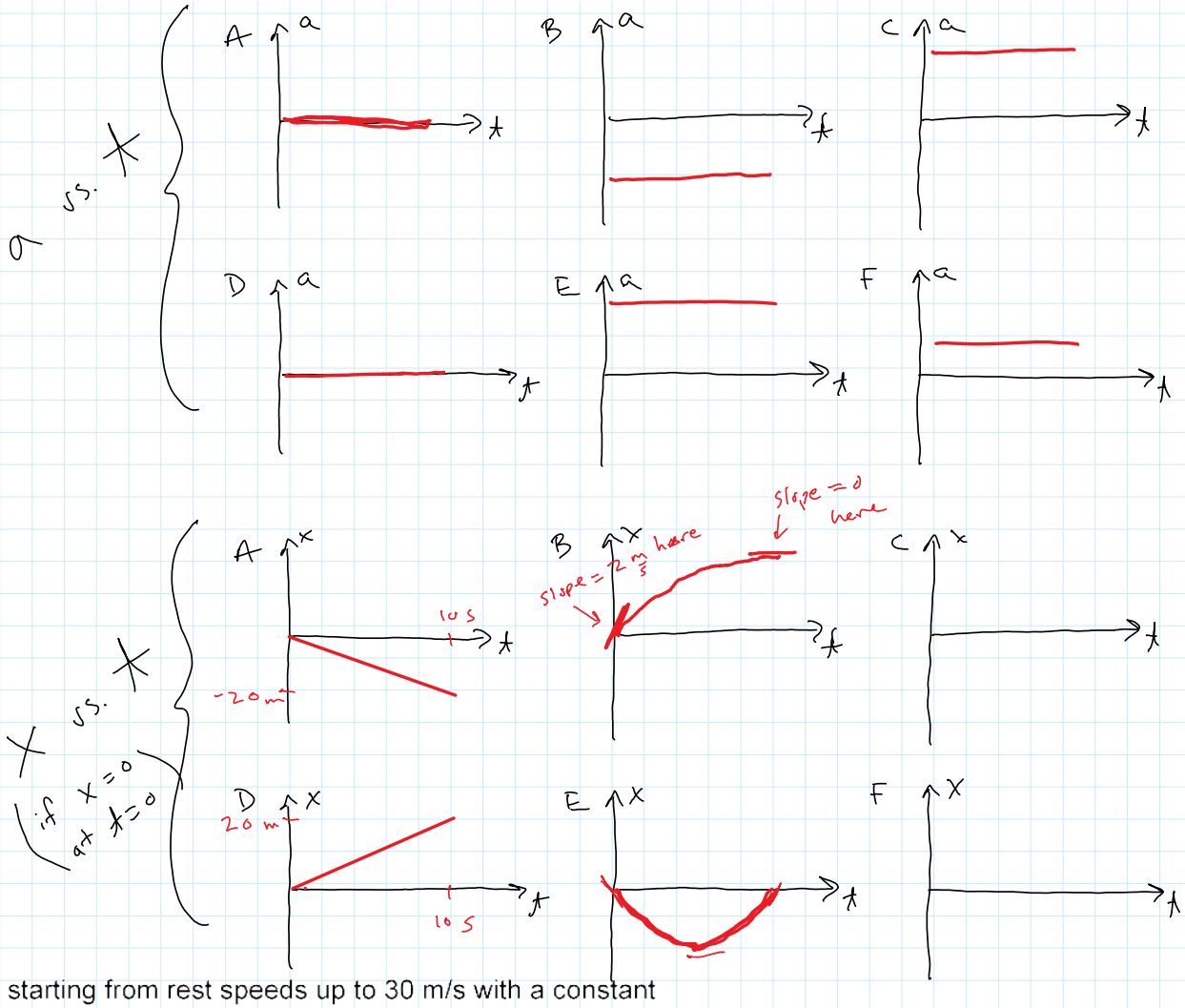




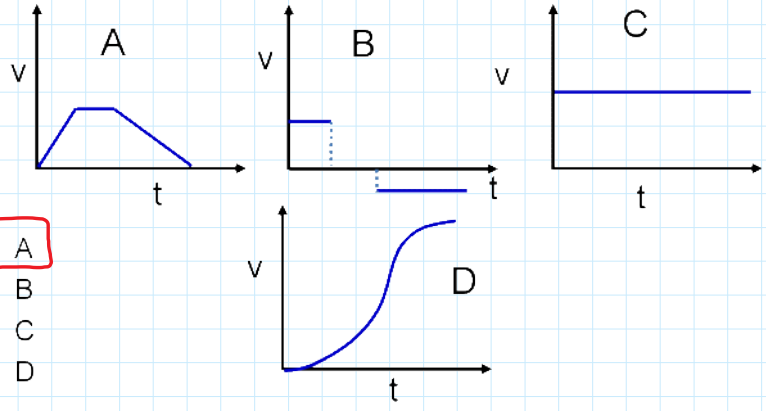








A car starting from rest speeds up to 30 m/s with a constant acceleration over a time of 10 seconds. Then, it travels at 30 m/s for 10 seconds, and finally brakes to a stop in 20 seconds with a constant deceleration. Which of the following graphs represents its graph of speed versus time?



1. A
2. B
3. C
4. D

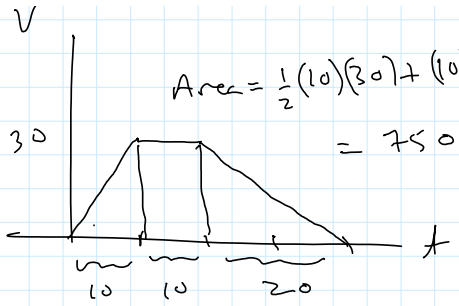
Which One represents acceleration vs time? B

How far does it travel in the 40 second time period?

1. 100 m
2. 200 m

Area $= \frac{1}{2}(10)(30) + (10)(30) + \frac{1}{2}(20)(30)$

1. 100 m
2. 200 m
3. 400 m
4. 800 m
5. None of the above.



$\text{Area} = \frac{1}{2}(10)(30) + (10)(30) + \frac{1}{2}(20)(30)$

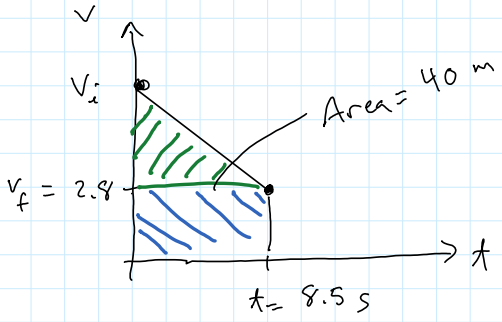
$= 750$ m

Book Prob 2-28

given: $\Delta x = 40$ m, $t = 8.5$ s, $v_f = 2.8 \frac{m}{s}$

find: a, v_i

1st) Graphically:



$\frac{1}{2}(8.5)(v_i - 2.8) + (8.5)(2.8) = 40$

$v_i = 6.61 \frac{m}{s}$

$\text{slope} = a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t} = \frac{2.8 - 6.61}{8.5} = -0.448 \frac{m}{s^2}$

2nd) kinematics equations: (since constant acceleration)

	x-motion
Δx x_i	0
Δx x_f	40 m
v_i	?
v_f	2.8 $\frac{m}{s}$
a	
t	8.5 s

$x_f = x_i + \left(\frac{v_i + v_f}{2}\right) t$

Solve for v_i: $\quad 40 = 0 + \left(\frac{v_i + 2.8}{2}\right) 8.5$

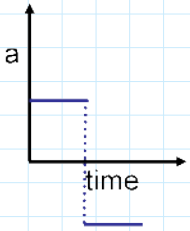
$v_i = 6.61 \ \frac{m}{s}$

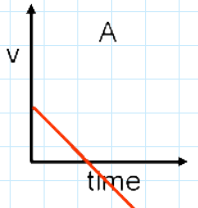
use $\quad v_f = v_i + at$

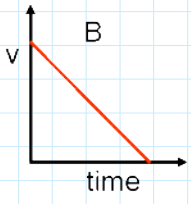
Solve for a: $\quad 2.8 = 6.61 + a(2.8)$

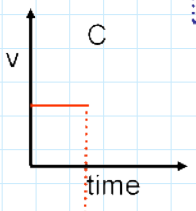
$a = -0.448 \ \frac{m}{s^2}$

Which of the graphs of ***velocity*** versus time could correspond to the graph of ***acceleration*** versus time shown on the right?

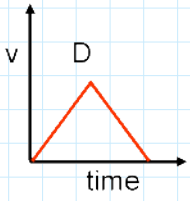


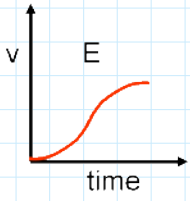






1. A
2. B
3. C
4. D
5. E

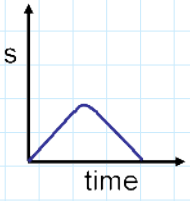


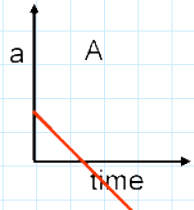


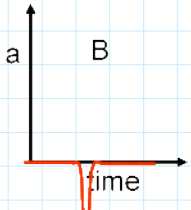
Which of the graphs of ***distance*** versus time corresponds to the graph of ***acceleration*** versus time shown on the right?

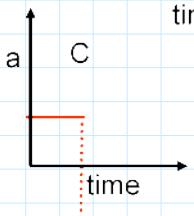
E

Which of the graphs of ***acceleration*** versus time corresponds to the graph of ***distance*** versus time shown on the right?

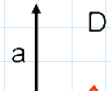


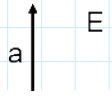






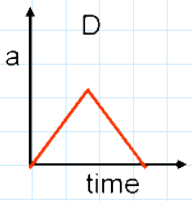
1. A
2. B
3. C

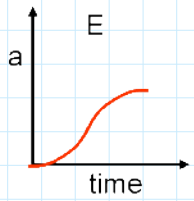


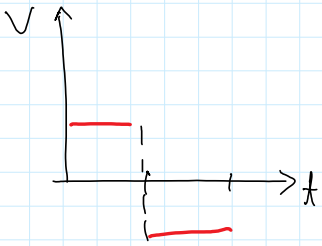


V ↑

1. A
2. B
3. C
4. D
5. E

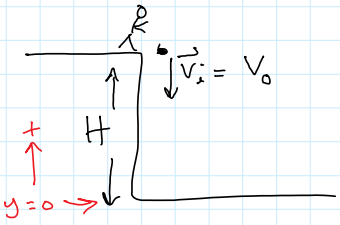






Freefall

acceleration of gravity : $g = 9.80 \frac{m}{s^2}$



given: V_i, H

find: V_f

1) Define origin and positive direction

2) Fill in chart:

y-motion	
Δy { y_i	$+H$
Δy { y_f	0
V_i	$-V_0$
V_f	$?$
a	$-9.8 \frac{m}{s^2}$ or $-g$
t	$?$

3) Choose equation:

$$y_f = y_i + V_i t + \frac{1}{2} a t^2$$

Solve for t

OR

$$V_f^2 = V_i^2 + 2a\Delta y$$

Solve for V_f

V_f should be negative

use: $V_0 = 30 \frac{m}{s}$

$$y_f = y_i + V_i t + \frac{1}{2} a t^2$$

$$0 = 50 + (-30)t + \frac{1}{2}(-9.8)t^2$$

$t < -1.49$

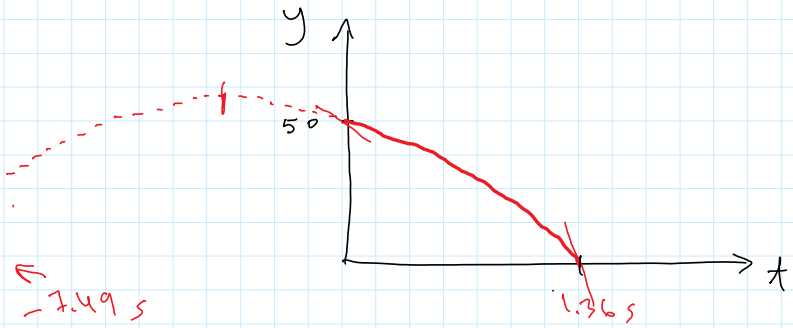
use: $V_0 = 30 \frac{m}{s}$

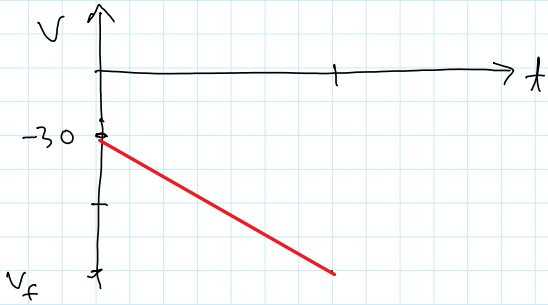
$H = 50$ m

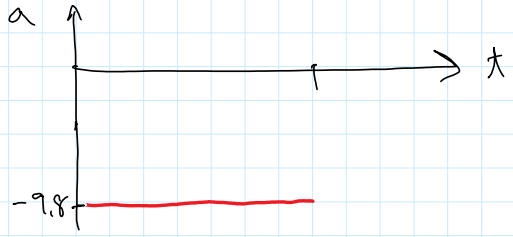
$0 = 50 + (-30)t + \frac{1}{2}(-9.8)t^2$

$t = \begin{cases} -7.49 \text{ s} \\ +1.36 \text{ s} \end{cases}$

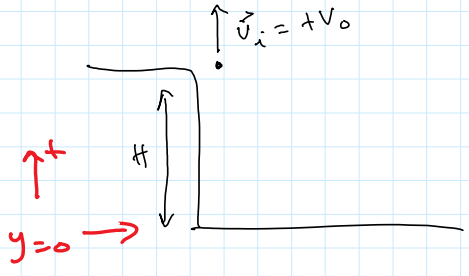
$V_f = -43.4 \frac{m}{s}$







Now: throw ball up



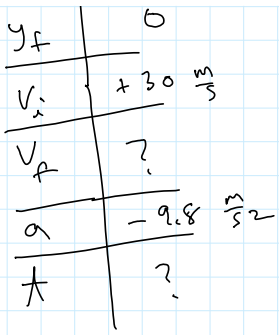
given: $V_0 = 30 \frac{m}{s}$

$H = 50$ m

find: V_f

y motion

y_i	+50 m
y_f	0
V_i	+30 m/s



$$v_f^2 = v_i^2 + 2a\Delta y$$

$$v_f^2 = (30)^2 + 2(-9.8)(0-50)$$

$$v_f = \pm 43.4 \ \frac{m}{s}$$

$$v_f = -43.4 \ \frac{m}{s}$$ must be down