

9-9-13

(1)

CH 2:

general equations uniform  
accelerated motion:

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GRAVITY  
 $a = -g$

(y POS)  
↑

$$v_2 = v_1 + a \Delta t \rightarrow$$

$$\hookrightarrow v_2 = v_1 - g \Delta t$$

$$\Delta x = v_1 \Delta t + \frac{1}{2} a \Delta t^2$$

$$\hookrightarrow \Delta y = v_1 \Delta t - \frac{1}{2} g \Delta t^2$$

$$v_2^2 = v_1^2 + 2a \Delta x$$

$$\hookrightarrow v_2^2 = v_1^2 - 2g \Delta y$$

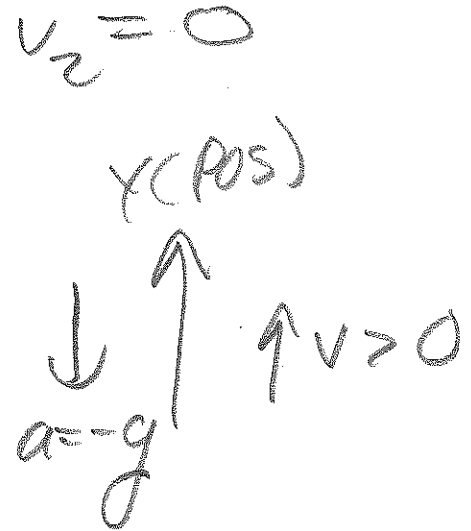
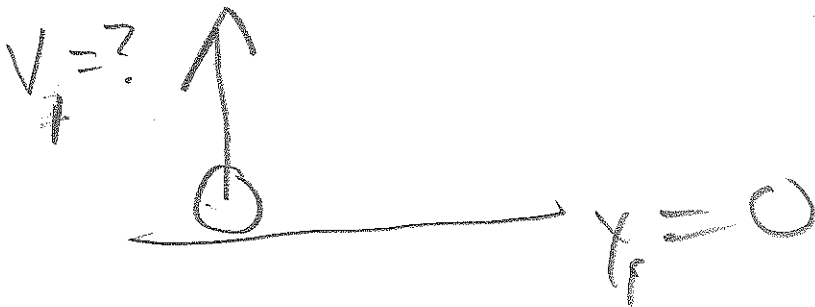
$$\left( \frac{v_2 + v_1}{2} \right) = \bar{v} \rightarrow \left( \frac{v_2 + v_1}{2} \right) = \bar{v}$$

# HINTS QUIZ 3

(2)

(46.)

$$y_2 = 22 \text{ cm} = 0.22 \text{ m}$$



$$v_2^2 = v_1^2 - 2g\Delta y$$

$$\Delta y = y_2 - y_1 = 22 - 0 = 22 \text{ cm} = 0.22 \text{ m}$$

$$0 = v_1^2 - 2\left(9.8 \frac{\text{m}}{\text{s}^2}\right)(0.22 \text{ m})$$

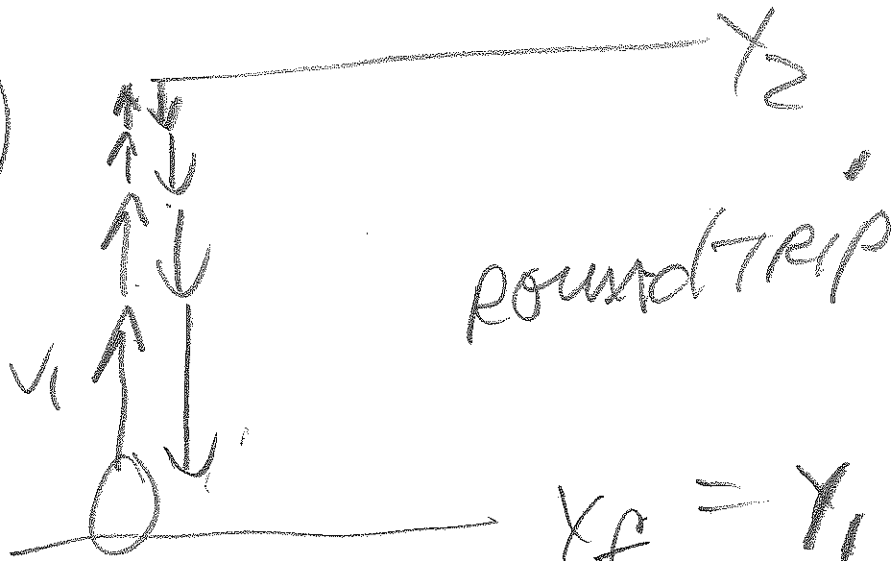
$$v_1^2 = \pm \sqrt{19.6 \frac{\text{m}}{\text{s}^2} \cdot (0.22 \text{ m})} \text{ (take +)}$$

$$v_1 = +2.0 \text{ m/s} = 2.0 \frac{\text{m}}{\text{s}} \text{ UP}$$

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(3)

(b)



$$\Delta y = 0 \quad (\text{round TRIP})$$

$$\Delta y = y_f - y_i = 0$$

$$0 = v_1 \Delta t - \frac{1}{2} g \Delta t^2$$

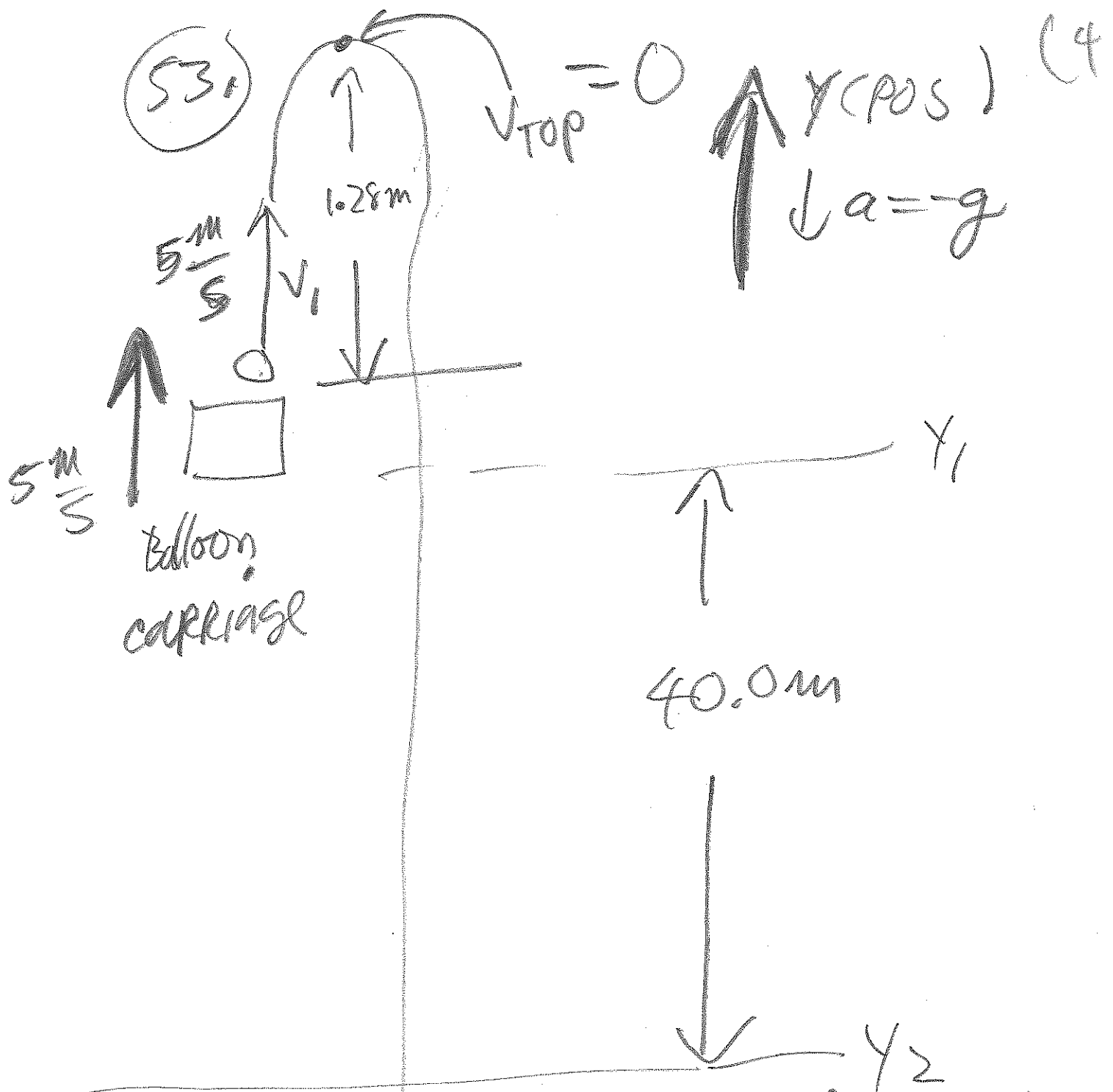
$$0 = \left(2.1 \frac{\text{m}}{\text{s}}\right) \Delta t - \frac{1}{2} \left(9.8 \frac{\text{m}}{\text{s}^2}\right) \Delta t$$

$$0 = \Delta t \cdot \left(2.1 \frac{\text{m}}{\text{s}} - \frac{4.9 \text{m} \cdot \Delta t}{\text{s}^2}\right)$$

$\Delta t = 0$   
reject

$$\Delta t = \frac{2.1 \text{ m/s}}{4.9 \text{ m/s}^2} = 0.429 \text{ s}$$

(5)



BASIC INFO: TIME TO GET

TO TOP:

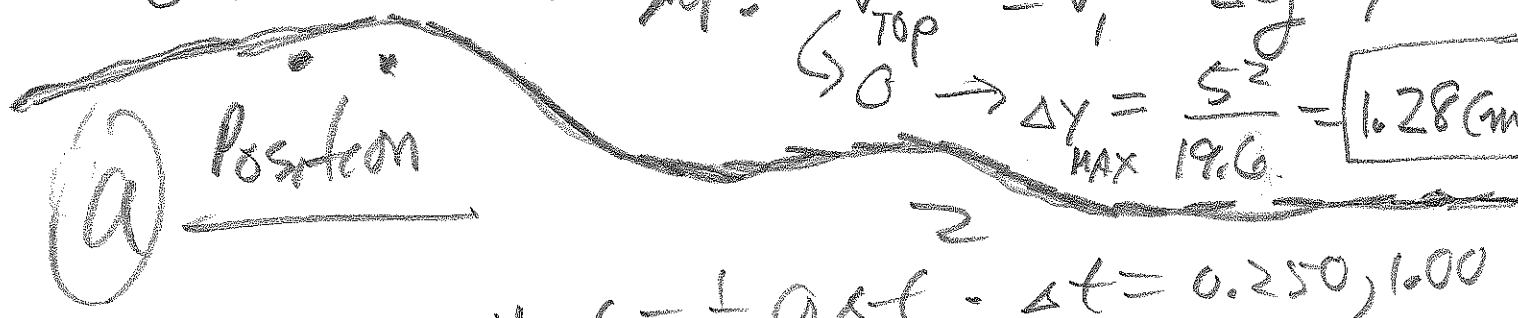
$$v_{\text{top}} = v_i - g \Delta t$$

$$0 = 5 \frac{\text{m}}{\text{s}} - (9.8 \frac{\text{m}}{\text{s}^2}) \cdot \Delta t$$

$$\Delta t = \frac{5 \text{ m/s}}{9.8 \text{ m/s}^2} = \boxed{0.51 \text{ (s)}}$$

GET MAXIMUM HEIGHT:

$$v_{\text{TOP}} = 0 \rightarrow \Delta y = \frac{v_i^2}{2g} = \frac{5^2}{19.6} = \boxed{1.28 \text{ (m)}}$$



$$\Delta y = v_i \Delta t - \frac{1}{2} g \Delta t^2; \quad \Delta t = 0.250, 1.00 \text{ (s) (s)}$$

0.250 (s):  $\Delta y = (5) \cdot (0.250) - (4.9)(0.25)^2$   
~~\_\_\_\_\_~~  
 $= 1.25 - 0.30625$   
 $= 0.94 \text{ (m)}$

1.00 (s):  $\Delta y = (5)(1.00) - (4.9)(1)^2$   
~~\_\_\_\_\_~~  
 $= 5 - 4.9$   
 $= 0.1 \text{ (m)}$

Quick  
check

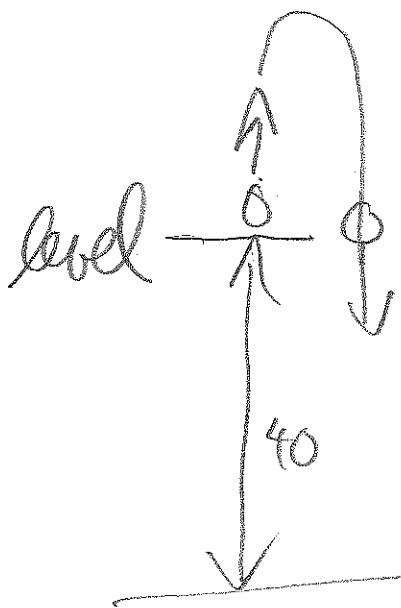
How long does it take to return to same level (40 m)?

(8)

$$\Delta y = 0 = v_i \cdot \Delta t - \frac{1}{2} \cdot g \Delta t^2$$

$$0 = 5 \cdot \Delta t - 4.9 \Delta t^2$$

$$0 = \Delta t \cdot (5 - 4.9 \Delta t)$$



$\Delta t$  to return to same level ("round trip")

$$\Delta t \approx \frac{5}{4.9} = \frac{2v_i}{g}$$
$$\approx 1.02 \text{ (s)}$$

53 velocities at 0.250, 1.00(s)

(b):  
 0.250 :  $v_2 = v_1 - g \Delta t$   
 (s)

guess:  $v_2 > 0$   
 $v_2 = 5 \frac{m}{s} - (9.8) (0.250) = \boxed{2.55 \frac{m}{s}}$   
 as expected

AT 1.00(s):  $v_2 = v_1 - g \Delta t$

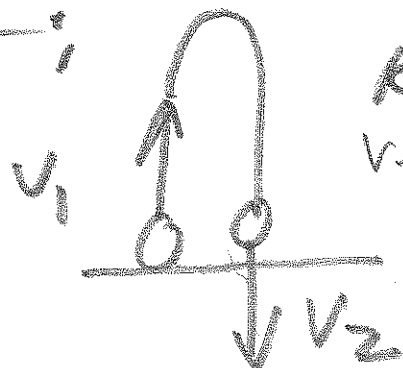
$v_2 < 0$  and  $|v_2| \approx |v_1|$

$v_2 = 5 \frac{m}{s} - (9.8)(1.00)$   
 $= -4.8 \frac{m}{s}$  AS EXPECTED.

Quick comment:

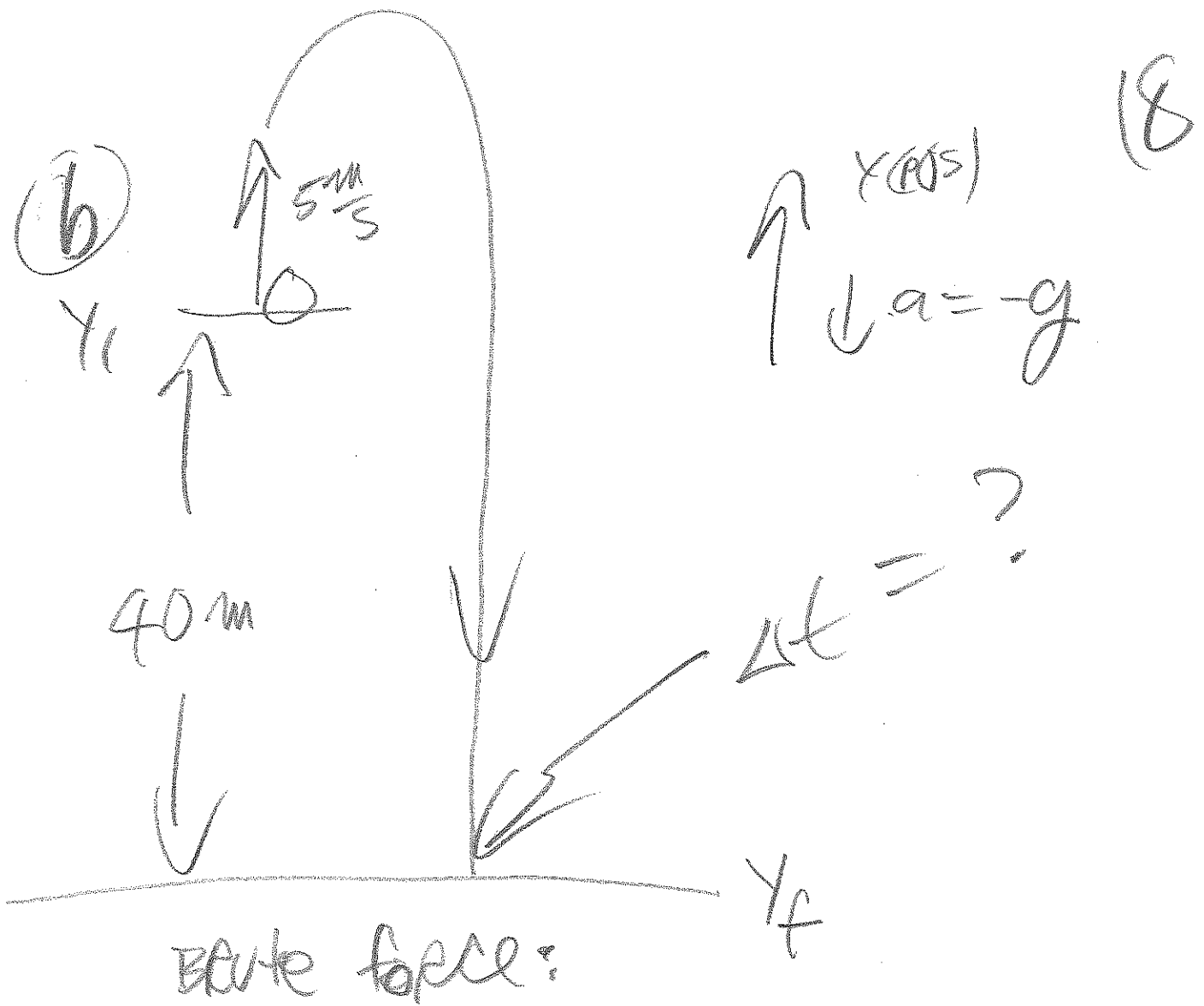
$v_2 = -v_1$

TOTAL TIME:  $\frac{2v_1}{g}$



ROUND TRIP:

$v_2 = v_1 - g \Delta t$   
 $= v_1 - g \cdot \left( \frac{2v_1}{g} \right)$   
 $= -v_1$



$$\Delta y = y_f - y_i = -40 \text{ m}$$

$$-40 \text{ (cm)} = v_i \Delta t - \frac{1}{2} g \Delta t^2$$

$$-40 = 5 \cdot \Delta t - 4.9 \Delta t^2$$

$$4.9 \Delta t^2 - 5 \Delta t + 40 = 0$$

$$\Delta t = \frac{5 \pm \sqrt{25 + 4 \cdot (4.9)(40)}}{9.8}$$



9)

$$\Delta t = \frac{5 \pm \sqrt{25 + 784}}{9.8}$$

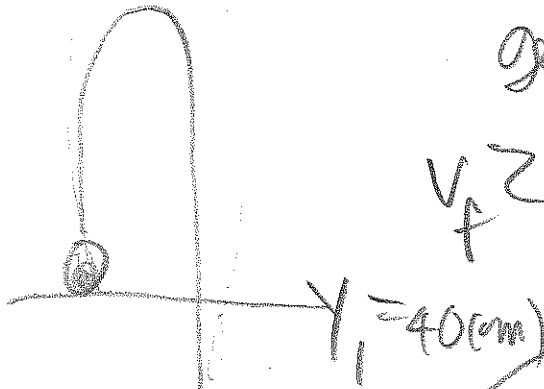
USE ONLY: 9.8

$$\Delta t = 3.4 \text{ (s)}$$

53  
 (10): "EASIER WAY":  $v_f = v_i - g \cdot \Delta t$  \*

get speed at ground

$$v_f^2 = v_i^2 - 2g \Delta y$$



$$\Delta y = -40 \text{ cm}$$

$$v_f^2 = \left(\frac{5 \text{ m}}{3}\right)^2 - 19.6 \frac{\text{m}}{\text{s}^2} \cdot (-40 \text{ m})$$

$$v_f^2 = \frac{25 \text{ m}^2}{9} + 784 \frac{\text{m}^2}{\text{s}^2}$$

$$= \frac{809 \text{ m}^2}{9}$$

$$* \Delta t = \frac{v_f - v_i}{-g}$$

$$v_f = \sqrt{809} \frac{\text{m}}{\text{s}} = -28.4 \frac{\text{m}}{\text{s}}$$

# 53 (b) EASY WAY

$$\Delta t = \frac{-28.4 \frac{m}{s} - 5 \frac{m}{s}}{-9.8 \frac{m}{s^2}}$$

$$= 3.4 (s)$$

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(c)  $|v_f| = 28.4 \frac{m}{s}$

(d)

$$40 + \Delta y_{top} = \Delta y_{MAX}$$

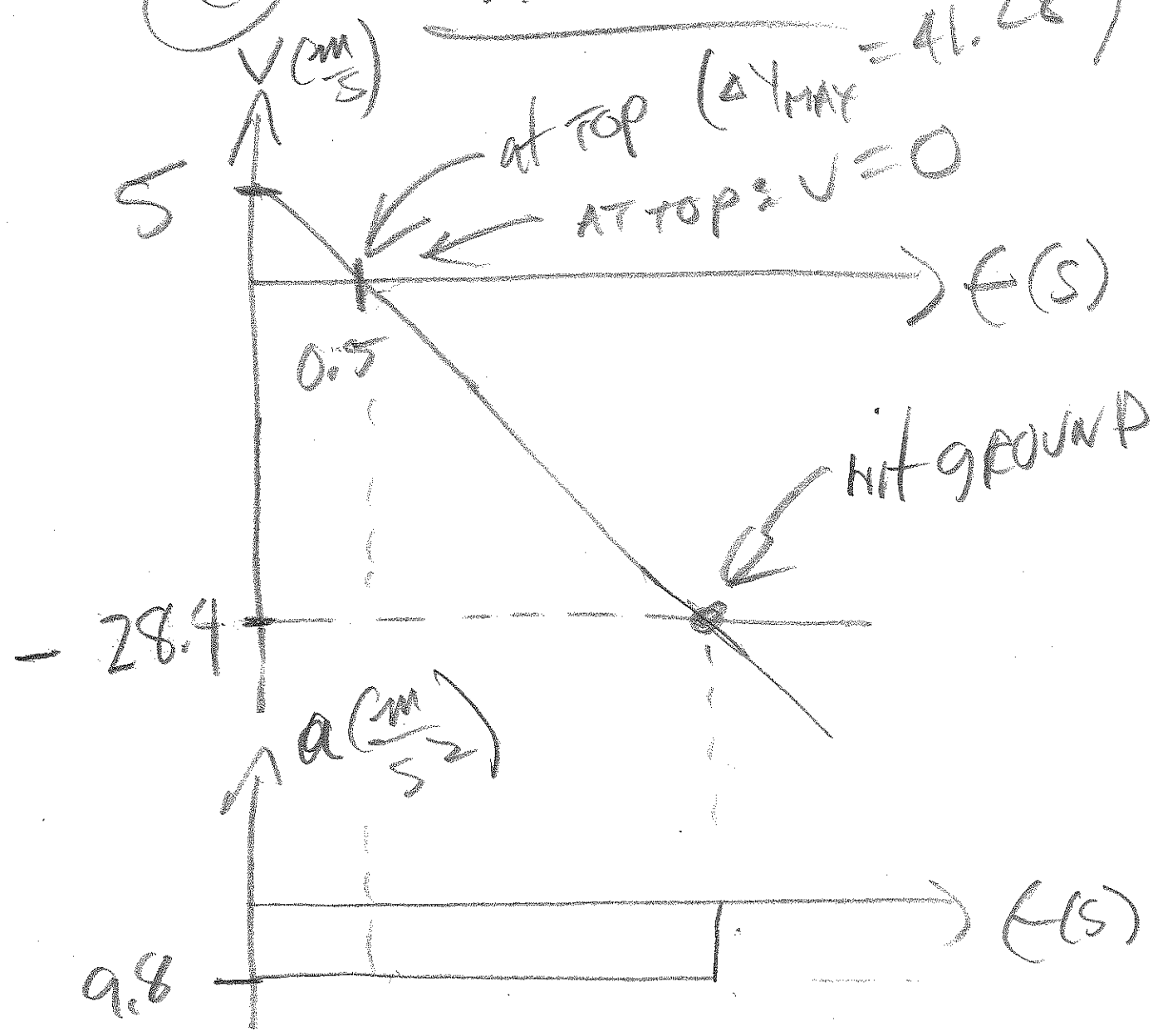
$$\leftarrow v_{top}^2 = v_i^2 - 2 \cdot g \cdot \Delta y_{top}$$

$$\rightarrow \Delta y_{top} = \frac{5^2}{19.6} = 1.28 (m)$$

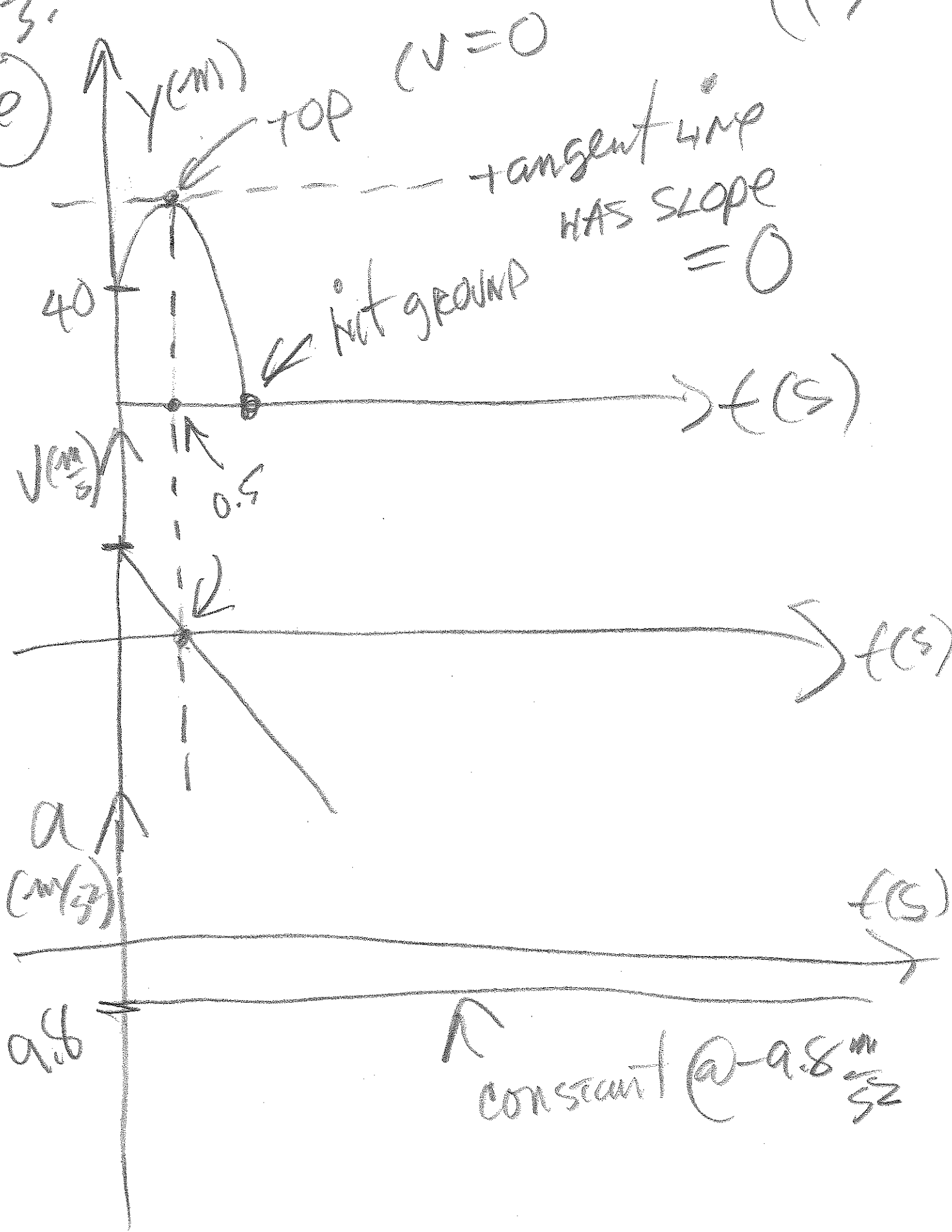
(d)  $\Delta Y_{MAX} = 40 + 1.28$  (12)  
 $= 41.28 \text{ cm}$

(e)

sketches



53. (e) (13)

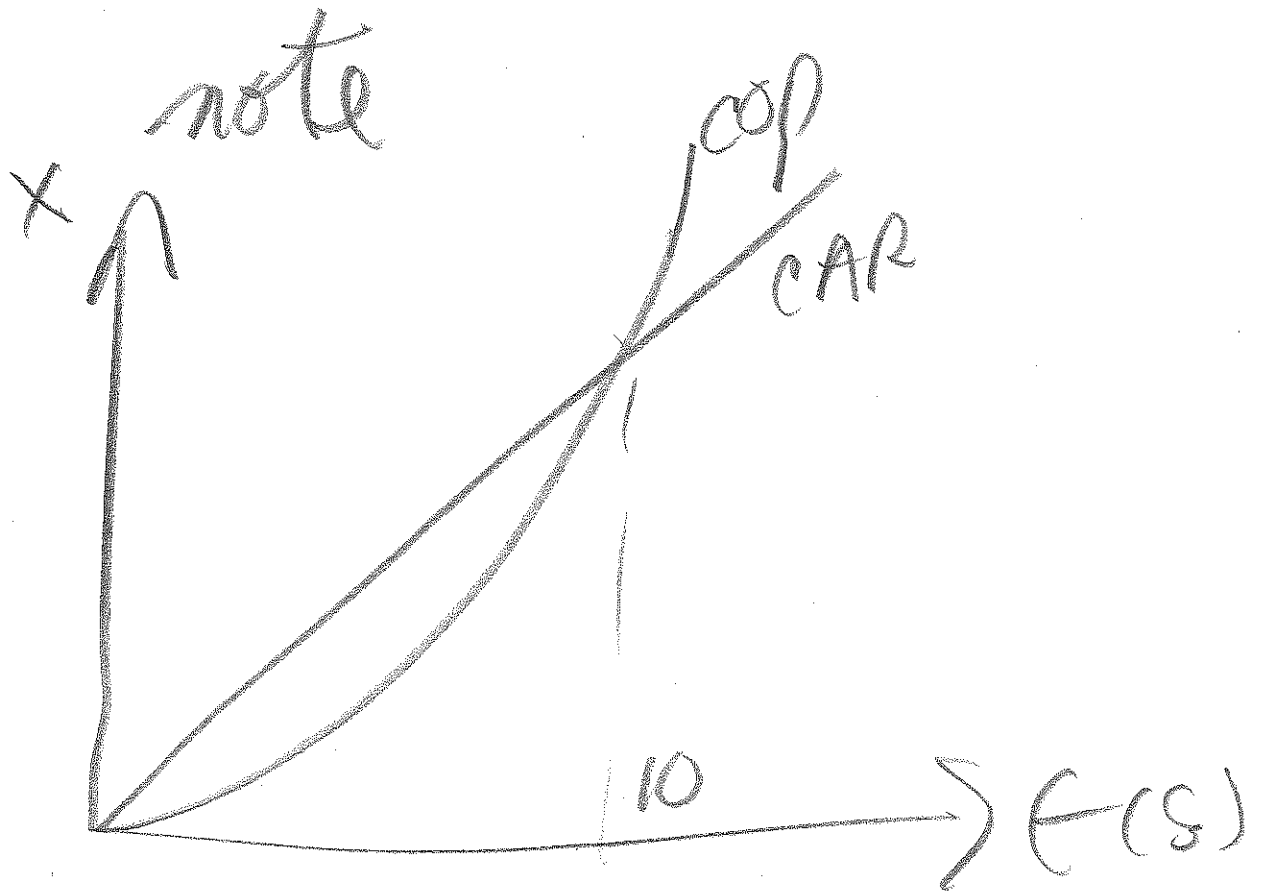


# Quick Review

(14)

## Example 2.9

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$$v_{\text{cop}} = a \cdot t = \left(3 \frac{\text{m}}{\text{s}^2}\right) (10 \text{ s})$$

$$= 30 \frac{\text{m}}{\text{s}} > 15 \frac{\text{m}}{\text{s}}$$

✓  
CAR

(15)

Exam 1 9-20; CH 1, 2, 4, 3 (E.C.)

Study tip:

write all problems

and worked out in

CLASS CH 1, 4, 2;

SEE POSTED LECTURE NOTES;

ALSO: ORDER

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