PHYSICS 4A 001, 002

2-4-13 Sp 13

Test 1 = 2-25-13

on Quiz 1, 2, and 3

Quiz 1 due 2/8 (FRI)

Quiz 2 due 2/13 (WED)

→ Quiz 3 due (2/22) (FRI)

1 4 weeks into term (3.5 weeks)

Test 1 ch (1) Quiz 1
(2) Quiz 2, Quiz 3
(3) Quiz 4 (PROJECTILE MOTION)
(4) Quiz 1,

(A.) where do you find the hints to *online problems (*masteringphysics.com)?

*mp

Answer: mpphysics.com.

NOTE: inputs for online problems ≠ BOOK inputs

(2

(3.) what do you hand in and when?

answer: solutions to same numbered problems in book using online inputs.

due: day of test

Test 1: 2-25-13

discussion questions: turn in a subset of book questions; book inputs.

Ch 2 free fall (3

drop ball

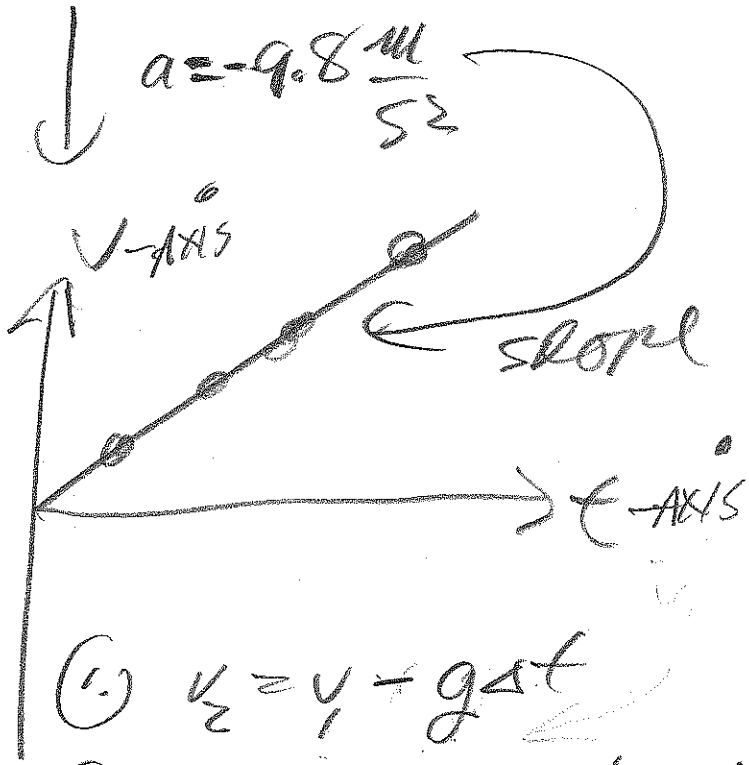
$v_0 = 0$ O 0s

$-9.8 \frac{m}{s}$ | O ↓ 1s

$-19.6 \frac{m}{s}$ O | 2s

$-29.4 \frac{m}{s}$ O | 3s

$-39.2 \frac{m}{s}$ O | 4s



$\Delta t = t_2 - t_1$

$\Delta y = y_2 - y_1$

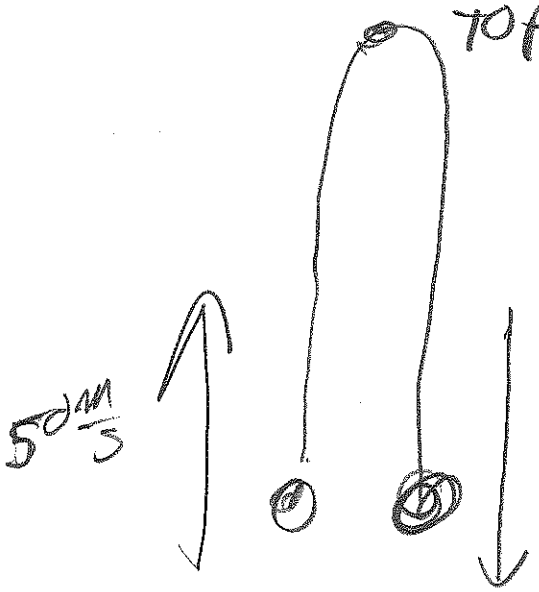
(1.) $v_2 = v_1 - g\Delta t$

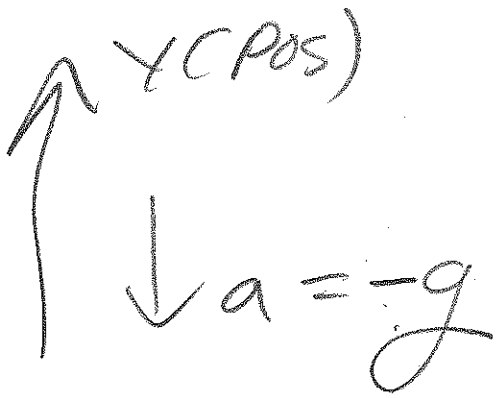
(2.) $y_2 - y_1 = v_1 \Delta t - \frac{1}{2} g \Delta t^2$

(3.) $v_2^2 = v_1^2 - 2g\Delta y$

(4.) $\bar{v}_y = \frac{v_1 + v_2}{2}$

Example: THROW a ball upward at 50.0 $\frac{m}{s}$.





$g = 9.8 \frac{m}{s^2}$

typical ERROR:

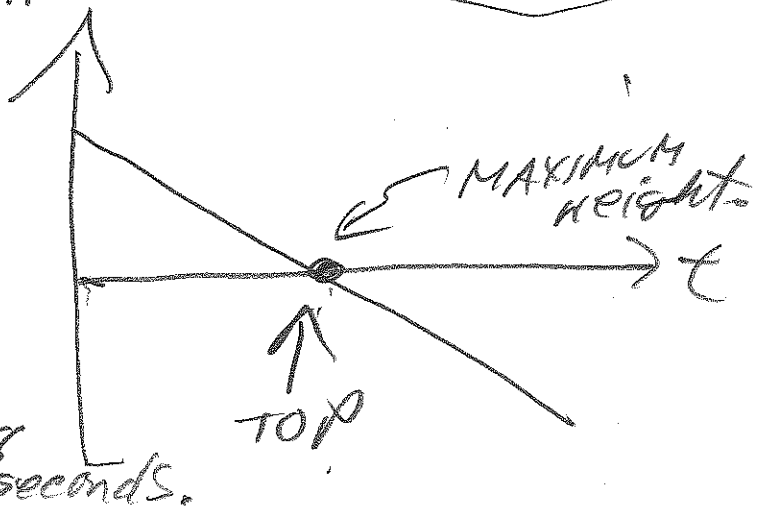
$g = -9.8 \frac{m}{s}$

(a) What is acceleration at TOP? $-9.8 \frac{m}{s^2}$

(b) What is MAXIMUM height?

(c) What is time of flight?

(d) $\bar{v}$ between 2 and 8 seconds.



(b) $v_{top}^2 = 0 = (50\frac{m}{s})^2 - 2g\Delta y_{max}$

$50\frac{m}{s} \approx 100\frac{mi}{h}$

$\Delta y_{max} = \frac{2500\ m^2/s^2}{19.6\ m/s^2}$

Orta Blue As pitcher. FASTBALL $\approx 110\frac{mi}{h}$

$\approx$ 125 m

Offscreen: Δt_{top}^*

$v_{top} = 0 = 50\frac{m}{s} - g\Delta t_{top}$

use $\Delta y_{max} = (50\frac{m}{s})\Delta t - \frac{1}{2}g\Delta t^2$

$\approx$ 375 ft.

*time to get to top $= \frac{50\ m/s}{9.8\ m/s^2} \approx 5(s)$

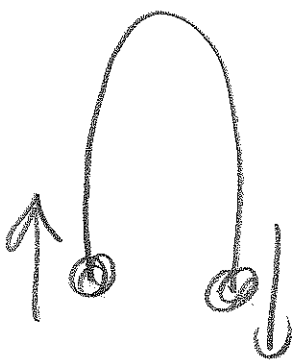
(c)

Quick answer

$\Delta t_{total} = 2 \cdot \Delta t_{top}$

$= 2 \cdot \left(\frac{50\ m/s}{9.8\ m/s^2}\right)$

$\approx 10(s)$



Show work:

use definition:

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

$0 = (50\frac{m}{s})\Delta t - \frac{1}{2}(9.8\frac{m}{s^2})\Delta t^2$ ⟹

(c)

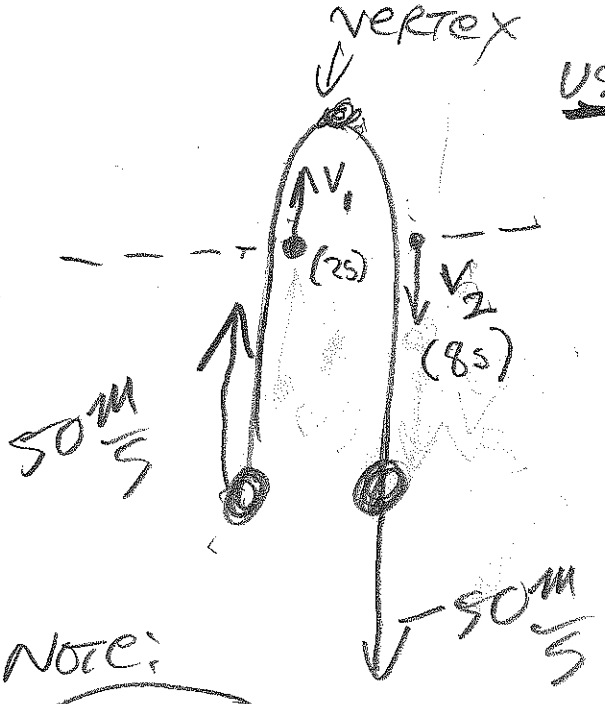
$$\Delta t \cdot \left(50\frac{m}{s} - 4.9\frac{m}{s^2}\Delta t\right) = 0$$

$$\Delta t = 0 \quad \text{OR} \quad 50 - 4.9\Delta t = 0$$

$$\Delta t = 0 \quad \text{OR} \quad \Delta t = \frac{50}{4.9}$$

$$\approx 10(s)$$

(d) $\bar{v}$ between 2 and 8 s.



Use: $v = 50 - gt$

$$\bar{v} = \frac{[50 - 9.8(2)] + [50 - (9.8)(8)]}{2}$$

$$= \frac{100 - (9.8)(10)}{2} = 0$$

Note: $v_2 = -v_1$

Prove that $v_2 = -v_1$:

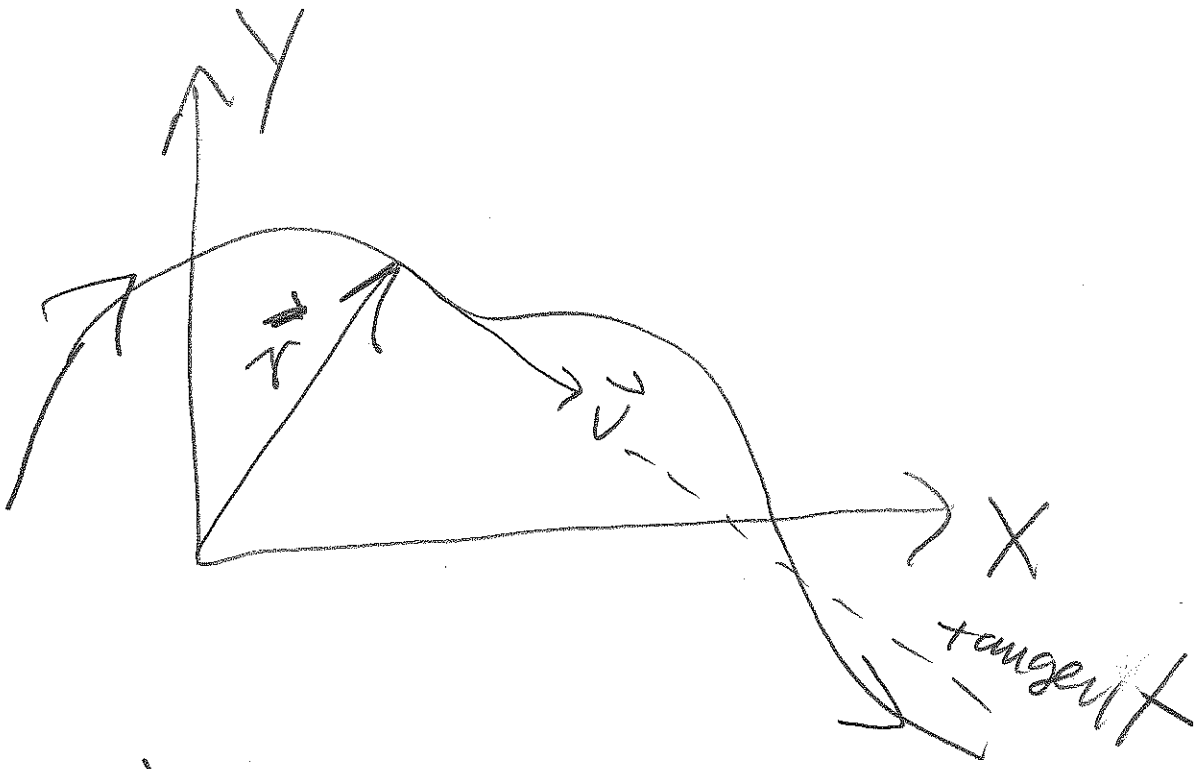
$$v_2 = v_1 - g\Delta t$$

$$v_2 = 50\frac{m}{s} - 9.8\frac{m}{s^2}(10s)$$

$$v_2 \approx 50 - 100 \approx -50\ m/s$$

where $v_1 = 50\frac{m}{s}$ and $v_2 = -50\ m/s$

Ch 3

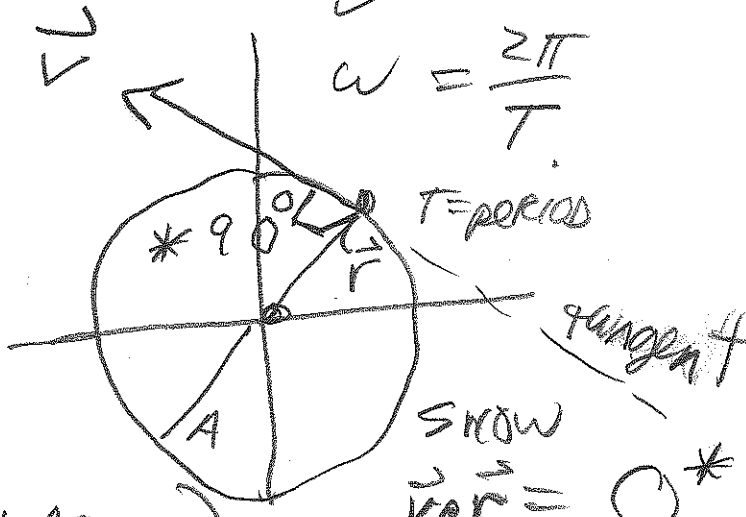


$$\vec{r} = (X(t), Y(t))$$

CIRCULAR MOTION
COUNTER CLOCKWISE

$$\omega = \frac{2\pi}{T}$$

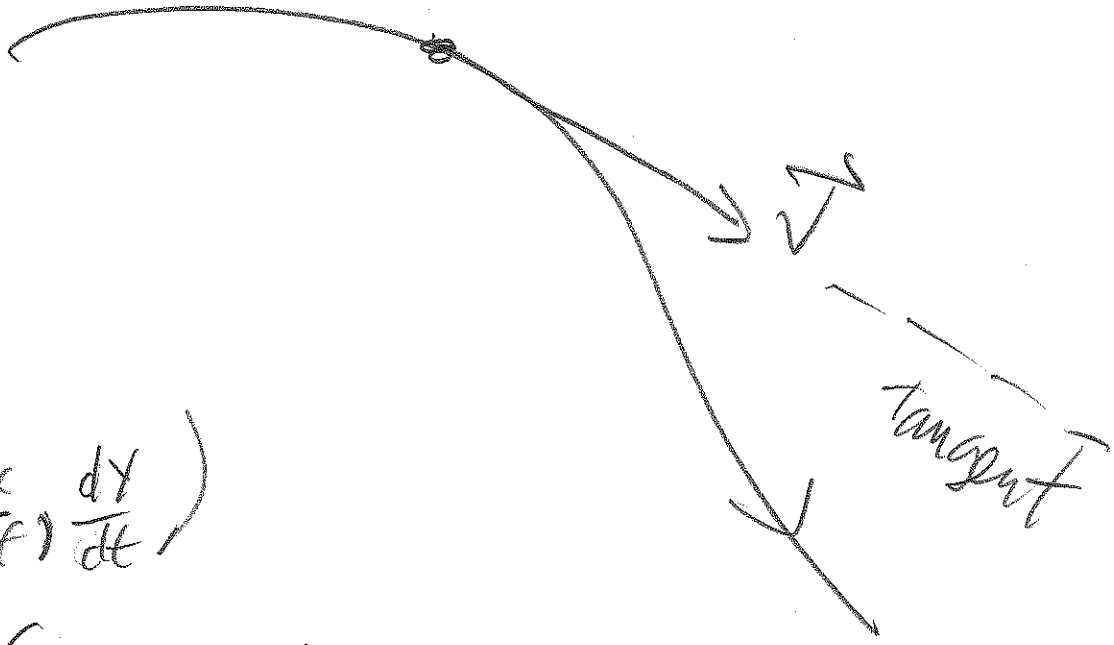
T = PERIOD



PROOF for circle:

$$\vec{r} = (A\cos\omega t, A\sin\omega t)$$
$$= (x, y)$$

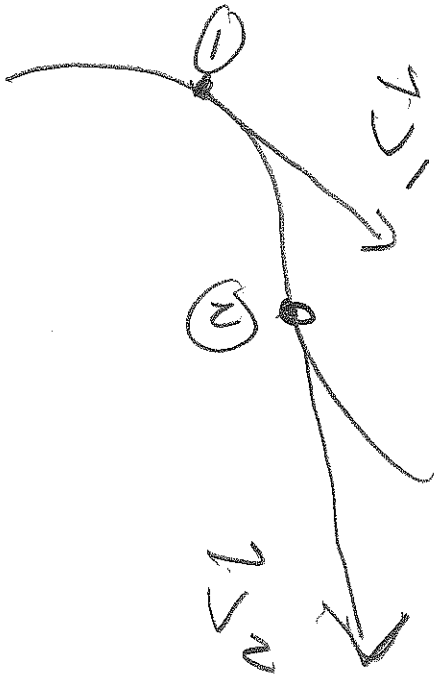
$$\vec{v} = \left(\frac{dx}{dt}, \frac{dy}{dt}\right) = (-A\omega\sin\omega t, \omega A\cos\omega t)$$

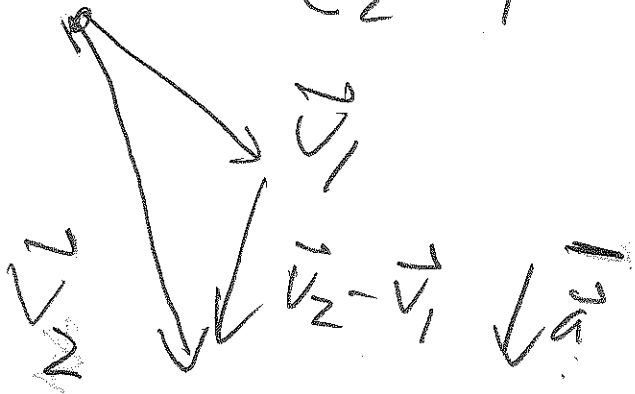


$$\vec{v} = \left(\frac{dx}{dt}, \frac{dy}{dt}\right)$$

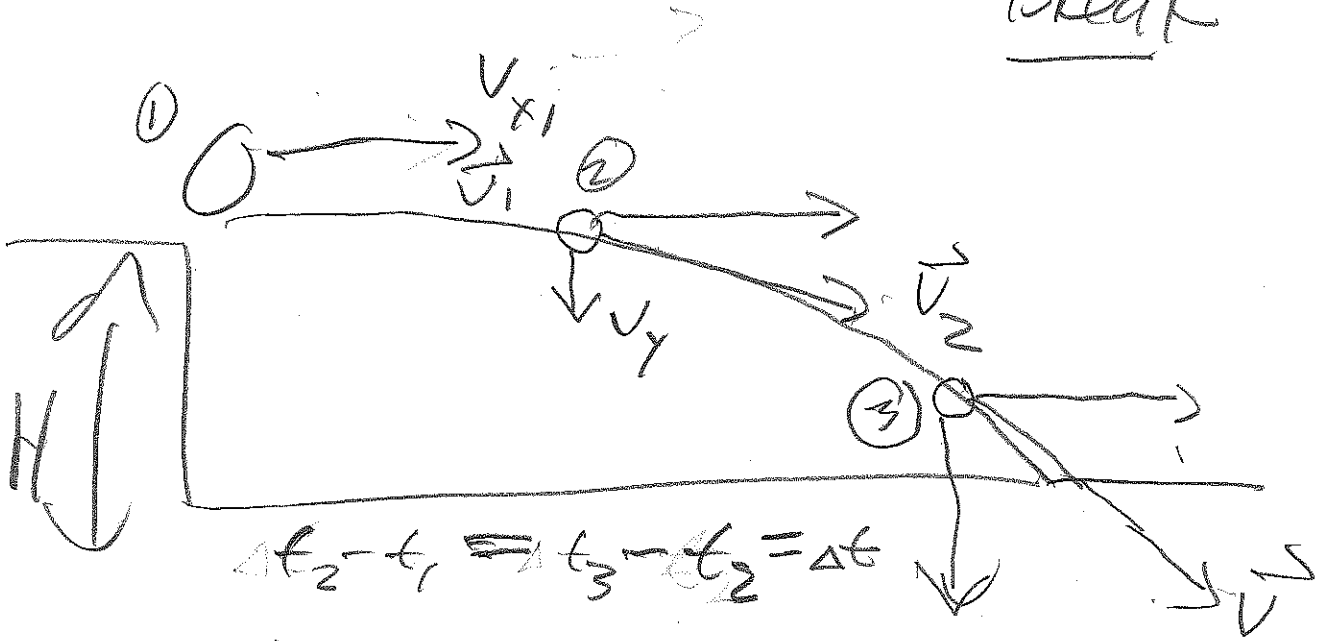
$$\vec{a} = \left(\frac{dv_x}{dt}, \frac{dv_y}{dt}\right) = (a_x, a_y)$$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$

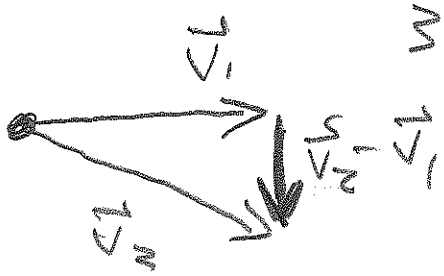




Projectile Motion demo after Break



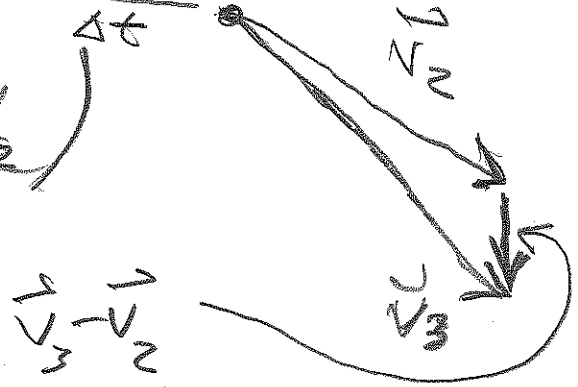
$\vec{v} = (v_x, v_y)$



Y (pos)

down $\vec{a} = (0, a_y) = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t} = \frac{\vec{v}_3 - \vec{v}_2}{\Delta t}$

$a_x = 0 \quad = (0, -9.8 \frac{m}{s^2})$



Note: $\vec{v}_2 - \vec{v}_1$ ↓ DOWN

$\vec{v}_3 - \vec{v}_2$ ↓ DOWN

(10)

$$\vec{a} = \vec{a} = -9.8 \frac{m}{s^2} \hat{j}$$

v_x = constant $\longrightarrow$ $a_x = 0 = \frac{dv_x}{dt}$

$a_x = -g \Longrightarrow$

y-motion

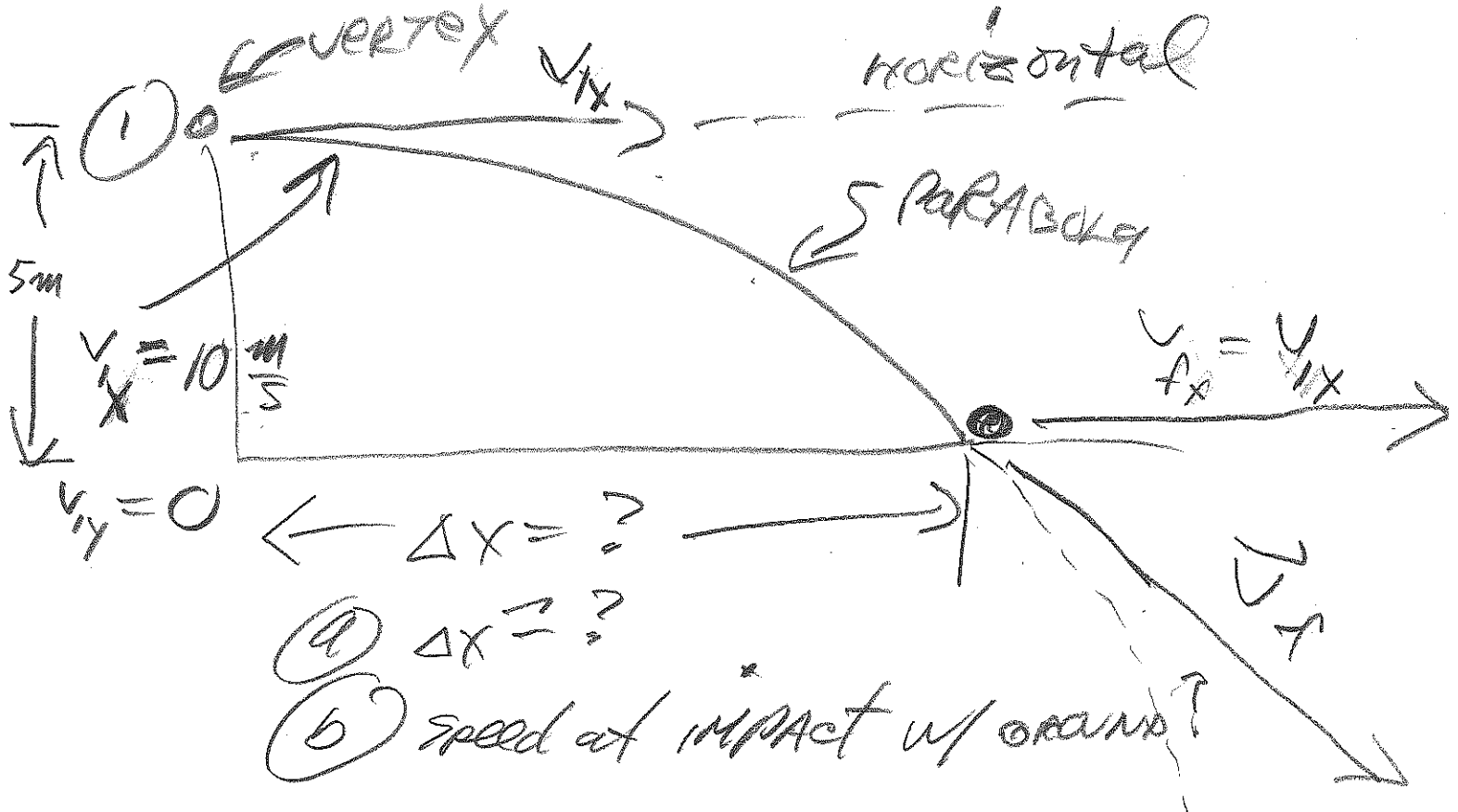
$v_{2y} = v_{1y} - gat$

$v_{2y}^2 = v_{1y}^2 - 2g\Delta y$

$y_2 - y_1 = v_{1y}\Delta t - \frac{1}{2}gat^2$

$\bar{v}_y = \frac{v_{1y} + v_{2y}}{2}$

y (pos) ↑



(a) $\Delta x = ?$

(b) speed at impact w/ ground?

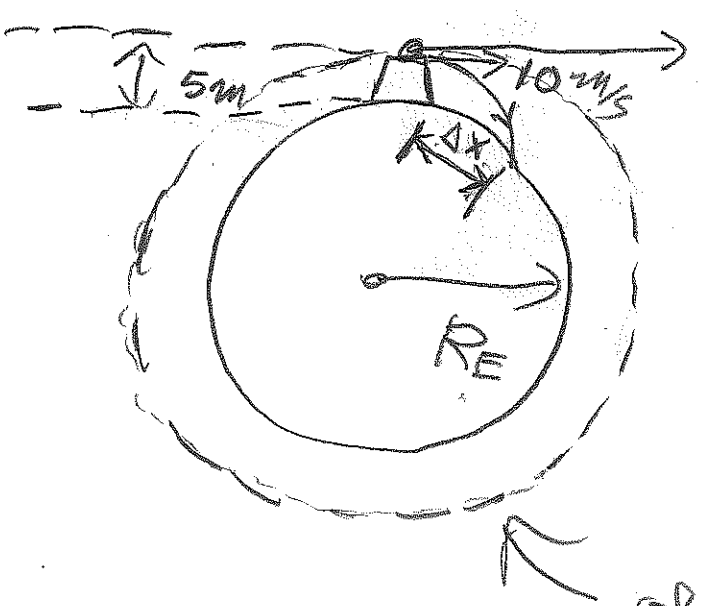
$\Delta x = v_{ix} \cdot \Delta t$ x-motion

simplest

$y_2 - y_1 = -H = -5m$

$-5m = -\frac{1}{2} g \Delta t^2$

$\Delta t = \sqrt{\frac{10m}{9.8 m/s}} \approx 1(s)$



$\Delta x = (10 \frac{m}{s})(1s)$

$= 10(m)$

orbit if launch speed $v = 8000 \frac{m}{s}$