# Physics 201 - Lecture 8

- Projectile Motion
- Assignment 3 (due a week from this Wednesday)
- Test 1: a week from this Friday (i.e. Feb. 19)

(i) on WebAssign, during class time

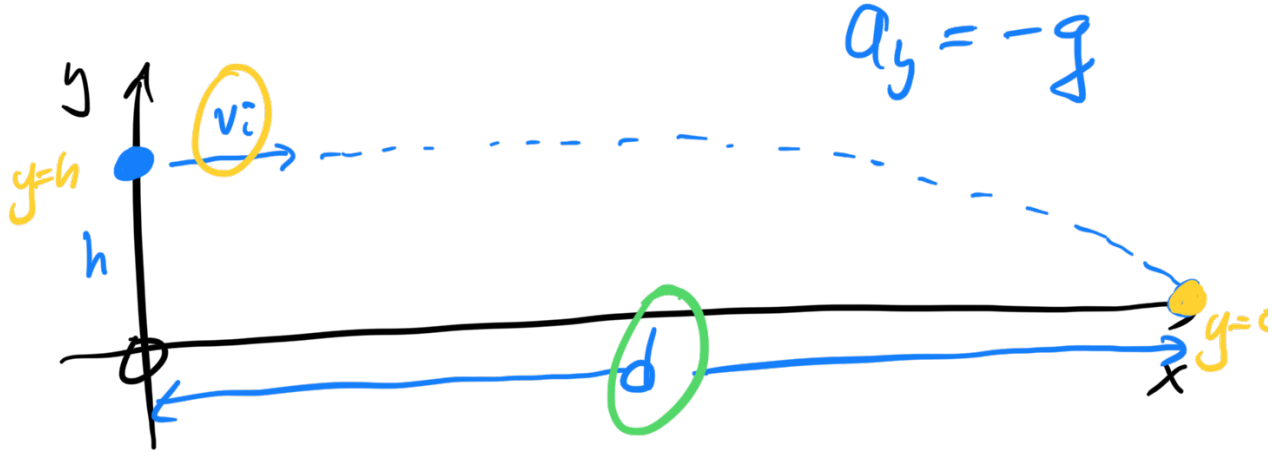
(ii) You make your own formula sheet

(iii) will cover A1, A2, A3

(iv) More on the format

later

PICTURE Step 1:




$V_i = 546$ m/s

$h = 1.2$ m

STEP2: Break apart the X- and Y-axis

| X | Y |
|---|---|
| ① $a_x = 0$ | ① $a_y = -g$ ✓ |
| ② $V_{ix} = V_i$ | ② $V_{iy} = 0$ ← horiz. ✓ |

③ $t = 0.495\ s$

$\Delta x = ?$

$\Delta x = v_{ix} t + \frac{1}{2} a_x t^2$

$= (546)(.495)$

$\Delta x = 270\ m$

② $\Delta y = -h$ ✓

$t = ?$

$\Delta y = v_{iy} t + \frac{1}{2} a_y t^2$

$-h = -\frac{1}{2} g t^2$

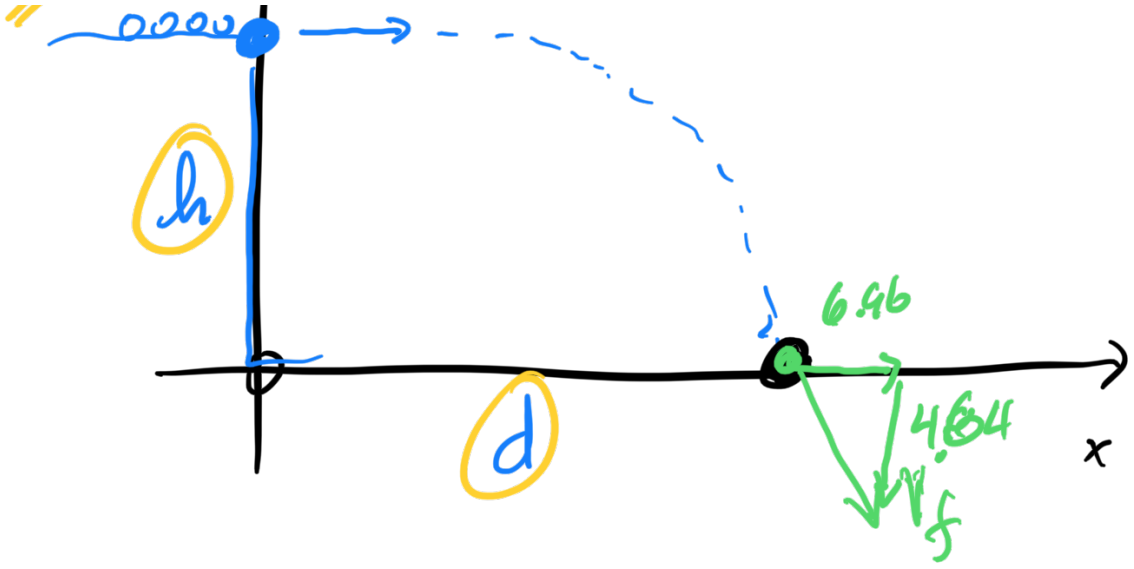
$t^2 = \frac{2h}{g}$

$t = \pm \sqrt{\frac{2h}{g}}$

$t = \pm 0.495\ s$

$t = 0.495\ s$

8. y ↑ $v_i$ ↙?




| X | Y |
|---|---|
| ① $a_x = 0$ | ① $a_y = -g$ |
| → $V_{ix} = V_i$ | ② $V_{iy} = 0$ (horiz) |
| ② $\Delta x = d$ | ③ $\Delta y = -h$ |
| ③ $t = 0.474\ s$ | $t = ?$ |
| $\Delta x = v_{ix} t + \frac{1}{2} a_x t^2$ (0) | $t = \pm\sqrt{\frac{2h}{g}}$ |
| $d = v_i \cdot t$ | $t = \oplus\ 0.474\ s$ |
| $v_i = \frac{d}{t} = \frac{3.3m}{.474s}$ | $V_{fy} = V_{iy} + a_y t$ (0) |

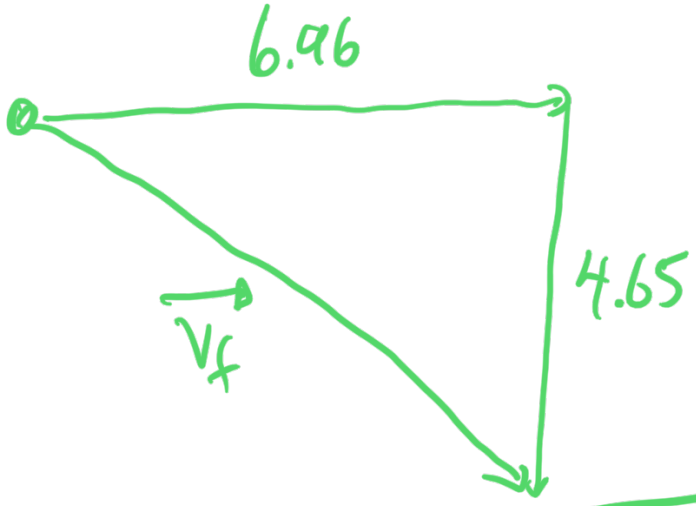
$V_i = 6.96$ m/s

$V_{fx} = V_{ix} + a_x t$ ($a_x = 0$)

$V_{fx} = 6.96$ m/s

$= (9.8)(.474)$

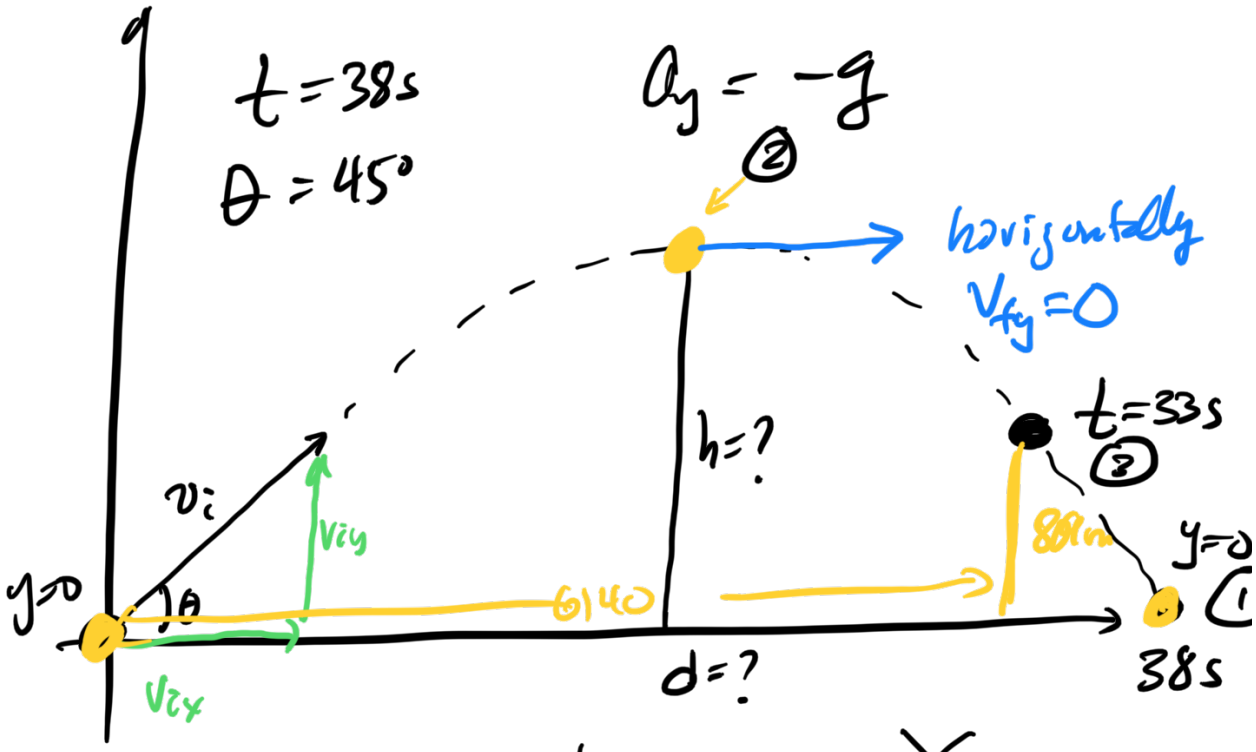
$V_{fy} = -4.65$ m/s ↑




"speed" $\equiv |\vec{v}_f| = \sqrt{6.96^2 + 4.65^2}$

$= 8.37$ m/s

10.




| X | Y |
|---|---|
| $a_x = 0$ ✓ | ① $a_y = -g$ ✓ |
| $V_{ix} = V_i \cos\theta$ ✓ | → $V_{iy} = V_i \sin\theta$ ✗ |
| $t = 38s$ | ② $\Delta y = 0$ (entire trip) |
| $\Delta x = ?$ | ③ $t = ? = 38s$ ☺ |
| $\Delta x = V_{ix} t + \frac{1}{2} a_x t^2$ | $\Delta y = V_{iy} t + \frac{1}{2} a_y t^2$ |
| $= (263.3)(\cos 45°)(38)$ | $0 = (V_i \sin\theta) t - \frac{1}{2} g t^2$ |

$\Delta x = 7080\ m$

(c)

$(v_i \sin\theta)\, t = \frac{1}{2} g t^2$

$v_i = \frac{gt}{2\sin\theta} = 263.3\ m/s$

(a)

(b)

| X | Y |
|---|---|
| $a_x = 0$ | ① $a_y = -g$ |
| $v_{ix} = 263\cos 45°$ | ② $v_{iy} = 263\sin 45°$ |
| | → $\Delta y = h$ |
| | ③ $v_{fy} = 0$ |

$v_{fy}^2 = v_{iy}^2 + 2 a_y \Delta y$

$0 = v_{iy}^2 - 2gh$

$h = \frac{v_{iy}^2}{2g} = \frac{(263\sin 45}{2(9.8}$

= 1140 m

(d) $t = 33$ s

new problem!

| X | Y |
|---|---|
| ① $a_x = 0$ | ① $a_y = -g$ |
| ② $v_{ix} = 263\cos 45°$ | ② $v_{iy} = 263\sin 45°$ |
| ③ $t = 33$s | ③ $t = 33$s |
| $\Delta x = ?$ | $\Delta y = ?$ |
| $\Delta x = v_{ix}t + \frac{1}{2}\cancel{a_x t^2}^{\,0}$ | $\Delta y = v_{iy}t + \frac{1}{2}a_y t^2$ |
| $= (263\cos 45°)(33)$ | $= (263\sin 45°)(33) - 4.9(33)^2$ |
| $= 6140$ m | $= 809$ m |

$$\left.\begin{matrix}\Delta\vec{r} \\ \Delta\vec{x}\end{matrix}\right\} = 6140\,\hat{i} + 809\,\hat{j}$$