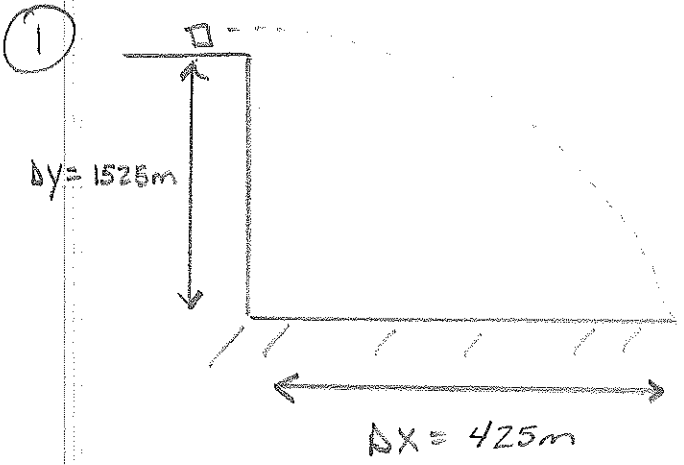
Pretest

(1)



$g = 9.81\ m/s^2$

$V_x = ?$

Soln:

$$V_x = \frac{\Delta x}{\Delta t}$$

$$\Delta y = \cancel{V_i \sin\theta\, \Delta t}^{\,0} - \tfrac{1}{2} g \Delta t^2$$

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

$$\Delta t = \sqrt{\frac{2\Delta y}{-g}}$$

Sub in Δt

$$V_x = \frac{\Delta x}{\sqrt{\frac{2\Delta y}{-g}}}$$

$$V_x = \Delta x \sqrt{\frac{-g}{2\Delta y}} = (425\,m)\sqrt{\frac{-9.81\ m/s^2}{2(-1525\,m)}}$$

$$\boxed{V_x = 24.1\ m/s}$$

(2)

Soln:

$\Delta x = V_i \cos\phi \, \Delta t$

$\Delta t = \dfrac{\Delta x}{V_i \cos\phi}$

$\Delta y = V_i \sin\phi \, \Delta t - \frac{1}{2} g \Delta t^2$ ($\Delta y = 0$)

$V_i \sin\phi \, \Delta t = \frac{1}{2} g \Delta t^2$

$V_i = \dfrac{g \Delta t}{2 \sin\phi}$

Sub in Δt $\longrightarrow$

$V_i = \dfrac{g \Delta x}{V_i \cos\phi \, 2 \sin\phi}$

$V_i^2 = \dfrac{g \Delta x}{\cos\phi \, 2 \sin\phi}$

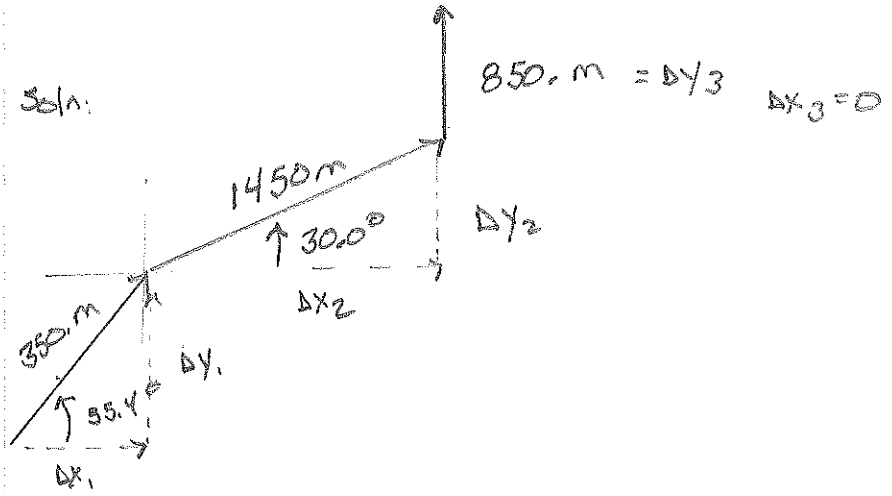
$V_i^2 = \dfrac{(9.81 \text{ m/s}^2)(300. \text{ m})}{\cos(28.0) \, 2 \sin 28.0}$

$\boxed{V_i = 59.6 \text{ m/s}}$

(3) Given: 1st 350. m @ 55.4° North of East
2nd 1450 m @ 30.0° North of East
3rd 850. m North

Find: Resultant displacement?

Soln:



$\Delta^2 = \Delta X_{Total}^2 + \Delta y_{Total}^2$

ΔX Total

$\Delta x_1 = d_1 \cos\theta$

$= 350.\text{ m} \cos 55.4°$

$\Delta x_1 = 199\text{ m}$

$\Delta x_2 = d_2 \cos\theta$

$= 1450\text{ m} \cos 30.0°$

$\Delta x_2 = 1260\text{ m}$

$\Delta x_3 = 0$

$\Delta X_T = 199\text{m} + 1260\text{m} + 0\text{m}$

$\Delta X_T = 1460\text{ m}$

ΔY Total

$\Delta y_1 = d_1 \sin\theta$

$= 350.\text{m} \sin 55.4°$

$\Delta y_1 = 288\text{ m}$

$\Delta y_2 = d_1 \sin\theta$

$= 1450 \sin(30.0°)$

$\Delta y_2 = 725\text{m}$

$\Delta y_3 = 850.\text{m}$

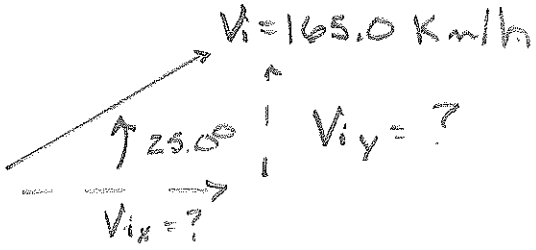
$\Delta y_T = 288\text{m} + 725\text{m} + 850.\text{m}$

$\Delta y_T = 1863\text{m}$

$d^2 = (1460\text{m})^2 + (1863\text{m})^2$

$\tan\theta = \frac{y_{Total}}{x_{Total}}$

(4) Given:



Soln:

$V_x = V_i \cos\phi$

$= (165.0 \text{ km/h}) \cos 25.0°$

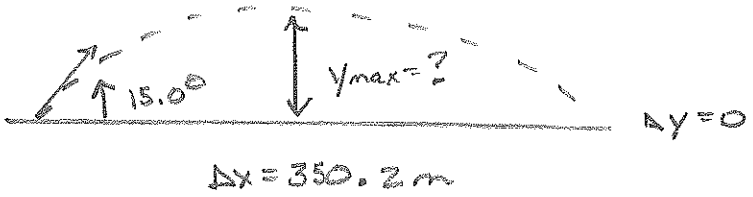
$V_x = 150.$ km/h

$V_y = V_i \sin\phi$

$= (165.0 \text{ km/h}) \sin 25.0$

$V_y = 69.7$ km/h

(5) Given:



$V_y = 0$ @ $\Delta t = \Delta t/2$!!

Soln:

Step 1: $\Delta x = V_i \cos\phi \, \Delta t$

$\Delta t = \dfrac{\Delta x}{V_i \cos\phi}$

Step 2: $V_{yf} = V_i \sin\phi - g\Delta t$ $\quad \Delta t = \frac{\Delta t}{2}$

$0 = V_i \sin\phi - g\dfrac{\Delta t}{2}$

$V_i = \dfrac{g\Delta t}{2\sin\phi}$

Step 3

$\Delta t = \dfrac{350.2\ m}{(82.9\ m/s)\cos 15.0}$

$\Delta t = 4.37\ s$

$V_i = \dfrac{g\left(\frac{\Delta x}{V_i \cos\phi}\right)}{2\sin\phi}$ Sub in Δt

$V_i^2 = \dfrac{g\Delta x}{2\sin\phi\cos\phi}$

Step 4

$\Delta y = V_i \sin\phi \, \Delta t - \frac{1}{2} g \Delta t^2$

$y_{max} = \frac{\Delta t}{2}$

$\Delta y = V_i \sin\phi\left(\frac{\Delta t}{2}\right) - \frac{1}{2} g \left(\frac{\Delta t}{2}\right)^2$

$V_i^2 = \dfrac{(9.81\ m/s^2)(350.2\ m)}{2(\sin 15.0)(\cos 15.0)}$

$\boxed{V_i = 82.9\ m/s}$

$= (82.9\ m/s)\sin 15.0\left(\frac{4.37\ s}{2}\right) - \frac{1}{2}(9.81\ m/s^2)\left(\frac{4.37\ s}{2}\right)^2$

$= 46.9\ m - 23.4\ m$

$\boxed{\Delta y = 23.5\ m}$

$= y_{max}$