PHY131H1F Centre-screen notes
Monday Oct. 1, 2012

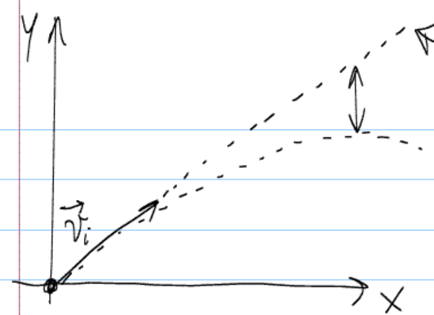
At the moment the scotch is dropped from rest, the barometer is alredy moving down.

$d_{scotch} = \frac{1}{2} g t^2 \qquad d_{bar.} = d_0 + v_0 t + \frac{1}{2} g t^2$

$d_{bar} - d_{scotch} = d_0 + v_0 t + \cancel{\frac{1}{2} g t^2} - \cancel{\frac{1}{2} g t^2}$

$= d_0 + \underbrace{v_0 t}_{\text{gets larger as } t \text{ increases.}}$

Monkey & Hunter.



set d = distance between actual path & straight line.

Known: $a_x = 0$ | $a_y = -9.80 \, m/s^2$

$\downarrow$

$v_x = v_{xi} = \text{constant}$ | $v_y = v_{yi} + a_y t$

$x = x_i + v_{xi} t$ | $y = y_i + v_{yi} t + \frac{1}{2} a_y t^2$

Set $x_i = y_i = 0$

Actual Path: $x = v_{xi} t \quad , \quad y = v_{yi} t + \frac{1}{2} a_y t^2$

Straight line can be found by setting $a_y = 0$:

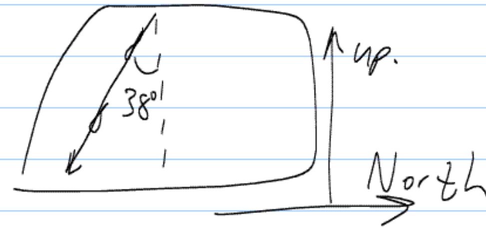
$x_{line} = v_{xi} t \quad , \quad y_{line} = v_{yi} t$

$d = y_{line} - y = \cancel{v_{yi} t} - [\cancel{v_{yi} t} + \frac{1}{2} a_y t^2]$

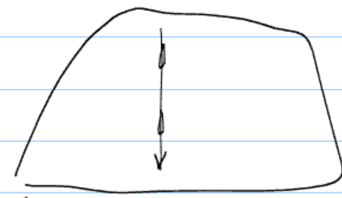
$$= -\frac{1}{2} a_y t^2$$

$$\boxed{d = \frac{1}{2} g t^2}$$ ← Same as the distance monkey falls in this time!

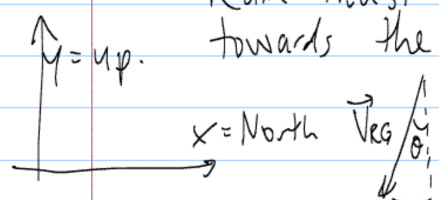
4.55 While driving North:



While driving South:



Rain must be being blown by the wind towards the South!



← instantaneous velocity "South of down by angle θ".

R = rain

G = ground.

$$(V_{RG})_x = -V_{RG} \sin\theta$$

$$(V_{RG})_y = -V_{RG} \cos\theta.$$

Set N = North-driving car

S = South-driving car.

While driving North: $\vec{V}_{RG} = \vec{V}_{RN} + \vec{V}_{NG}$

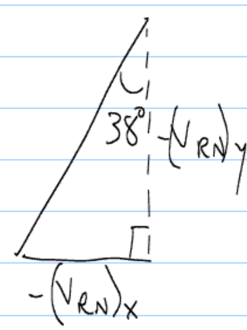
$$(V_{NG})_x = +25 \text{ m/s}$$

$$(V_{NG})_y = 0$$

$$\vec{V}_{RN} = \vec{V}_{RG} - \vec{V}_{NG}$$

$$(V_{RN})_x = -V_{RG} \sin\theta - 25$$

$$(V_{RN})_y = -V_{RG} \cos\theta$$



Eq. (1). $$\tan 38° = \frac{V_{RG} \sin\theta + 25}{V_{RG} \cos\theta}$$

While driving South;

$$\vec{V}_{RS} = \vec{V}_{RG} - \vec{V}_{SG}$$

straight down.

$$(V_{RS})_x = -V_{RG} \sin\theta + 25 = 0$$
$$(V_{RS})_y = -V_{RG} \cos\theta$$

$$\boxed{V_{RG} \sin\theta = 25 \text{ m/s}}$$

Plug into eq. 1

$|V_{RG}|_x$

$$\tan 38° = \frac{25+25}{V_{RG}\cos\theta}$$

$$\boxed{V_{RG} \cos\theta = 64 \text{ m/s}}$$

$|V_{RG}|_y$

Components are known;
Convert to mag & dir.

Mag: $V_{RG} = \sqrt{25^2 + 64^2} = 68.7 \text{ m/s}.$

$$\theta = \tan^{-1}\left(\frac{25}{64}\right) = 21.3°$$

"Rain drops travel at 69 m/s, at an angle of 21° South of Down."