

Name:

Key

ID #

1- The pilot of an airplane flies due north relative to the ground with a speed of 400 km/h. A wind is blowing towards the east with a speed of 40 km/h. What is the speed of the airplane relative to the wind?

$$\vec{v}_{pg} = 400 \hat{i}$$

$$\vec{v}_{wg} = 40 \hat{j}$$

$$\begin{aligned} \vec{v}_{pw} &= \vec{v}_{pg} + \vec{v}_{gw} \\ &= 400 \hat{i} - 40 \hat{j} \end{aligned}$$

$$|\vec{v}_{pw}| = \sqrt{(400)^2 + (-40)^2} \approx 402 \frac{m}{s}$$

2- A boy on the edge of a vertical wall 30 m high throws a stone horizontally outwards with a speed of 30 m/s. Calculate the magnitude of the final velocity of the ball (just before it hits the ground).

$$\vec{v} = v_x \hat{i} + v_y \hat{j}$$

$$v_x = v_{0x} \cos \theta_0 = 30 \frac{m}{s}$$

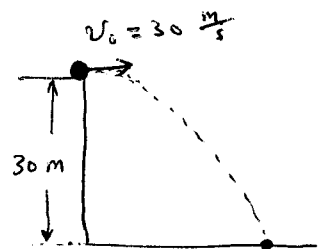
$$v_y = v_{0y} + a_y t$$

$$v_y = -9.8(2.5) =$$

$$\Rightarrow \vec{v} = 30 \hat{i} - 24.5 \hat{j}$$

the magnitude of the final velocity is:

$$|\vec{v}| = \sqrt{30^2 + (-24.5)^2} \approx 39 \frac{m}{s}$$



for the y-coordinate

$$\Delta y = -30 \text{ m}$$

$$v_{0y} = 0$$

$$a_y = -g$$

\* we can find the time

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

$$-30 = -4.9 t^2$$

$$t = \sqrt{\frac{-30}{-4.9}} \approx \pm 2.5 \text{ s}$$

$$t = 2.5 \text{ s}$$