Solutions PHYS-205A-002 (Midterm Exam 01) Fall 2024

Problem 1

$$[t] = \left[\frac{x}{v}\right] = [b]$$

b has dimension of Time.

$$\Rightarrow [b] = [t] = T$$

Problem 2

$\Delta x = 0$ $\quad v_i = +4.9 \frac{m}{s}$ $\quad a = -9.8 \frac{m}{s^2}$

$\Delta t = ?$ $\quad v_f =$

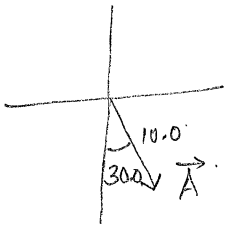
$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$0 = 4.9 \Delta t + \frac{1}{2}(-9.8) \Delta t^2 \Rightarrow \Delta t = 1.0\ s.$$

Problem 3

$$\vec{A} = +\hat{i}\ 10.0 \sin(30.0) - \hat{j}\ 10.0 \cos 30.0$$

$$= +\hat{i}\ 5.00\ m - \hat{j}\ 8.66\ m.$$



Problem 4

- horizontal component of initial velocity $\vec{V}_0$ is $V_{0x} = V_0 \cos\theta_0 = 22\ m/s$.
- horizontal component of acceleration is zero.
- vertical component of velocity at B is zero.
- thus, because there is no acceleration in the horizontal direction, we have.

$$V_B = V_{Bx} = V_{0x} = 22 \frac{m}{s}.$$

- magnitude.
- direction is horizontal.

Problem 5

speeder

$\Delta x_s = v_s \Delta t$

$= (38)\Delta t$

cop

$\Delta x_c = v_{ci}\Delta t + \frac{1}{2} a_c \Delta t^2$

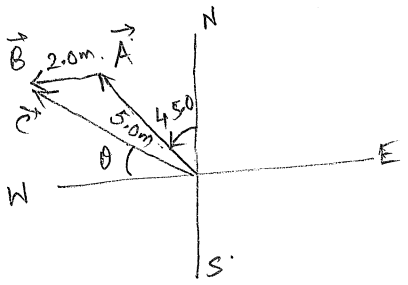
$= 0 + \frac{1}{2}(3.0)\Delta t^2$

$\Delta x_s = \Delta x_c$ (when the cop catches up)

$38\,\Delta t = \frac{1}{2}(3.0)\Delta t^2$

$\Delta t = 0$ (or) 25 seconds ← answer

Problem 6



$\vec{A} = -\hat{i}\,5.0\sin(45.0) + \hat{j}\,5.0\cos(45.0)$

$= -\hat{i}\,3.5\text{ m} + \hat{j}\,3.5\text{ m}$

$\vec{B} = -\hat{i}\,2.0\text{ m} + \hat{j}\,0$

$\vec{C} = \vec{A} + \vec{B} = -\hat{i}\,5.5\text{ m} + \hat{j}\,3.5\text{ m}.$

magnitude: $|\vec{C}| = \sqrt{(5.5)^2 + (3.5)^2} = 6.5\text{ m}.$

direction: $\theta = \tan^{-1}\left(\frac{3.5}{5.5}\right) = 33^\circ$ North of West

Problem 7

$\Delta x = ?$

$\Delta t =$

$v_{ix} = 3.50\frac{m}{s}$

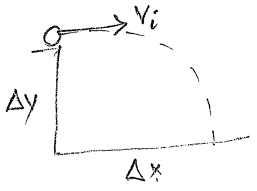
$\Delta y = -1.10\text{m}$

$\Delta t =$

$a_y = -9.8\frac{m}{s^2}$

$v_{iy} = 0$

$v_{fy} =$



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

$-1.10 = 0 + \frac{1}{2}(-9.8)\Delta t^2$

$\Delta t = 0.47\text{ s}$

$\Delta x = v_{ix}\Delta t$

$= (3.50)(0.47)$

$= 1.7\text{ m}.$