

Solution

Midterm Exam 01 (PHYS 203A-002) 2018 Fall

Prob. 1

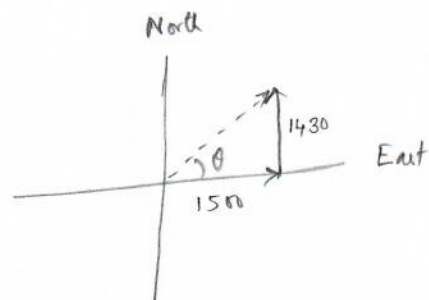
$$\vec{P} = 1500 \hat{i} + 0 \hat{j}$$

$$\vec{Q} = 0 \hat{i} + 1430 \hat{j}$$

$$\vec{R} = \vec{P} + \vec{Q} = 1500 \hat{i} + 1430 \hat{j}$$

$$|\vec{R}| = \sqrt{(1500)^2 + (1430)^2}$$

$$= 2100 \text{ m}$$



$$\theta = \tan^{-1}\left(\frac{1430}{1500}\right) = 44^\circ \text{ N of E.}$$

Prob. 2

$$\vec{A} = 5.0 \hat{i} + 0 \hat{j}$$

$$\vec{B} = 2.5 \cos 20^\circ \hat{i} - 2.5 \sin 20^\circ \hat{j}$$

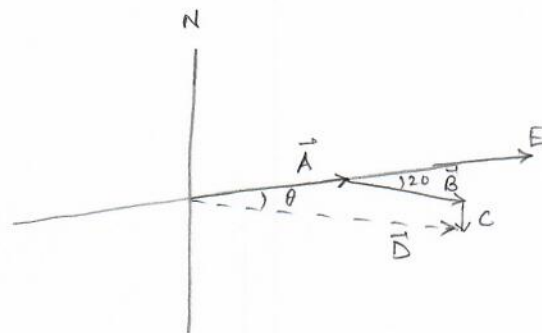
$$= 2.35 \hat{i} - 0.855 \hat{j}$$

$$\vec{C} = 0 \hat{i} - 0.50 \hat{j}$$

$$\vec{D} = \vec{A} + \vec{B} + \vec{C} = 7.35 \hat{i} - 1.36 \hat{j}$$

$$|\vec{D}| = \sqrt{(7.35)^2 + (-1.36)^2} = 7.5 \text{ m}$$

↓
magnitude



direction

$$\theta = \tan^{-1}\left(\frac{1.36}{7.35}\right) = 11^\circ \text{ S of E}$$

Prob. 3

(a) 0

(b) 9.8 m/s^2 towards the ground.

Prob. 4

$$\Delta y = ?$$

$$\Delta t =$$

$$v_i = +15 \frac{m}{s}$$

$$v_f = 0$$

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

$$2 a \Delta y = v_f^2 - v_i^2$$

$$2(-9.8) \Delta y = 0^2 - 15^2$$

$$\Delta y = 12 m$$

Prob. 5

$$\Delta x_s = \Delta x_p$$

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

$$(40.0) \Delta t = 0 + \frac{1}{2} (3.0) \Delta t^2$$

$$\Delta t = \frac{(40.0)(2)}{3.0} = 26.7 s$$

$$\Delta x_s = v_s \Delta t$$

$$= (40.0)(26.7) = 1100 m$$

(a=0) ————— speeder

$$(a=3.0 \frac{m}{s^2})$$

police.

Prob. 6

$$\Delta y = -50.0 m$$

$$\Delta t =$$

$$v_i = +2.0 \frac{m}{s}$$

$$v_f =$$

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

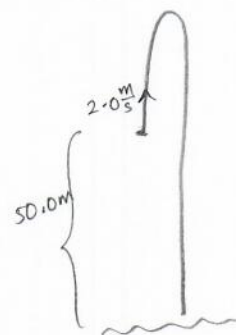
$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$-50 = 2.0 \Delta t + \frac{1}{2} (-9.8) \Delta t^2$$

$$4.9 \Delta t^2 - 2.0 \Delta t - 50 = 0$$

$$\Delta t = \frac{+2.0 \pm \sqrt{(-2.0)^2 - 4(4.9)(-50)}}{2(4.9)}$$

$$= 3.4 s \quad (\text{OR}) \quad -1.2 s$$



Answer: +3.4 seconds.

Prob. 7

x-dir

$$\Delta x = ?$$

$$\Delta t =$$

$$v_{ix} = 750 \frac{m}{s}$$

y-dir

$$\Delta y = -0.025 m$$

$$\Delta t =$$

$$v_{iy} = 0$$

$$v_{fy} =$$

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



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

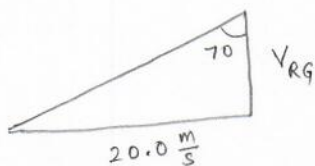
$$-0.025 = 0 + \frac{1}{2} (-9.8) \Delta t^2$$

$$\Delta t = 0.0714 s$$

$$\begin{aligned} \Delta x &= v_{ix} \Delta t \\ &= (750)(0.0714) = 54 m \end{aligned}$$

Prob. 8

$$\vec{v}_{RT} = \vec{v}_{RG} - \vec{v}_{TG}$$



$$\tan 70 = \frac{20.0}{v_{RG}}$$

$$v_{RG} = \frac{20.0}{\tan 70} = 7.3 \frac{m}{s}$$

