Solutions

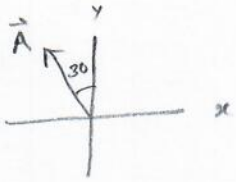
PHYS - 203A-002 (Midterm Exam 01) Fall 2021

## Problem 1

$$9.8 \frac{m}{s^2} = 9.8 \frac{m}{s^2} \left(\frac{1\ km}{1000\ m}\right) \left(\frac{60 \times 60\ s}{1\ hour}\right)^2$$

$$= 1.3 \times 10^5 \frac{km}{hour^2}$$

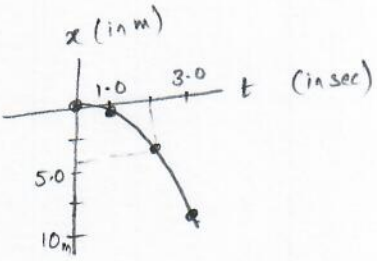
## Problem 2




$$\vec{A} = -15 \sin 30\, \hat{i} + 15 \cos 30\, \hat{j}$$

$$A_x = -15 \sin 30 = -7.5\ m$$

## Problem 3




| t | 0 | 1.0s | 2.0s | 3.0s |
|---|---|---|---|---|
| x | 0 | -1.0m | -4.0m | -9.0m |

## Problem 4

$9.8 \frac{m}{s^2}$ vertically downwards.

## Problem 5

Horizontal velocity remains the same. Thus, it lands with a horizontal velocity of $50.0 \frac{m}{s}$.

## Problem 6

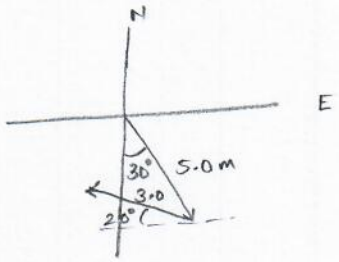
$$[m^2c^4] = [p^2c^2]$$

$$[m]^2[c]^4 = [p]^2[c]^2$$

$$[p] = [m][c]$$

$$= MLT^{-1}$$

## Problem 7

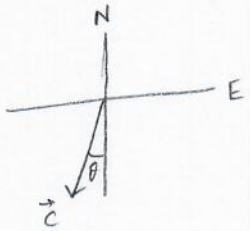



$$\vec{A} = +5.0 \sin 30\, \hat{i} - 5.0 \cos 30\, \hat{j}$$

$$= +2.5\, \hat{i} - 4.3\, \hat{j}$$

$$\vec{B} = -3.0 \cos 20\, \hat{i} + 3.0 \sin 20\, \hat{j}$$

$$= -2.8\, \hat{i} + 1.0\, \hat{j}$$




$$\vec{C} = \vec{A} + \vec{B} = -0.3\, \hat{i} - 3.3\, \hat{j}$$

$$|\vec{C}| = \sqrt{0.3^2 + 3.3^2} = 3.3 \text{ m}$$

$$\theta = \tan^{-1}\left(\frac{0.3}{3.3}\right) = 5.2^\circ \text{ W of S.}$$

## Problem 8

$\Delta y = ?$ $\quad V_i = \text{missing} \quad a = -9.8 \frac{m}{s^2}$

$\Delta t = 1.5\,s \quad V_f = 0$

$$\Delta y = V_f \Delta t - \frac{1}{2} a \Delta t^2$$

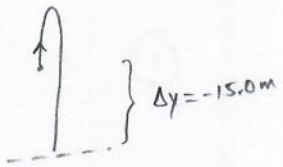
$$= 0(\Delta t) - \frac{1}{2}(-9.8)(1.5)^2$$

$$= 11\ m$$

## Problem 9

$\Delta y = -15.0m \quad V_i = +4.0 \frac{m}{s} \quad a = -9.8 \frac{m}{s^2}$

$\Delta t = \text{missing} \quad V_f = ?$

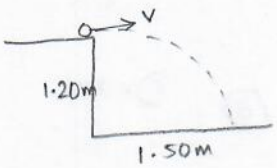



$$V_f^2 = V_i^2 + 2a\Delta y$$

$$= (4.0)^2 + 2(-9.8)(-15.0)$$

$$V_f = 18 \frac{m}{s}$$

## Problem 10




**x-dir**

$\Delta x = 1.50m$

$\Delta t = \boxed{0.49s}$

$V_{ix} = ?$

**y-dir**

$\Delta y = -1.20m \quad V_{iy} = 0$

$\Delta t = \boxed{0.49s} \quad V_{fy} =$

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

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

$$-1.20 = 0 + \frac{1}{2}(-9.8)\Delta t^2$$

$$\Delta t = 0.49\,s$$

$$V_{ix} = \frac{\Delta x}{\Delta t}$$

$$= \frac{1.50}{0.49}$$

$$= 3.1 \frac{m}{s}$$