Solutions

PHYS-205A-002 (Midterm Exam 01) Fall 2023

Problem 1

$$\left[\frac{a\,t}{7\,v}\right] = \frac{[a][t]}{[v]} = \frac{L\,T^{-2}\,T}{L\,T^{-1}} = 1 = L^0\,M^0\,T^0 \rightarrow \text{dimensionless}$$

Problem 2

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

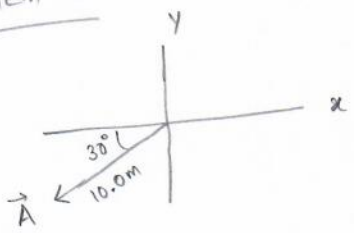
$\Delta x = -10.0\,m$ $\quad v_f = ?$

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$v_f = \sqrt{0 + 2(-9.8)(-10.0)}$$

$$= 14\ \frac{m}{s}$$

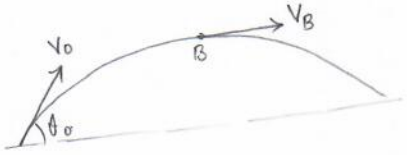
Problem 3



$$\vec{A} = -(10.0)\cos 30\ \hat{i} - (10.0)\sin 30\ \hat{j}$$

$$= -(8.7\,m)\ \hat{i} - (5.0\,m)\ \hat{j}$$

Problem 4



- the horizontal velocity remains constant in a projectile motion.
- at the highest point B the velocity is completely in the horizontal direction

$$\vec{V}_B = \hat{i}\,V_0\cos\theta_0 + \hat{j}\,0$$

$$= \hat{i}\,25\cos 30 + \hat{j}\,0$$

$$= \hat{i}\,22\ \frac{m}{s} + \hat{j}\,0$$

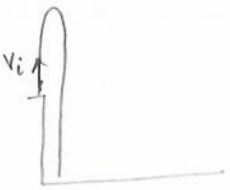
magnitude: $22\ \frac{m}{s}$

direction: horizontal $(+\hat{i})$

Problem 5

$\Delta t = ?$ $\quad v_i = +19.6 \frac{m}{s}$ $\quad a = -9.8 \frac{m}{s^2}$.

$\Delta y =$ $\quad v_f = 0$



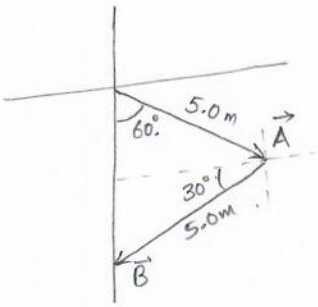
$$v_f = v_i + a\,\Delta t$$
$$0 = 19.6 + (-9.8)\,\Delta t$$
$$\Delta t = 2.0 \text{ seconds.}$$

Problem 6

$$\vec{A} = +5.0 \sin 60\, \hat{i} - 5.0 \cos 60\, \hat{j}$$
$$= +4.3\, \hat{i} - 2.5\, \hat{j}$$

$$\vec{B} = -5.0 \cos 30\, \hat{i} - 5.0 \sin 30\, \hat{j}$$
$$= -4.3\, \hat{i} - 2.5\, \hat{j}$$

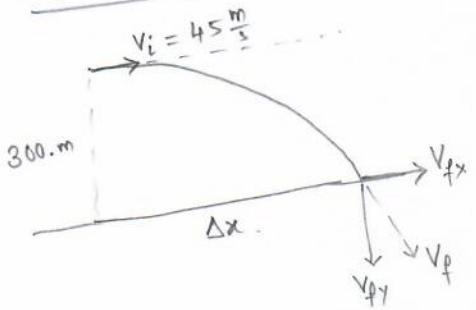
$$\vec{A} + \vec{B} = 0\, \hat{i} - 5.0\, \hat{j}$$



magnitude : 5.0m

direction : South.

Problem 7



$\Delta t =$

$\Delta x =$

$v_{ix} = 45 \frac{m}{s}$

$\Delta t =$

$\Delta y = -300.m$

$v_{iy} = 0$

$v_{fy} =$

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

$$v_{fy}^2 = v_{iy}^2 + 2 a_y \Delta y$$
$$v_{fy} = \sqrt{0 + 2(-9.8)(-300.)}$$
$$= 77 \frac{m}{s}$$

$$v_f = \sqrt{v_{fx}^2 + v_{fy}^2}$$
$$= \sqrt{45^2 + 77^2}$$
$$= 89 \frac{m}{s}$$