Solutions

PHYS-205A (Midterm Exam 01) Spring 2026

Problem 1

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

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

$$[p] = [m][c] = M L T^{-1}$$

$\alpha = 1$

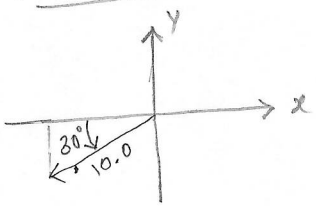
$\beta = 1$

$\gamma = -1$

Problem 2

No, acceleration is not zero at $t = 3.0$ hours. Acceleration is the change in velocity in time. Velocity is continuously changing in the plot.

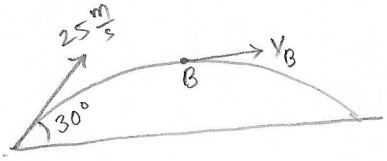
Problem 3



$$\vec{A} = -\hat{i}\, 10.0 \cos 30^\circ - \hat{j}\, 10.0 \sin 30^\circ$$

$$= -\hat{i}\, 8.66\ \text{m} - \hat{j}\, 5.00\ \text{m}$$

Problem 4

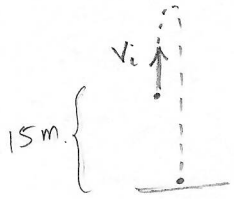


$$v_B = 25 \cos 30^\circ$$

$$= 22\ \frac{m}{s}$$

direction is horizontal to right.

Problem 5



$\Delta t =$

$\Delta x = -15\,m$

$V_i = +6.0\,\frac{m}{s}$

$V_f =$

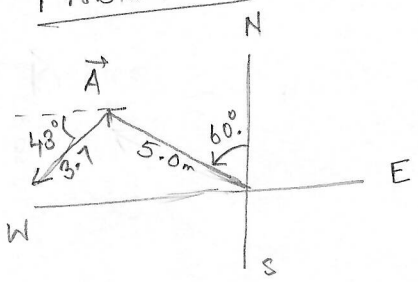
$a = -9.8\,\frac{m}{s^2}$

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

$$V_f = \sqrt{6.0^2 + 2(-9.8)(-15)}$$

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

Problem 6



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

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

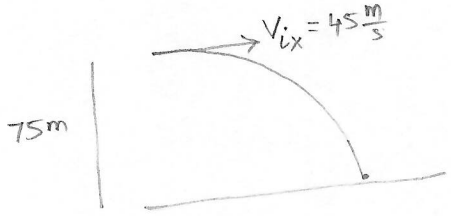
$$\vec{B} = -\hat{i}\,3.7\cos 43 - \hat{j}\,3.7\sin 43$$

$$= -\hat{i}\,2.7 - \hat{j}\,2.5$$

$$\vec{A} + \vec{B} = -\hat{i}\,7.0\,m + \hat{j}\,0.$$

magnitude: 7.0m direction: West.

Problem 7



$\Delta t =$

$\Delta x =$

$V_{ix} = 45\,\frac{m}{s}$

$\Delta t =$

$\Delta y = -75\,m$

$V_{iy} = 0$

$V_{fy} =$

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

$$V_{fy}^2 = V_{iy}^2 + 2a\Delta y$$

$$= 0^2 + 2(-9.8)(-75)$$

$$V_{fy} = 38\,\frac{m}{s}$$

speed = magnitude of velocity

$$V_f = \sqrt{V_{fx}^2 + V_{fy}^2}$$

$$= \sqrt{45^2 + 38^2}$$

$$= 59\,\frac{m}{s}$$