

# Solutions

PHYS-205A

(Midterm Exam 01)

Spring 2025

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## Problem 1

$$[A] = [B] = [ct]$$

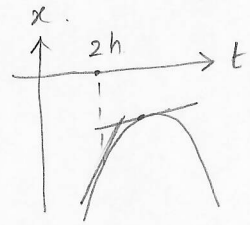
$$\Rightarrow [B] = [c][t]$$

$$\Rightarrow [c] = \frac{[B]}{[t]} = \frac{L}{T} = M^0 L^1 T^{-1}$$

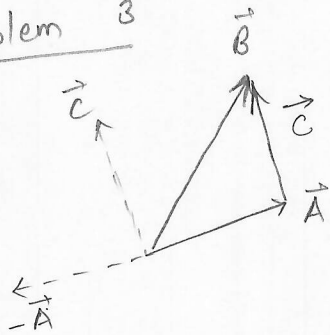
## Problem 2

Slope = speed

Since the slope is decreasing as a function of time at 2.0 hours, we conclude that the object is slowing at 2.0 hours.



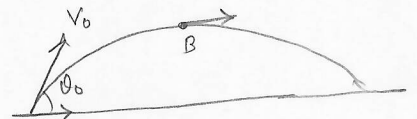
## Problem 3



## Problem 4

The horizontal velocity of the projectile does not change. Thus,

$$\begin{aligned} \vec{v}_B &= \hat{i} v_0 \cos \theta_0 \\ &= \hat{i} (32) \cos 40 \\ &= \hat{i} 25 \frac{m}{s} \end{aligned}$$

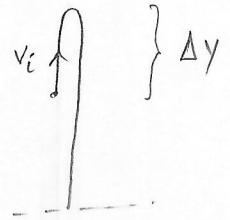


magnitude:  $25 \frac{m}{s}$   
direction:  $+\hat{i}$

Problem 5

$$\Delta y = ? \quad v_i = +15 \frac{m}{s} \quad a = -9.8 \frac{m}{s^2}$$

$$\Delta t = \quad v_f = 0$$



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

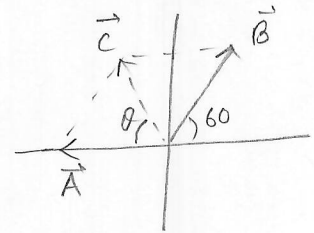
$$2(-9.8)\Delta y = 0^2 - 15^2 \Rightarrow \Delta y = 12 \text{ m}$$

Problem 6

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

$$\vec{B} = +5.0 \cos 60 \hat{i} + 5.0 \sin 60 \hat{j}$$

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



$$|\vec{C}| = \sqrt{(2.5)^2 + (4.3)^2} = 5.0 \text{ m} \rightarrow \text{magnitude}$$

$$\text{direction: } \theta = \tan^{-1}\left(\frac{4.3}{2.5}\right) = 60^\circ \text{ cw to } -\hat{i}$$

Problem 7

$$\Delta x = ? \quad \Delta y = -0.25 \text{ m}$$

$$\Delta t = \boxed{0.23 \text{ s}} \quad \Delta t = \boxed{0.23 \text{ s}}$$

$$v_{ix} = 600 \frac{m}{s} \quad v_{iy} = 0$$

$$v_{fy} = \quad \Delta x \quad \Delta y$$

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

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

$$-0.25 = 0 + \frac{1}{2}(-9.8) \Delta t^2$$

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

$$= (600)(0.23)$$

$$= 140 \text{ m}$$

$$\Delta t = \sqrt{\frac{(-0.25) \cdot 2}{(-9.8)}}$$

$$= 0.23 \text{ s}$$