

# Solutions

## Problem 1

$$[x] = [3 A t^2] = [5 B t^4]$$

$$[A] = \frac{[x]}{[3][t]^2} = L T^{-2}$$

$$[B] = \frac{[x]}{[5][t]^4} = L T^{-4}$$

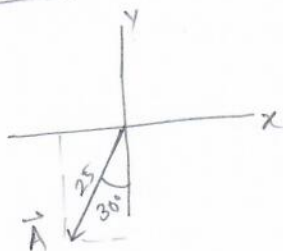
$$\left[\frac{A}{B}\right] = \frac{L T^{-2}}{L T^{-4}} = T^2$$

## Problem 2

Speeding up.

(Magnitude of slope is increasing.)

## Problem 3



$$\begin{aligned}\vec{A} &= -\hat{i} 25 \sin 30 - \hat{j} 25 \cos 30 \\ &= -\hat{i} 13\text{m} - \hat{j} 22\text{m}\end{aligned}$$

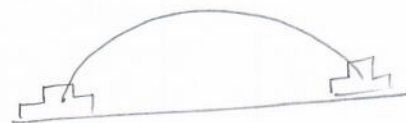
$$A_x = -13\text{m}$$

$$A_y = -22\text{m}$$

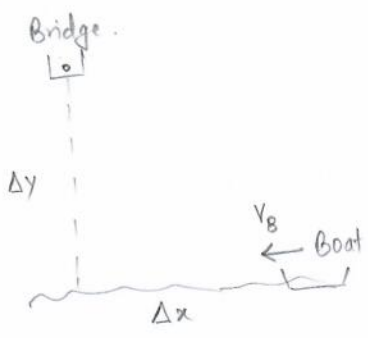
## Problem 4

It returns to his hands.

The ball has the same horizontal velocity as that of the car.



Problem 5



Boat

$\Delta t =$   
 $\Delta x = 15\text{m}$   
 $v_B = ?$

Key

$\Delta t =$   
 $\Delta y = -49\text{m}$   
 $v_{iy} = 0$   
 $v_{fy} =$   
 $a = -9.8 \frac{\text{m}}{\text{s}^2}$

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

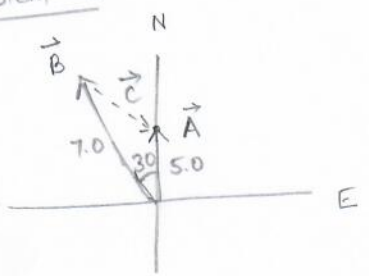
$$-49 = 0 + \frac{1}{2} (-9.8) \Delta t^2$$

$$\Delta t = 3.2\text{s}$$

$$v_B = \frac{\Delta x}{\Delta t}$$

$$= \frac{15}{3.2} = 4.7 \frac{\text{m}}{\text{s}}$$

Problem 6



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

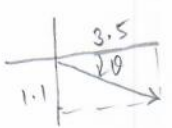
$$\vec{B} = -\hat{i} 7.0 \sin 30 + \hat{j} 7.0 \cos 30$$

$$= -\hat{i} 3.5 \text{ km} + \hat{j} 6.1 \text{ km}$$

$$\vec{B} + \vec{C} = \vec{A}$$

$$|\vec{C}| = \sqrt{3.5^2 + 1.1^2} = 3.7 \text{ km}$$

$$\theta = \tan^{-1}\left(\frac{1.1}{3.5}\right) = 18^\circ \text{ South of East}$$



$$\vec{C} = \vec{A} - \vec{B}$$

$$= +\hat{i} 3.5 \text{ km} - \hat{j} 1.1 \text{ km}$$

Problem 7

$\Delta t = 0.18\text{s}$   
 $\Delta x = ?$   
 $v_{ix} = 550 \frac{\text{m}}{\text{s}}$

$\Delta t = 0.18\text{s}$   
 $\Delta y = -0.15\text{m}$   
 $v_{iy} = 0$   
 $v_{fy} =$   
 $a = -9.8 \frac{\text{m}}{\text{s}^2}$



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

$$-0.15 = 0 + \frac{1}{2} (-9.8) \Delta t^2$$

$$\Delta t = 0.18\text{s}$$

$$\Delta x = v_{ix} \Delta t = (550)(0.18)$$

$$= 99\text{m}$$