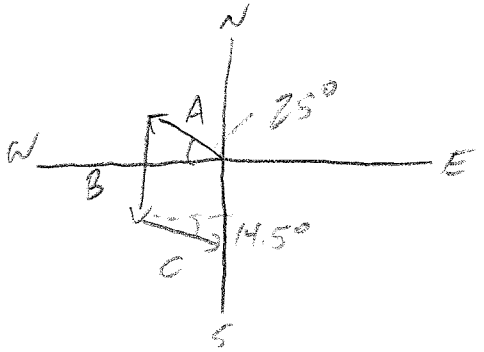
Physics 10154 - Quiz #3A

Please clearly indicate (with a box) your answers to the following problems. SHOW ALL WORK. If I cannot see how you arrived at an answer to a problem, you will lose points.

1. (40 pts) An airplane travels 245 miles in a direction 25.0° North of West, then 187 miles due South, then 143 miles in a direction 14.5° South of East. What is the magnitude and direction of the resultant displacement?



$A_x = -245 \cos 25° = -222.0$

$A_y = 245 \sin 25° = 103.5$

$B_x = 0$

$B_y = -187$

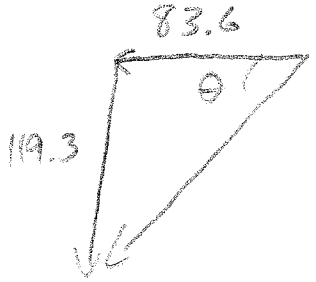
$C_x = 143 \cos 14.5° = 138.4$

$C_y = -143 \sin 14.5° = -35.8$

$R_x = -222 + 0 + 138.4 = -83.6$

$R_y = 103.5 - 187 - 35.8 = -119.3$

$|R| = \sqrt{(-83.6)^2 + (-119.3)^2} = 146 \text{ mi}$



$\theta = \tan^{-1}\left(\frac{119.3}{83.6}\right) = 55.0° \text{ S of W}$

2. (60 pts) A baseball is struck with an initial speed of 47 meters/sec at an angle of 15° above the horizontal from an elevation of 0.50 meters off the ground. The ball barely clears the 4.5 meter tall fence in left field.

a) How far away (in feet) is the left field wall from the batter?

b) What is the magnitude and direction of the ball's velocity at the instant it clears the wall?

$\Delta y = 4.0$ m, not 4.5m

X	Y
$\Delta x =$	$\Delta y = 4.0$
$V_{0x} = 47\cos 15^\circ = 45.4$	$V_{0y} = 47\sin 15^\circ = 12.2$
$V_x = 45.4$	$V_y =$
$a_x = 0$	$a_y = -9.8$
$t =$	$t =$

$V_y^2 = V_{0y}^2 + 2a_y\Delta y$

$V_y^2 = (12.2)^2 - 19.6(4)$

$= -8.39$ m/s

Use y information to find t & V_y

$\Delta y = V_{0y}t + \frac{1}{2}a_y t^2 \Rightarrow 4.0 = 12.2t - 4.9t^2$

$4.9t^2 - 12.2t + 4.0 = 0$

$t = \frac{12.2 \pm \sqrt{(-12.2)^2 - 4(4.9)(4.0)}}{9.8} = 1.24 \pm .86$

$= 2.10$ s

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a) $\Delta x = V_{0x}t = (45.4)(2.10) = 95.34$ m

$= \boxed{310 \text{ ft}}$

b) $|v| = \sqrt{(45.4)^2 + (-8.39)^2} = \boxed{46 \text{ m/s}}$

$\theta = \tan^{-1}\left(\frac{8.39}{45.4}\right) = \boxed{10^\circ \text{ below } +x}$