# Physics 10154 - Exam #1

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. (35 pts) A car starts from rest and accelerates uniformly to a final velocity of 13 m/s in 5.5 seconds, then the driver realizes that the road will abruptly end in a cliff. The driver hits the brakes and decelerates at a rate of -8.5 m/s². If the end of the road is 52 meters from the starting point, can the driver stop before the end of the road?

Part 1

$\Delta x = ?$
$v_0 = 0$
$v = 13$
$a = ?$
$t = 5.5$

$\Delta x = \frac{1}{2}(v + v_0)t = 35.75$

Part 1 : 35.75 → ← 16.25m left

← 52 m →

Part 2

$\Delta x = ?$
$v_0 = 13$
$v = 0$
$a = -8.5\ m/s^2$
$t = ?$

Find $\Delta x$, compare to 16.25m
$(52 - 35.75 = 16.25)$

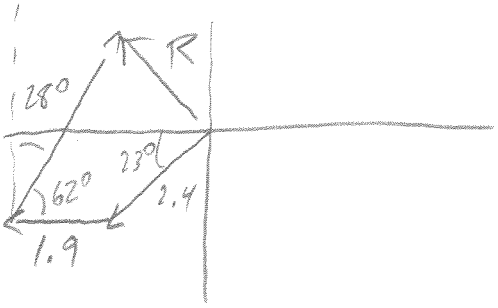
$v^2 = v_0^2 + 2a\Delta x$

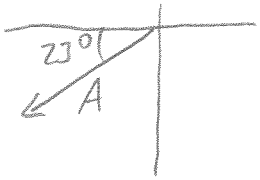
$0 = 13^2 + 2(-8.5)\Delta x$

$\Delta x = \frac{-13^2}{2(-8.5)} = 9.94\ m$

Yes, stops in time (6.31 m to spare)

2. (30 pts) A hiker walks 2.4 miles in a direction 23° South of West, then 1.9 miles West, then 3.4 miles in a direction 28° East of North. What is the magnitude and direction of the total displacement for this hike?



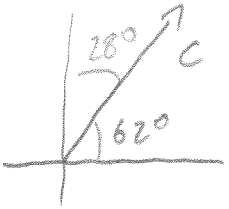




$A_x = -2.4 \cos 23^\circ = -2.209$

$A_y = -2.4 \sin 23^\circ = -0.938$


$B_x = -1.9$

$B_y = 0$

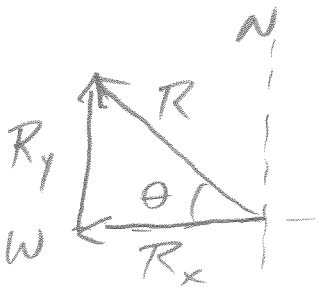



$C_x = 3.4 \cos 62^\circ = 1.596$

$C_y = 3.4 \sin 62^\circ = 3.002$

$R_x = -2.209 - 1.9 + 1.596 = -2.513$

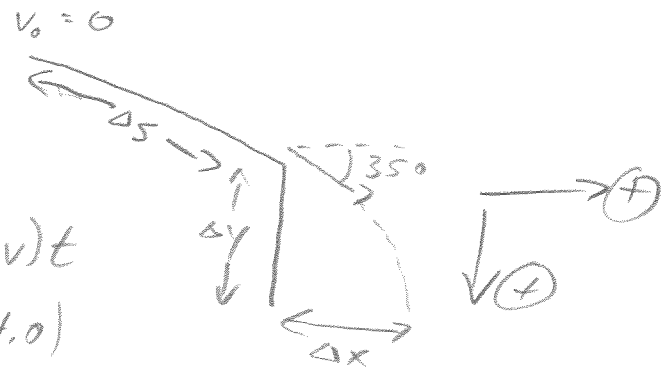
$R_y = -0.938 + 0 + 3.002 = 2.064$




$|\vec{R}| = \sqrt{R_x^2 + R_y^2} =$ 3.3 miles

$\theta = \tan^{-1}\left(\frac{|R_y|}{|R_x|}\right) =$ 39° N of W

3. (35 pts) A puck starts from rest and slides down a 2.1-meter ramp at an angle 35° below the horizontal in 4.0 seconds. Upon leaving the ramp, the puck is in the air for 1.5 seconds before hitting the ground. What is the magnitude and direction of the puck's velocity the instant before it hits the ground?




## Part 1

$\Delta s = 2.1\ m$
$v_0 = 0$
$v = ?$
$a = ?$
$t = 4.0\ s$

$\Delta s = \frac{1}{2}(v_0 + v)t$

$2.1 = \frac{1}{2}(v)(4.0)$

$v = 1.05\ s$

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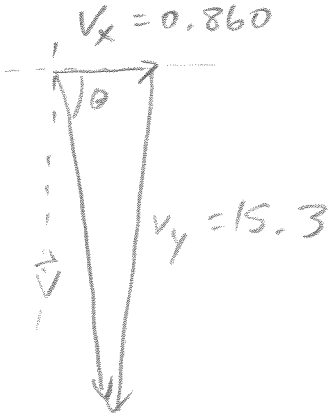
## Part 2 (free fall)

| x | y |
|---|---|
| $\Delta x =$ | $\Delta y = ?$ |
| $v_{0x} = 1.05\cos 35°$ | $v_{0y} = 1.05\sin 35°$ |
| $= 0.860$ | $= 0.602$ |
| $v_x = 0.860$ | $v_y = ?$ |
| $a_x = 0$ | $a_y = 9.8$ |
| $t = 1.5\ s$ | $t = 1.5\ s$ |

$v_y = v_{oy} + a_y t = 0.602 + (9.8)(1.5) = 15.3\ m/s$




$v = \sqrt{v_x^2 + v_y^2} = \boxed{15\ m/s}$

$\theta = \tan^{-1}\left(\frac{15.3}{.860}\right) = \boxed{87° \text{ below } +x}$