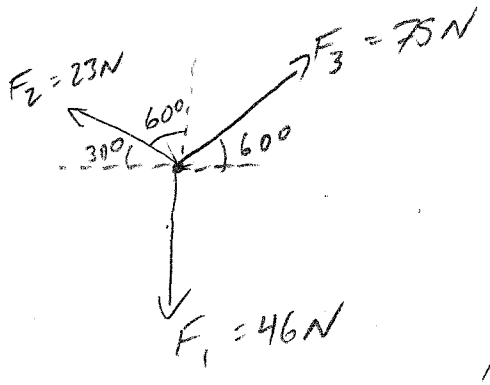
Physics 10154 - Exam #3A

Each problem is worth 50 points. 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. Three forces are acting on a block. Force #1 is 46 Newtons directed vertically downward. Force #2 is 23 Newtons directed 60.0° to the left of the +y direction. Force #3 is 75 Newtons directed 60.0° above the +x direction.

What is the magnitude and direction of the net force on the block?



$F_{1x} = 0$

$F_{1y} = -46$

$F_{2x} = -23\cos 30^\circ = -19.9$

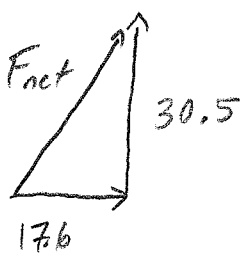
$F_{2y} = 23 \sin 30^\circ = 11.5$

$F_{3x} = 75 \cos 60^\circ = 37.5$

$F_{3y} = 75 \sin 60 = 65.0$

$F_{net,x} = 0 - 19.9 + 37.5 = 17.6\ N$

$F_{net,y} = -46 + 11.5 + 65 = 30.5\ N$



$|\vec{F}_{net}| = \sqrt{17.6^2 + 30.5^2}$

$= \boxed{35\ N}$

$\theta = \tan^{-1}\left(\frac{30.5}{17.6}\right) = \boxed{60^\circ \text{ above } +x}$

2. A puck slides from rest with an acceleration of 5.6 meters/sec^2 for 3.5 meters down a frictionless ramp angled 35° below the horizontal. From the end of the ramp, it is in free-fall until it strikes the ground. The measured travel time from the end of the ramp to the ground is 1.2 seconds. How high is the bottom of the ramp off the ground?

1st part

$\Delta s = 3.5\ m$

$v_0 = 0$

$v =$

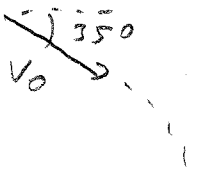
$a = 5.6\ m/s^2$

$t =$

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

$v^2 = 0 + 2(5.6)(3.5)$

$v = 6.26\ m/s$



Δx

$\Delta x = ?$

$v_{0x} = 6.26 \cos 35$
5.13

$v_x = 5.13$

$a_x = 0$

$t = 1.2$

Δy

$\Delta y = ?$

$v_{0y} = -6.26 \sin 35$
-3.59

$v_y = ?$

$a_y = -9.8$

$t = 1.2$

$$\Delta y = v_{0y} t + \frac{1}{2} a_y t^2$$

$$= (-3.59)(1.2) - 4.9(1.2)^2$$

$$= \boxed{11\ m}$$