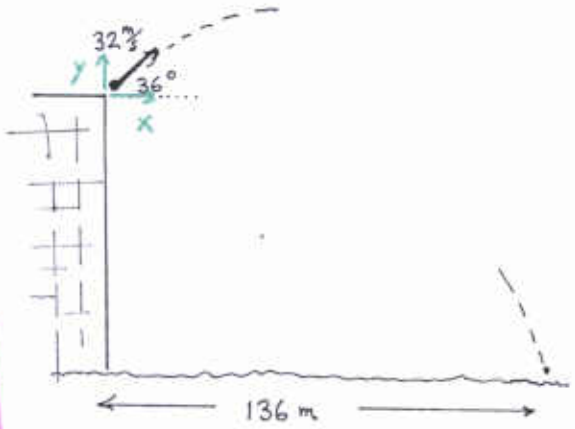
Name_____

Phys 121, Section 2
Quiz #2



1. A projectile is fired from the top of a building with an initial speed of 32.0 $\frac{m}{s}$, at an angle of 36.0° up from the horizontal. It lands 136.0 m from the base of the building.

a) Find the components of the initial velocity vector.

with $v_0 = 32.0\ \frac{m}{s}$ and $\theta = 36.0°$,

$v_{0x} = v_0 \cos\theta = (32.0\ \frac{m}{s}) \cos 36° = \boxed{25.9\ \frac{m}{s}}$

$v_{0y} = v_0 \sin\theta = (32.0\ \frac{m}{s}) \sin 36° = \boxed{18.8\ \frac{m}{s}}$

b) Find the time that the projectile was in flight.

Projectile hits dirt when $x = 136$ m. At what t is $x = 136$ m?

$x = v_{0x} t = (25.9\ \frac{m}{s})\, t = 136\ m$

$t = \frac{136\ m}{(25.9\ \frac{m}{s})} = \boxed{5.25\ s}$

Hint: What mathematical condition do we know for the time of impact?

c) Find the height of the building.

What is y at the time of impact?

$y = v_{0y} t + \frac{1}{2} a_y t^2 = (18.8\ \frac{m}{s})(5.25\ s) + \frac{1}{2}(-9.8\ \frac{m}{s^2})(5.25\ s)^2$

$= \boxed{-36.5\ m}$

d) How long did it take the projectile to reach maximum height?

At max. height, $v_y = 0$. At what t does $v_y = 0$?

$v_y = v_{0y} + a_y t = (18.8\ \frac{m}{s}) + (-9.8\ \frac{m}{s^2})\, t = 0$

$t = \frac{18.8\ \frac{m}{s}}{9.8\ \frac{m}{s^2}} = \boxed{1.92\ s}$

e) Find the components of the projectile's velocity at the time of impact.

At $t = 5.25\,s$,

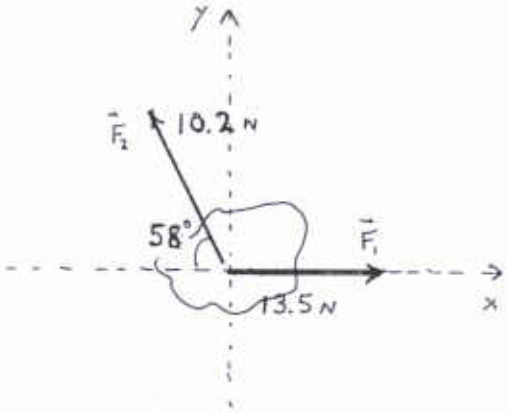
$v_x = v_{0x} + 0 = \boxed{25.9\ \frac{m}{s}}$

$v_y = v_{0y} + a_y t = (18.8\ \frac{m}{s}) + (-9.8\ \frac{m}{s^2})(5.25\,s)$

$= \boxed{-32.7\ \frac{m}{s}}$

2. Two forces act on a mass as shown. (Force $\mathbf{F}_1$ points along the $+x$ axis; the magnitudes are $F_1 = 13.5$ N and $F_2 = 10.2$ N.)

Find the magnitude and direction of the net force. That is, add up the force vectors.



Using the picture & a little trig,

$F_{net,x} = -(10.2\,N)\cos 58° + 13.5\,N = 8.09\,N$

$F_{net,y} = +(10.2\,N)\sin 58° = 8.65\,N$

Magnitude:

$F_{net} = \sqrt{(8.09\,N)^2 + (8.65\,N)^2} = \boxed{11.8\,N}$

Direction:

$\theta = \tan^{-1}\left(\frac{8.65}{8.09}\right) = \boxed{46.9°}$ [c-c-wise from +x axis]

You must show all your work!

$$g = 9.80\ \tfrac{\text{m}}{\text{s}^2} \quad A_x = A\cos\theta \quad A_y = A\sin\theta \quad A = \sqrt{A_x^2 + A_y^2} \quad \theta = \tan^{-1}\frac{A_y}{A_x}$$

$$v_x = v_{0x} + a_x t \qquad v_y = v_{0y} + a_y t \qquad x = v_{0x}t + \tfrac{1}{2}a_x t^2 \qquad y = v_{0y}t + \tfrac{1}{2}a_y t^2$$

$$v_x^2 = v_{0x}^2 + 2a_x x \qquad v_y^2 = v_{0y}^2 + 2a_y y$$

$$\mathbf{F}_{\text{net}} = m\mathbf{a} \implies F_{\text{net, x}} = ma_x \quad F_{\text{net, y}} = ma_y$$