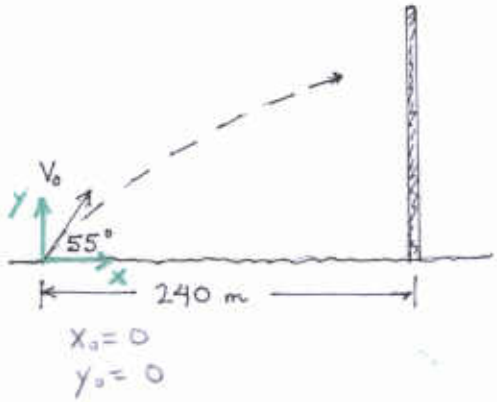
Name_____

Phys 2110, Section 5
Quiz #2 — Fall 2001

1. A projectile is fired from ground level toward a vertical wall. It is launched at an angle of 55.0° above the horizontal at a horizontal distance of 240 m from the wall. The projectile strikes the wall 6.70 s after being fired.



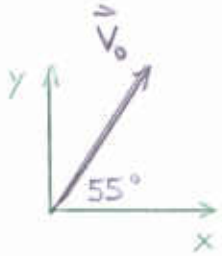
a) Find the x–component of the projectile's initial velocity.

Since $a_x = 0$ we have:

$x = x_0 + v_{0x}t \rightarrow (240\,m) = v_{0x}(6.70\,s)$

$\rightarrow v_{0x} = \frac{240\,m}{6.70\,s} = \boxed{35.8\ m/s}$

b) Find the magnitude of the projectile's initial velocity, i.e. the initial speed. (Hint: Use the given *direction* of the initial velocity.)



Since $v_{0x} = v_0(\cos 55°)$, then

$v_0 = \frac{v_{0x}}{\cos 55°} = \frac{35.8\ m/s}{\cos 55°} = \boxed{62.5\ m/s}$

c) Find the y–component of the initial velocity.

$v_{0y} = v_0 \sin 55° = (62.5\ m/s)\sin 55° = \boxed{51.2\ m/s}$

d) Find the height at which the projectile strikes the wall.

At $t = 6.70$ s, what is the value of y? With $a_y = -9.80\ m/s^2$,

$y = v_{0y}t + \frac{1}{2}a_y t^2 = (51.2\ m/s)(6.70\,s) + \frac{1}{2}(-9.80\ m/s^2)(6.70\,s)^2 = \boxed{123\ m}$

e) When the projectile hit the wall, was it increasing or decreasing in height?

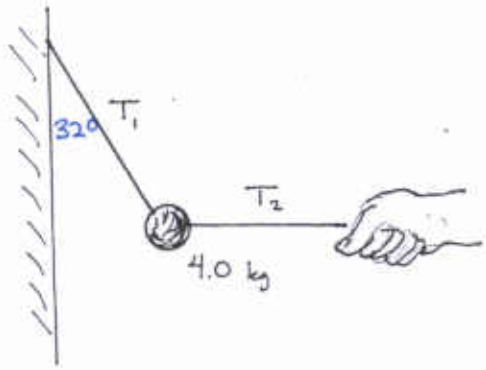
At the time of impact, what is v_y? We have:

$v_y = v_{0y} + a_y t = (51.2\ m/s) + (-9.8\ m/s^2)(6.70\,s)$

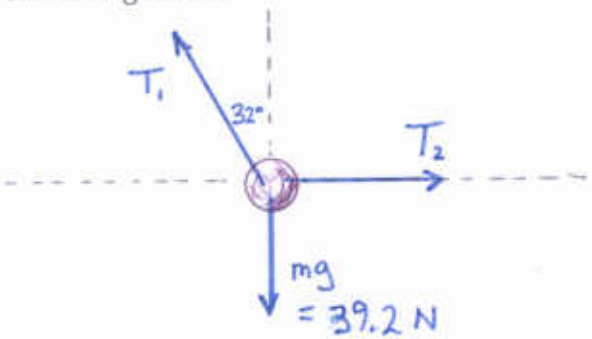
$= \boxed{-14.5\ m/s}$

The projectile was decreasing in height (v_y is negative).

2. A 4.0 kg mass is supported by two cables, as shown in this picture. One of the cables makes an angle of 32.0° with the vertical and the other is horizontal.



a) Draw a Free–Body Diagram (*DDP!*) for the mass showing all the forces acting on it.



$W = mg$
$= (4.0\ kg)(9.80\ m/s^2)$
$= 39.2\ N$

b) Find the tensions in the two cables.

Mass is not accelerating at all ($a_x = 0$, $a_y = 0$) so N's 2nd Law of motion gives:

$$x: \quad \Sigma F_x = -T_1 \sin 32° + T_2 = 0 \qquad (1)$$

$$y: \quad \Sigma F_y = T_1 \cos 32° - 39.2\ N = 0 \qquad (2)$$

From (2),

$$T_1 = \frac{39.2\ N}{\cos 32°} = \boxed{46.2\ N}$$

From (1),

$$T_2 = T_1 \sin 32° = (46.2\ N) \sin 32° = \boxed{24.5\ N}$$

You must show all your work and include the right units with your answers!

$A_x = A\cos\theta \qquad A_y = A\sin\theta \qquad A = \sqrt{A_x^2 + A_y^2} \qquad \tan\theta = \left(\frac{A_y}{A_x}\right) \qquad g = 9.8\ \frac{m}{s^2}$

For free-fall problems ignore air resistance.

$v = v_0 + at \qquad x = x_0 + v_0 t + \frac{1}{2}at^2 \qquad v^2 = v_0^2 + 2a(x - x_0) \qquad x = x_0 + \frac{1}{2}(v_0 + v)t$

$a_c = \frac{v^2}{r} \qquad \mathbf{F}_{\text{net}} = m\mathbf{a} \qquad W = mg$