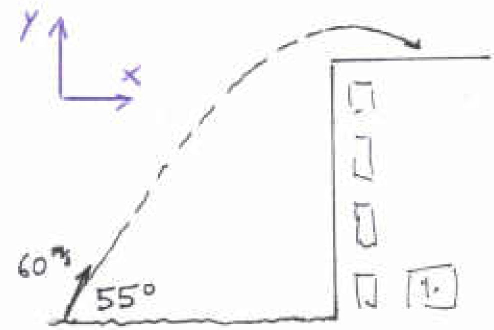
Name________________________

Phys 2010, Section 3
Quiz #2 — Fall 2003

1. A projectile is fired from ground level with a speed of $60.0\frac{\text{m}}{\text{s}}$ at and angle of $55.0°$ above ground level. It lands on the roof of a building 5.50 s later.



a) What are the x and y components of the initial velocity vector?

$V_{0x} = 60\frac{m}{s} \cos 55° = \boxed{34.4\frac{m}{s}}$

$V_{0y} = 60\frac{m}{s} \sin 55° = \boxed{49.1\frac{m}{s}}$

b) How high is the building?

What is y at $t = 5.50\,s$? With $a_y = -g$, get:

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

$= (49.1\frac{m}{s})(5.50\,s) + \frac{1}{2}(-9.8\frac{m}{s^2})(5.50\,s)^2$

$= \boxed{122\ m}$ (This is the height of the bldg)

c) When the projectile lands on the building, through what horizontal distance has it travelled?

What is x at $t = 5.50\,s$? With $a_x = 0$, get:

$x = V_{0x}t + \frac{1}{2}a_x t^2$

$= (34.4\frac{m}{s})(5.50\,s) = \boxed{189\ m}$

d) When the projectile lands on the building, what is the y component of its velocity?

Find V_y at $t = 5.50\,s$

$V_y = V_{0y} + a_y t$

$= (49.1\frac{m}{s}) + (-9.80\frac{m}{s^2})(5.50\,s)$

$= \boxed{-4.75\frac{m}{s}}$

e) When the projectile lands on the building, what is its speed?

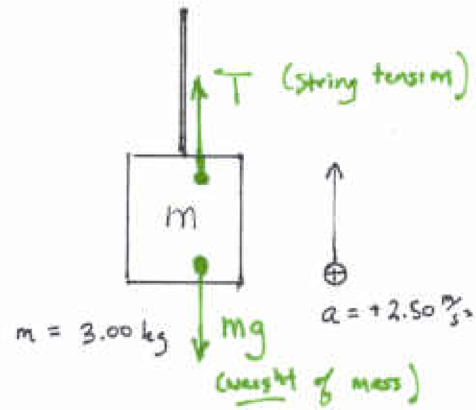
Also $V_x = V_{ox} = 34.4 \frac{m}{s}$ when it lands on bldg. Then:

$$V = \sqrt{V_x^2 + V_y^2} = \sqrt{(34.4 \frac{m}{s})^2 + (4.75 \frac{m}{s})^2} = \boxed{34.7 \frac{m}{s}}$$

2. A string pulls a 3.00 kg mass upward so that its (upward) acceleration is $2.50 \frac{\mathrm{m}}{\mathrm{s}^2}$.

a) On the picture, indicate the (two) forces acting on the block. (draw & label!)

Forces are as shown.



b) Find the tension in the string.

$\vec{F}_{net} = m\vec{a}$, so:

$$T - mg = ma_y$$

$$\rightarrow T = mg + ma_y = m(g + a_y)$$

$$= (3.00\,\mathrm{kg})(9.80 \tfrac{m}{s^2} + 2.50 \tfrac{m}{s^2}) = \boxed{36.9\ N}$$

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

1 in = 2.54 cm   1 m = 3.281 ft   1 mi = 5280 ft   1 yd = 36 in $g_{\text{Earth}} = 9.80 \frac{\mathrm{m}}{\mathrm{s}^2}$

$A_x = A\cos\theta$ $A_y = A\sin\theta$ $A = \sqrt{A_x^2 + A_y^2}$ $\tan\theta = A_y / A_x$

$$v_x = v_{0x} + a_x t \qquad x = v_{0x}t + \tfrac{1}{2}a_x t^2 \qquad v_x^2 = v_{0x}^2 + 2a_x x \qquad x = \tfrac{1}{2}(v_{0x} + v_x)t$$

$$v_y = v_{0y} + a_y t \qquad y = v_{0y}t + \tfrac{1}{2}a_y t^2 \qquad v_y^2 = v_{0y}^2 + 2a_y y \qquad y = \tfrac{1}{2}(v_{0y} + v_y)t$$

$$\mathbf{F}_{\text{net}} = m\mathbf{a} \qquad 1\ \text{lb} = 4.448\ \text{N}$$