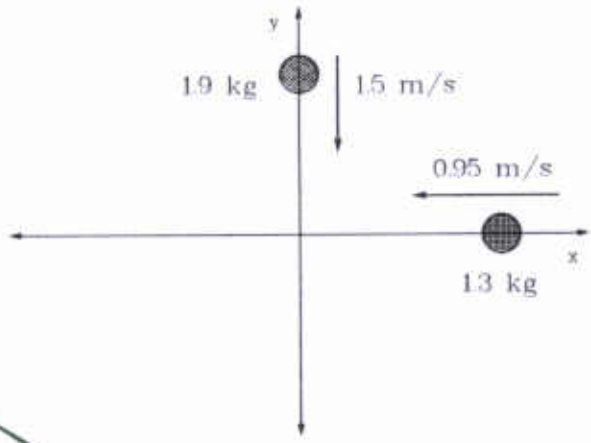
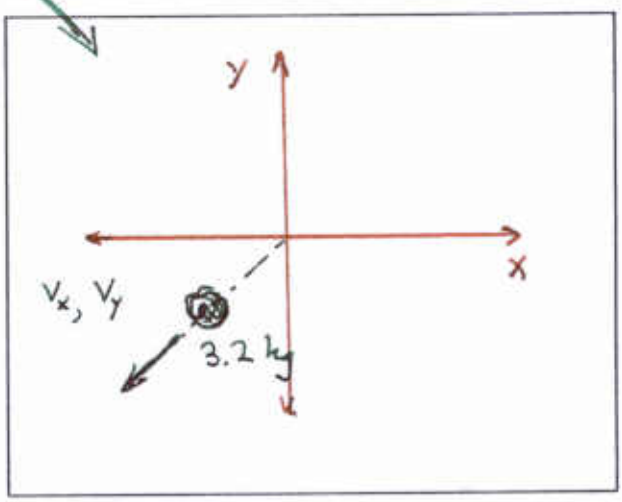
Name _____

Physics 121, Section 1 .....Quiz #4

1. In a two-dimensional collision, a 1.3 kg mass moving in the $-x$ direction with a speed of $0.95 \frac{m}{s}$ collides with a 1.9 kg mass moving in the $-y$ direction with a speed of $1.5 \frac{m}{s}$. When the masses collide, they stick together (and move off with the same velocity)!



a) In the space provided, draw a picture illustrating what happens after this collision.



b) Find the velocity components v_x and v_y of the the final mass.

Conservation of momentum:

x: $(1.3\ kg)(-0.95\ m/s) = (3.2\ kg)\, V_x$

$\rightarrow$ $\boxed{V_x = -0.386\ m/s}$

y: $(1.9\ kg)(-1.5\ m/s) = (3.2\ kg)\, V_y$

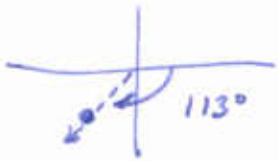
$\rightarrow$ $\boxed{V_y = -0.891\ m/s}$

c) Find the speed and direction of motion of the final mass. (Be very clear as to what you mean by the given direction.)

Speed:

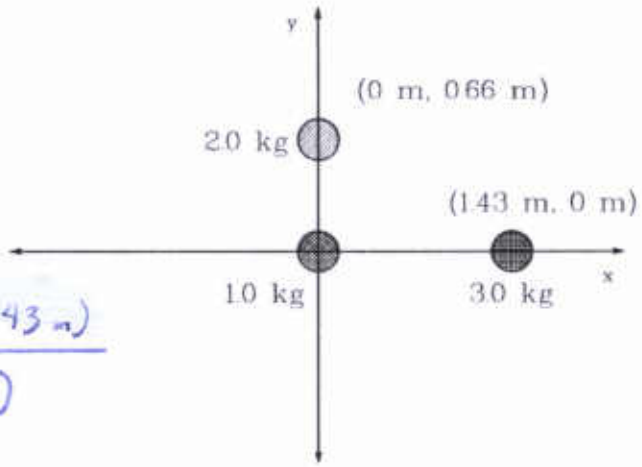
$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(-.386\ m/s)^2 + (-.891\ m/s)^2} = \boxed{0.97\ m/s}$

$\theta = \tan^{-1}\left(\frac{-0.891}{-0.386}\right) = \boxed{-113^\circ}$



2. Three spheres of various masses are located in the $x-y$ plane. Their masses and the locations of their centers are as given in this figure. (The 1.0 kg mass is at the origin.)

Find the x and y coordinates of the center of mass of this system.



$$x_{cm} = \frac{(1.0\text{ kg})(0) + (2.0\text{ kg})(0) + (3.0\text{ kg})(1.43\text{ m})}{(1.0\text{ kg} + 2.0\text{ kg} + 3.0\text{ kg})}$$

$$= \boxed{0.715\text{ m}}$$

$$y_{cm} = \frac{(1.0\text{ kg})(0) + (2.0\text{ kg})(0.66\text{ m}) + (3.0\text{ kg})(0)}{(1.0\text{ kg} + 2.0\text{ kg} + 3.0\text{ kg})}$$

$$= \boxed{0.220\text{ m}}$$

3. Express 28° in radians.

$$28^\circ = (28\text{ deg})\left(\frac{\pi\text{ rad}}{180\text{ deg}}\right) = \boxed{0.489\text{ rad}}$$

$\text{KE} = \frac{1}{2}mv^2$

$\mathbf{p} = m\mathbf{v}$ In collisions, total momentum is conserved.

$x_{\text{CM}} = \dfrac{m_1x_1 + m_2x_2 + \cdots}{m_1 + m_2 + \cdots}$ $\quad y_{\text{CM}} = \dfrac{m_1y_1 + m_2y_2 + \cdots}{m_1 + m_2 + \cdots}$

$\pi\text{ rad} = 180^\circ$ $\quad \ell = \theta r$

REMEMBER TO SHOW YOUR WORK!