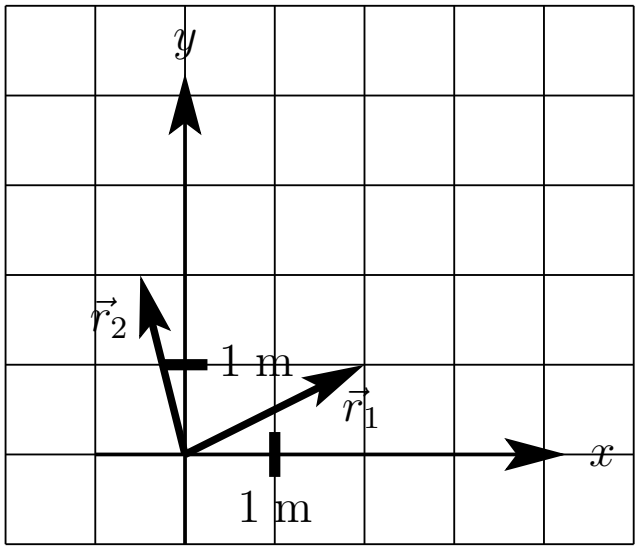
Name: ..... Section:.....

Physics 208 Quiz 1

January 16, 2008 (due: January 23, 2008)

Problem 1 (30 points)



(a) In the figure above, add the vectors $\vec{r}_1$ and $\vec{r}_2$ geometrically.

(b) What are the components of these vectors, (x_1, y_1) and (x_2, y_2), and the sum $\vec{r}_1 + \vec{r}_2$.

(c) If at the end points of the vectors are particles with masses m_1 and m_2, what is the gravitational force, $\vec{F}_{12}$, exerted by particle 1 on particle 2? [You do not need to give numbers, just the expression in terms of $\vec{r}_1$ and $\vec{r}_2$, the masses etc.]

Problem 2 (70 points)

(a) A particle with mass, m, moves along the trajectory

$$\vec{r}(t) = R\cos(\omega t)\,\vec{i}_x + R\sin(\omega t)\,\vec{i}_y, \tag{1}$$

where $\vec{i}_x$ and $\vec{i}_y$ are unit vectors, perpendicular to each other (giving a Cartesian coordinate system); t is time and $\omega = \text{const}$ the angular velocity. Show that the particle moves along a circle with the center in the origin of the coordinate system. What is the radius of this circle? **Hint:** Calculate the distance of the particle from the origin to show that it is constant with time!

(b) Calculate the velocity, $\vec{v}(t)$, and the acceleration, $\vec{a}(t)$, of the particle. Determine the magnitude of these quantities.

(c) What is the force $\vec{F}(t)$ exerted on the particle?

(d) Can you express the force in terms of $\vec{r}$? What is its direction and magnitude?