SP211E 1111/33111 EXAM 1 1998 NAME: _____ PERIOD __

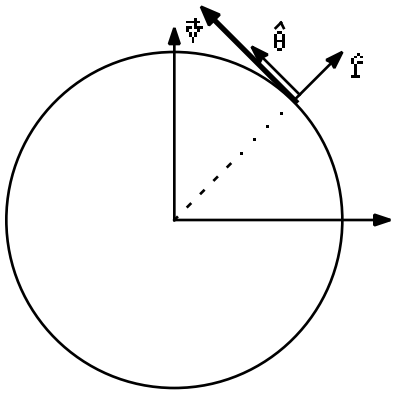
1. a. Name the two major attributes of a vector quantity
   State definitions for the following clearly and completely in prose form.
   b. displacement
   c. average velocity
   d. acceleration

2. a. Given the position as a function of time for a particle
   $\vec{r}(t) = (2\ m + 2\ m/s\ \ t)\ \hat{i}\ + 4\ m/s^2\ \ t^2\ \ \hat{j}$, find $\vec{v}(t)$, $\vec{a}(t)$.
   b. Find the average velocity of the particle during the interval $1\ s \le t \le\ 3\ s$?

3. A student throws a set of keys vertically upward to her sorority sister, who is in a window 8.0 m above. The keys are caught at the level of the window 2.00 s later by the sister's outstretched hand.
   (a.) What was the initial velocity of the keys ? (vector responses whenever appropriate !)
   (b.) What was the velocity of the keys just before they were caught ?

4. a.) The earth has a radius of 6.37×10^6 m and rotates on its axis once each 24 hours (86,400 s). Compute the centripetal acceleration of a point on the earth's surface at the equator.

   b.) A runner has a speed of 8 m/s as he runs around a circular track of radius 32 m, and he is slowing down at the rate of 0.5 m/s^2. Find his acceleration $\vec{a}$. Sketch $\vec{a}$ on the drawing.



5. A surgical tubing water cannon launches a water balloon at 53.13° above the horizontal from ground level at the roof of the 16 story tower dormitory. It's initial speed is 49 m/s.
   a.) Find the time at which the balloon is at its high point.
   b.) Find the maximum height that the balloon reaches.
   c.) Find the velocity of the balloon at the high point.
   d.) Given that the balloon is properly aimed, at what time will it crash down on the roof of the tower dormitory which is 58.8 m above the ground.

EXTRA CREDIT: Compute the velocity of the balloon just before it strikes the roof. If the balloon strikes the roof at a speed greater than 60 mph, it will break the

roofing tiles leading to a stern response from the school's administration. Does it break the tiles ? Explain how you estimate the conversion from $^{m}/_{s}$ to mph.