Physics 180

Problem Set # 3: Due: October 1st

"Imagination is more important than knowledge."
-Albert Einstein

(mks units throughout)

1) Chenxing is moving on a circle with constant angular acceleration. If he starts from angular position $\theta_i = \pi/8$ relative to a fixed axis and is located at $\theta = \pi/3$ and $\theta = \pi/2$ after 1 and 2 *s* respectively, what is his angular position and angular speed at 10 s?

2) Mark twirls a rock on a string so that it moves in a circle of radius 0.5 m at constant angular acceleration. The rock is initially at rest. The angle between the total (linear) acceleration and the (linear) velocity is $9\pi/20$ at $t = 1s$. How many revolutions has the rock made by $t = 4$ s and what is the angle between the linear velocity and total (linear) acceleration at that time? If the string breaks at that time and the rock moves with its (constant) release velocity, at t = 5 s how far is it from the point where Mark began to twirl the rock?

3) A river that is 50 m wide flows at 0.1 m/s. If Justin, swimming at constant speed takes 90 sec to swim across the river if he arrives on the directly opposite point on the shore, how long does it take him to cross the river if he swims with the same speed relative to the water as before, but in a path that takes him to a point 5 m upstream (opposite to direction of flow) on the opposite shore? What time does he take if he arrives 5 m downstream?

4) Carole is in the middle of a pack of bicycle racers strung out over 100 m and all moving at a constant speed of 9 m/s. She then makes a break for the front, moving at a new constant "burst" speed that allows her to move to the front of the pack. When she reaches the front she immediately tires and moving at half her burst speed finds herself at the back of the pack 50 s after she made her break. How long did it take her to reach the front, and what is her burst speed?

Practice problems:

Ch. 4: 26, 28,30,34,37,40