Math 217 Assignment 2

This assignment is due in class on Thurs. Sept. 20.

1. In the picture tube of an oscilloscope, a magnetic field is used to control the path of ions that transmit the image to the screen. If $q$ is the charge of a particle, $v$ is its velocity, and $B$ is the magnetic field, then the force exerted on the particle is $F = (qv) \times B$. Suppose that the velocity vector for the ions is $v = <c, -c, 0>$, where $c$ is a constant. The magnetic field will have the form $B = <a, 1, 1>$, where the value of $a$ will be varied to force the ions to go in different directions. If we want to exert a force on a negatively charged ion in the same direction as $<c, c, c>$, how should we select $a$?

2. Assume the position $r(t)$ of a particle is twice continuously differentiable. Show that it travels with constant speed if and only if its velocity and acceleration vectors are orthogonal at all times.

3. Consider the point $P$ where a wheel of radius $a$ initially meets the ground. Find the distance that $P$ travels during one revolution of the wheel. Justify your answer.

4. Sec. 11.8 #50, #30

5. Consider the curve parameterized by $r(t) = (e^t, \sqrt{2}t, e^{-t})$, $t \geq 0$. Find an arclength parametrization of the curve.

Additional Practice Problems (Not to hand in):
Sec. 11.4 # 54, 55
Sec. 11.5 # 14, 26, 49, 50
Sec. 11.6 #68(b)
Sec. 11.7 #30