Math 217 Assignment 3

Due Friday October 2

■ Problems from the text (do NOT turn in these problems):

- Section 14.3: 2–6, 13–16, 18–20, 24, 43–46.
- Section 14.4: 10–16, 19–38.

■ Problems to turn in:

1. Find the length of the curve of intersection of the cylinder $4x^2+y^2=4$ and the plane $x+y+z=2$. Express your answer as a definite integral, but do not evaluate it.
2. Find the curvature of $\mathbf{r}(t)=\langle e^t\cos t, e^t\sin t, t\rangle$ at the point $(1,0,0)$.
3. Reparametrize the curve $\mathbf{r}(t)=\langle e^t, e^t\sin t, e^t\cos t\rangle$ with respect to arc length measured from the point $(1,0,1)$ in the direction of increasing t.
4. Let C be the curve given by the equations
$$x=2-t^3,\quad y=2t-1,\quad z=\ln t.$$
Find
(a) the point where C intersects the (x,z)-plane.
(b) parametric equations of the tangent line at $(1,1,0)$.
(c) an equation of the normal plane to C at $(1,1,0)$.
5. A batter hits a baseball 3 ft above the ground toward the center field fence, which is 10 ft high and 400 ft from home plate. The ball leaves the bat at speed 115 ft/s at an angle 50° above the horizontal. Is it a home run? (In other words, does the ball clear the fence?)
6. The water speed along a straight portion of a river at a point x units from the west bank is being modelled by the equation
$$f(x)=3\sin\left(\frac{\pi x}{40}\right).$$
The two banks of the river are 40 meters apart. A boater would like to cross the river from a point A on the west bank to a point B on the east bank directly opposite A. If he wants to maintain a constant speed of 5 m/s and constant heading, determine the angle at which he should point the boat.
7. For a moving particle whose position vector with respect to time is given by $\mathbf{r}(t)=t\mathbf{i}+\cos^2 t\mathbf{j}+\sin^2 t\mathbf{k}$, find the tangential and normal components of acceleration.