Math 215
Homework Set 2: §§13.4–14.2
Fall 2009

Most of the following problems are modified versions of the problems from your text book, *Multivariable Calculus*, 6th ed., by James Stewart. Your solution to each problem should be complete, show all work, and be written in complete sentences where appropriate. For *Maple* problems, include a print-out that shows all of the work and graphs that you generated in *Maple* to solve the problem, in addition to any work you may have done by hand.

13.4.1: Problem #16 from §13.4.

13.4.2: Find two unit vectors orthogonal to both $\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and $2\mathbf{j} + \mathbf{k}$. Are there any others? Explain.

13.4.3: Let P be a point not on a plane that passes through the points Q, R and S. Let $\mathbf{a} = \overrightarrow{QR}$, $\mathbf{b} = \overrightarrow{QS}$, and $\mathbf{c} = \overrightarrow{QP}$. Show that the distance d from P to the plane is

$$d = \frac{|(\mathbf{a} \times \mathbf{b}) \cdot \mathbf{c}|}{|\mathbf{a} \times \mathbf{b}|}.$$

13.5.1: Find an equation for the set of all points that are equidistant from the points $(1, 0, -2)$ and $(3, 4, 0)$.

13.5.2: Find the distance between the skew lines with parametric equations $x = 1 + t$, $y = 1 + 6t$, $z = 2t$ and $x = 1 + 2s$, $y = 5 + 15s$, $z = -2 + 6s$.

14.1.1: Sketch by hand the curve of intersection of the circular cylinder $x^2 + z^2 = 4$ and the parabolic cylinder $z = y^2$. Then find parametric equation for this curve and use these equations to graph the curve using *Maple*.

14.2.1: If $\mathbf{r}(t) \neq 0$, show that $\dfrac{d}{dt}\,|\mathbf{r}(t)| = \dfrac{1}{|\mathbf{r}(t)|}\,\mathbf{r}(t) \cdot \mathbf{r}'(t)$. [Hint: $|\mathbf{r}(t)|^2 = \mathbf{r}(t) \cdot \mathbf{r}(t)$]

M.1: *Maple* problem 1. Consider the surface $z = xy$ and the cylinder $x^2 + y^2 = 1$.

(a) Find the vector function $\mathbf{r}(t)$ that describes the intersection of these two surfaces.

(b) At what points is the tangent to $\mathbf{r}(t)$ horizontal?

(c) Find the equations of the lines that are tangent to $\mathbf{r}(t)$ at these points.

(d) Use *Maple* to plot the two surfaces, their intersection, and the tangent lines. When you have a plot that clearly shows all of these, print it out and submit it with your homework.