Math 223, Spring 2007
Review Information for Test #1

1. The test will be in class on **Thursday 3/1/07**. Tuesday's class will consist of a review session.

2. Bring a supply of loose-leaf paper to the test.

3. You are responsible for all of Chapters 1 and 2 of the textbook, *except* the following topics:

- Symmetric form of the equation of a line in $\mathbb{R}^3$ (eqn. (7), p. 12).
- Torque and rotation of a rigid body (pp. 33–34).
- Standard bases for cylindrical and spherical coordinates (pp. 69–71).
- Classification of quadric surfaces (pp. 89–91). (That is, you don't have to know what "hyperboloid of one sheet", "hyperbolic paraboloid", etc., mean.)
- Newton's method (pp. 130–137).
- Implicit and Inverse Function Theorems (pp. 162–167).

The test will focus on topics from Chapter 2.

4. The following formulas will be provided to you on the test. (Not all of them may actually be used on the test. But if you are working on review problems and you need a formula that is not on the list below, then that means that you need to know it.)

Cauchy-Schwarz inequality: For all vectors $\mathbf{a}, \mathbf{b} \in \mathbb{R}^n$,

$$|\mathbf{a} \cdot \mathbf{b}| \leq \|\mathbf{a}\|\|\mathbf{b}\|.$$

Triangle inequality: For all vectors $\mathbf{a}, \mathbf{b} \in \mathbb{R}^n$,

$$\|\mathbf{a} + \mathbf{b}\| \leq \|\mathbf{a}\| + \|\mathbf{b}\|.$$

Volume of a parallelpiped with sides $\mathbf{a}, \mathbf{b}, \mathbf{c}$:

$$|(\mathbf{a} \times \mathbf{b}) \cdot \mathbf{c}|$$

Conversion between rectangular and spherical coordinates:

$$\begin{cases} x = \rho \sin\phi \cos\theta \\ y = \rho \sin\phi \sin\theta \\ z = \rho \cos\phi \end{cases} \qquad \begin{cases} \rho^2 = x^2 + y^2 + z^2 \\ \tan\phi = \sqrt{x^2 + y^2}/z \\ \tan\theta = y/x \end{cases}$$

Product and Quotient Rules: If $f : \mathbb{R}^n \to \mathbb{R}$ and $g : \mathbb{R}^n \to \mathbb{R}$ are functions that are differentiable at $\mathbf{a} \in \mathbb{R}^n$, then fg and (provided $(g(\mathbf{a}) \neq 0)$ f/g are differentiable at $\mathbf{a}$, and

$$D(fg)(\mathbf{a}) = g(\mathbf{a})Df(\mathbf{a}) + f(\mathbf{a})Dg(\mathbf{a}),$$

$$D(f/g)(\mathbf{a}) = \frac{g(\mathbf{a})Df(\mathbf{a}) - f(\mathbf{a})Dg(\mathbf{a})}{g(\mathbf{a})^2}.$$

Chain Rule: If $g : \mathbb{R}^n \to \mathbb{R}^m$ and $f : \mathbb{R}^m \to \mathbb{R}^k$ are functions, g is differentiable at $\mathbf{a} \in \mathbb{R}^n$, and f is differentiable at $g(\mathbf{a}) \in \mathbb{R}^m$, then

$$D(f \circ g)(\mathbf{a}) \;=\; \big[Df(g(\mathbf{a}))\big]\,\big[Dg(\mathbf{a})\big].$$