Mathematics 280 $\hfill$ Spring 2008

<div align="right">**Exam 1**</div>

February 7, 2008

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<div align="right">*Name*</div>

Technology used: $\underline{}$ Only
write on one side of each page.

- Show all of your work. Calculators may be used for numerical calculations and answer checking only.

Do any six (6) of the following

1. Sketch the graph of **one** (1) of the following polar equations. Include any tangent lines to the curve at the origin.

    (a) $r = \sin(3\theta)$

    (b) $r^2 = 4\cos(2\theta)$

2. Do **one** (1) of the following.

    (a) Find the area inside one loop of $r = \sin(3\theta)$

    (b) Find the area inside one loop of $r^2 = 4\cos(2\theta)$

3. Use simplified equations or inequalities to describe the set of points $P(x, y, z)$ that are the same distance from the point $P_1(1, 2, 3)$ as from $P_2(-1.0, 0)$. What is your geometric intuition for the shape of this set of points?

4. Do **one** of the following.

    (a) Find the coordinates of the point Q that is $3/8$ of the way along the line segment from $P_1(2, 2, 3)$ to $P_2(-2, 5, -1)$.

    (b) Find a number c for which the angle between the vectors $\langle 1, 2, 1\rangle$ and $\langle 1, 0, c\rangle$ equal to $\pi/3$.

5. Given $\overrightarrow{a} =< \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{6}} >$, and $\overrightarrow{b} =< 0, \frac{1}{\sqrt{2}}, -1 >$ find

    (a) The scalar component (scalar projection) of $\overrightarrow{b}$ in the direction of $\overrightarrow{a}$.

    (b) The vector projection of $\overrightarrow{b}$ in the direction of $\overrightarrow{a}$.

6. Write $\overrightarrow{b} =< 8, 4, -12 >$ as the sum of a vector parallel to $\overrightarrow{a} =< 1, 2, -1 >$ and a vector orthogonal to $\overrightarrow{a}$.

7. Find the angle between the diagonal of a cube and one of the edges the diagonal meets at a vertex.

8. Given vectors $\overrightarrow{a}$, $\overrightarrow{b}$, and $\overrightarrow{c}$, use the dot product to write formulas for the following.

    (a) The vector projection of $\overrightarrow{a}$ onto $\overrightarrow{b}$.

    (b) A vector with the length of $\overrightarrow{a}$ and the direction of $\overrightarrow{b}$.