Mathematics 280 Spring 2008

Exam 2

February 28, 2008

_____
Name

Technology used: _____

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 BOTH of these problems

A.1 (10 points) If $\overrightarrow{a}$, $\overrightarrow{b}$,and $\overrightarrow{c}$ are vectors in $\mathbf{R}^3$, state whether each expression is meaningful. If it is, state whether it is a scalar or a vector.

(a) $\overrightarrow{a} \cdot \left(\overrightarrow{b} \times \overrightarrow{c}\right)$

(b) $\overrightarrow{a} \times \left(\overrightarrow{b} \cdot \overrightarrow{c}\right)$

(c) $\overrightarrow{a} \times \left(\overrightarrow{b} \times \overrightarrow{c}\right)$

(d) $\left(\overrightarrow{a} \cdot \overrightarrow{b}\right) \times \overrightarrow{c}$

(e) $\left(\overrightarrow{a} \cdot \overrightarrow{b}\right) \times \left(\overrightarrow{c} \cdot \overrightarrow{d}\right)$

(f) $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \cdot \left(\overrightarrow{c} \times \overrightarrow{d}\right)$

(g) $\left[\left(\vec{a} \times \vec{b}\right) \cdot \vec{c}\right] \vec{c} \cdot \vec{a}$

A.2 (10 points) Convert **three** (3) of these equations to rectangular coordinates.

(a) $z = r^2 \sin(2\theta)$

(b) $r = \sin(\theta)$

(c) $\rho^2 \sin^2(\phi) = 1$

(d) $\rho^2 \sin(\phi) \cos(\phi) \cos(\theta) = 1$

Do any two (2) of the following

B.1 Express the tangent line to the curve $\overrightarrow{F}(t) = \langle t^2, e^{t-1}, \ln(t) \rangle$ at the point where $t = 1$ in parametric form.

B.2 Write an equation for the plane that passes through the point $P(6, 0, -2)$ and contains the line $x = t,\ y = \frac{1}{2}t,\ z = \frac{1}{3}t$.

B.3 What is the distance (measured along a line orthogonal to both) between the parallel planes $x + 2y - 3z = 1$ and $x + 2y - 3z = 50$? [The answer is not 49.]

Do any three (3) of the following

C.1 Identify **three** of the following quadric surfaces by name and quickly sketch **one** of them.

(a) $y^2 + z^2 = 1 - 4x^2$

(b) $y^2 + z^2 = x$

(c) $y^2 + z^2 = 1$

(d) $x^2 + z^2 = 1 + y^2$

C.2 Suppose $\overrightarrow{r}''(t) = (3t^2 + 4)\,\mathbf{i} + \mathbf{j} + 4t\,\mathbf{k}$. If $\overrightarrow{r}(0) = \mathbf{i} + \mathbf{j}$, and $\overrightarrow{r}'(0) = \overrightarrow{0}$ find the function $\overrightarrow{r}(t)$.

C.3 Find the point of intersection of $\overrightarrow{r}_1(t) =< t, 1-t, 3+t^2 >$ and $\overrightarrow{r}_2(s) =< 3-s, s-2, s^2 >$ and compute the angle between the tangent vectors at this point.

C.4 The paraboloid $2y = (x-1)^2 + z^2$ and the plane $x + z = 1$ intersect along a curve in $\mathbf{R}^3$. Find a parametrization $\overrightarrow{F}(t)$ for this curve.