MA 26100 Exam 1 February 24, 2009

Name ______________________________

Student ID ______________________________

Recitation Instructor ______________________________

Recitation Time ______________________________

Instructions

1. This exam contains 12 problems. Problems 1–8 are worth 8 points and 9–12 are worth 9 points.
2. Please supply all information requested above and on the mark–sense sheet.
3. Work only in the space provided, or on the backside of the pages. Mark your answers clearly on the scantron. Also circle your choice for each problem in this booklet.
4. No books, notes or calculator, please.

C D E B B D A C E A D A

1. The two values of x for which the vectors $\langle x, 1, 1\rangle, \langle -3, x^2, 2\rangle$ are perpendicular are

A. $1, 0$

B. $-1, -2$

C. $1, 2$

D. $0, 2$

E. $1, 3$

2. The area of the triangle with vertices $(1,0,0), (0,1,0), (0,0,1)$ is

A. $\sqrt{3}$

B. 1

C. $\frac{2}{\sqrt{3}}$

D. $\frac{\sqrt{3}}{2}$

E. $\sqrt{2}$

3. The value of c so that the two lines

$$L_1: \quad \frac{x-1}{2} = y+3 = \frac{z+1}{4}$$
$$L_2: \quad x = 1+t, \quad y = -t, \quad z = 1+ct$$

intersect is

A. 0

B. -1

C. $\frac{1}{2}$

D. $-\frac{2}{3}$

E. 1

4. The values of a and b so that the line

$$x = 1+at, \qquad y = bt, \qquad z = 5t$$

is the line of intersection of the planes

$$x + 2y - z = 1, \qquad 2x - y + z = 2$$

are

A. $a = 1, b = 0$

B. $a = -1, b = 3$

C. $a = -1, b = 2$

D. $a = 0, b = 1$

E. $a = 1, b = 1$

5. The length of the curve

$$x = \sqrt{2}t, \quad y = \frac{1}{2}t^2, \quad z = lnt, \; 1 \leq t \leq e$$

is

A. $\frac{e^2}{2}$

B. $\frac{e^2+1}{2}$

C. $\frac{e+1}{2}$

D. $e + 1$

E. $e/2$

6. A particle moves along $\vec{r}(t)$ with acceleration $\vec{a}(t) = t\vec{i} + 3t^2\vec{k}$ and the initial conditions $\vec{v}(0) = \vec{i} + \vec{j} + \vec{k}$, $\vec{r}(0) = \vec{0}$. Then $\vec{r}(1) =$

A. $\frac{1}{6}\vec{i} + \frac{1}{4}\vec{k}$

B. $7\vec{i} + \vec{j} + 5\vec{k}$

C. $\vec{i} + \frac{5}{4}\vec{k}$

D. $\frac{7}{6}\vec{i} + \vec{j} + \frac{5}{4}\vec{k}$

E. $5\vec{i} + 7\vec{j} + \vec{k}$

7. Find all the points on the circle $x^2 + y^2 = 1$ at which the direction of fastest change of the function $f(x, y) = x^2 + y^2 - 10x - 8y$ is parallel to $\vec{i} + \vec{j}$.

A. $(1, 0)$ and $(0, -1)$

B. $(1, 0)$ and $(-1, 0)$

C. $(0, 1)$ and $(-1, 0)$

D. $(-1, 0)$ and $(0, -1)$

E. $(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$ and $(-\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}})$

8. Approximate the number $\sqrt{(3.2)^2 + (3.9)^2}$ using the linear approximation to the function $f(x, y) = \sqrt{x^2 + y^2}$ at $(3, 4, 5)$.

A. 5.02

B. 4.96

C. 5.04

D. 5.06

E. 4.92

9. Use the Chain Rule to find $\frac{dz}{dt}$ at $t = 1$ if $z = \arctan(yx^2)$, $\quad x = x(t)$,
$y = t^2$, $\quad \frac{dx}{dt}(1) = x(1) = 1$.

A. 1

B. $\frac{5}{2}$

C. $\frac{1}{2}$

D. $\frac{2}{3}$

E. 2

10. Find an equation of the tangent plane to the surface $z = x^2 - y^3$ at the point $(2, 1, 3)$.

A. $4x - 3y - z = 2$

B. $2x - 3y + z = 1$

C. $x - y - 8z = -11$

D. $2x + y + z = 9$

E. $x - 3y + 2z = 5$

11. If $f(x,y) = \frac{x+y}{x-y^2}$ then $f_x(1,2)$ is equal to

A. $\frac{1}{3}$

B. $\frac{2}{9}$

C. 0

D. $-\frac{2}{3}$

E. $-\frac{2}{9}$

12. Evaluate the limit

$$\lim_{(x,y)\to(0,0)} \frac{x^2 y}{x^2 + y^2}$$

A. 0

B. 2

C. 1

D. does not exist

E. ∞