MA	261
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## DIRECTIONS

- 1. Write your name, student ID number, recitation instructor's name and recitation time in the space provided above. Also write your name at the top of pages 2–6.
- 2. The exam has six (6) pages, including this one.
- 3. Circle the correct answer for problems 1–3. Write your answer in the box provided for problems 4–12.
- 4. You must show sufficient work to justify your answers.
- 5. Credit for each problem is given in parentheses in the left hand margin.
- 6. No books, notes or calculators may be used on this exam.
- (5) 1. Let  $\vec{a} = \vec{i} 2\vec{j} + 3\vec{k}$  and  $\vec{b} = 3\vec{i} + 4\vec{j} + 7\vec{k}$ . Then  $\frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\|} =$

А.	8
В.	$\frac{33}{14}$
С.	$\frac{33}{\sqrt{14}}$
D.	$\frac{16}{\sqrt{14}}$

E.  $\frac{8}{7}$ 

(7) 2. Symmetric equations for the tangent line to the curve  $\vec{r}(t) = e^t \vec{i} + (2t+3)\vec{j} + (5-\sin t)\vec{k}$  at the point (1,3,0) are:

А.	$\frac{x-1}{1} = \frac{y-3}{2} = \frac{z}{-1}$
В.	$\frac{x-1}{1} = \frac{y-3}{3} = \frac{z}{5}$
С.	$\frac{x-1}{e^t} = \frac{y-3}{2} = \frac{z}{-\cos t}$
D.	x = 1 + t, y = 3 + 2t, z = -t
Е.	x = 1 + t, y = 3 + 3t, z = 5t

(7) 3. Which of the following surfaces represents the graph of  $f(x, y) = 4x^2 + y^2 - 4$ ?

(9) 4. Find an equation of the plane through the points (1, 2, -3), (4, 1, 1), and (5, 0, 2).

(9) 5. If a particle has velocity  $\vec{v}(t) = 2\vec{i} + 3t^2\vec{j} + e^t\vec{k}$  and initial position  $\vec{r}(0) = \vec{i} + 2\vec{k}$ , find the position  $\vec{r}(t)$  of the partial at time t.

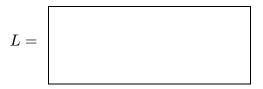
$$\left. \frac{dw}{dt} \right|_{t=1} =$$

(9) 7. Find the directional derivative of  $f(x, y) = \frac{1}{3}x^3 + x \ln y$  at the point (2, 1) in the direction from (2, 1) to (5, 5).

$$D_{\vec{u}}f(2,1) =$$

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(9) 8. Find the length, L, of the curve  $\vec{r}(t) = \frac{1}{3}(1+t)^{3/2}\vec{i} + \frac{1}{3}(1-t)^{3/2}\vec{j} + \frac{1}{2}t\vec{k}$  for  $-1 \le t \le 1$ .



(9) 9. Find an equation of the plane tangent to the graph of  $f(x,y) = \frac{x+1}{y-1}$  at the point (3,2,4).

tangent plane:

(9) 10. Find the critical point(s) of  $f(x, y) = (\sin x)(\cos y)$  in the square,  $0 \le x \le \pi$ ,  $0 \le y \le \pi$ .

## (9) 11. Apply the second partial derivative test to determine whether

$$f(x,y) = x^3 + y^3 - xy - 2x - 2y$$

has a relative maximum, a relative minimum, or a saddle point at its critical point (1,1). Circle the correct answer. (Give reasons for your answer.)

**Relative Maximum** 

**Relative Minimum** 

Saddle Point

(9) 12. Find the extreme value(s) of  $f(x, y) = x^2 - 6y$  on the circle  $x^2 + y^2 = 25$ .

Extreme Value(s):