Math 26100 Exam 1

10/08/15

Version01

Name:

10 digit PU-ID Number:

Signature:

(1) **Do Not Open** until instructed to do so.
(2) You have to be in your section and in your assigned seat.
(3) When time is called: **Remain in Your Seat.**
(4) You may not use any electronic devices or have them out.
(5) You may not have anything else out, like paper, extra pens etc. Just the exam, scantron, one pencil and eraser (optional).
(6) Use No 2 pencil.
(7) **Mark Your Test With The Version Number!**
(8) Sign the exam policies on the next page.
(9) There are 10 problems each worth 10 points.
(10) If you take the exam apart, mark each page with your name.

General Exam Policies

(1) Students may not open the exam until instructed to do so.
(2) Students must obey the orders and requests by all proctors, TAs, and lecturers.
(3) No student may leave in the first 20 min or in the last 10 min of the exam.
(4) Books, notes, calculators, or any electronic devices are not allowed on the exam, and they should not even be in sight in the exam room. Students may not look at anybody else's test, and may not communicate with anybody else except, if they have a question, with their TA or lecturer.
(5) After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
(6) Any violation of these rules and any act of academic dishonesty may result in severe penalties. Additionally, all violators will be reported to the Office of the Dean of Students.

I have read and understand the exam rules stated above:

STUDENT NAME: ______________________________

STUDENT SIGNATURE: ______________________________

PROBLEM 1: The angle between the planes given by the equations

$$x + y = 2 \text{ and } x + y + \sqrt{2}z = \sqrt{6}$$

is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{6}$

D. π

E. $\frac{\pi}{3}$

PROBLEM 2: a) Consider the following two curves $r_1(t) = \langle t, t^2, t^3 \rangle$ and $r_2(t) = (-1 + 3t, 1 + 3t, -1 + 9t)$. The curves have

A. 2 intersection points and no points of collision.

B. 1 intersection point, which is a point of collision.

C. 2 intersection points, one of which is a point of collision.

D. 1 intersection point and no points of collision.

E. 2 intersection points which both are points of collision.

PROBLEM 3: Find the length of the curve given by

$$r(\vec{t}) = \langle 2t, 4\sqrt{t}, \ln t\rangle$$

for $1 \leq t \leq e$.

A. $e - 1$

B. $2e + 1$

C. $e + 1$

D. $2e - 1$

E. $4e - 3$

PROBLEM 4: A particle is moving with acceleration $t\vec{j} + \vec{k}$. If the velocity at time $t = 1$ is $\vec{v}(1) = \vec{i} - \frac{1}{2}\,\vec{j}$, what is the velocity at time $t = 0$?

A. $\vec{i} - \vec{j} - \vec{k}$

B. $\vec{i} - \vec{j} + 2\vec{k}$

C. $\vec{i} - \frac{1}{2}\vec{j} - \vec{k}$

D. $\vec{i} + \frac{1}{2}\vec{j} - \vec{k}$

E. $-\vec{i} + \vec{j}$

PROBLEM 5: The function

$$f(x,y) = \begin{cases} \frac{2xy}{x^2+y^2} & \text{if } (x,y) \neq (0,0) \\ 0 & \text{if } (x,y) = (0,0) \end{cases}$$

A. is continuous on $\mathbb{R}^2$.

B. is not well defined at $(0,0)$, since it evaluates to $\frac{0}{0}$.

C. has limit 0 at $(0,0)$ along the diagonal $x = y$.

D. has limit 2 at $(1,1)$.

E. is continuous on $\mathbb{R}^2 \setminus (0,0)$.

PROBLEM 6: Consider the function

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

At the point $(1,1,2)$.

A. The slope of the tangent line to the curve of intersection of the graph of f and $x = 1$ is positive.

B. The gradient of f is $\langle -7, -1, 1 \rangle$.

C. The slope of the tangent line to the curve of intersection of the graph of f and $y = 1$ is positive.

D. The partial derivatives vanish.

E. The tangent plane is $z - 2 = 5(x-1) + 6(y-2)$.

PROBLEM 7: Consider the function

$$f(x, y, z) = xyz$$

which of the following is true.

(1) $df = xdx + ydy + zdz$
(2) Its linear approximation is the tangent plane.
(3) If $\Delta x = \Delta y = \Delta z = 0.2$ then the error estimated by using differentials at $(1, 2, 1)$ is 1
(4) Its gradient is $\langle yz, xz, xy\rangle$
(5) Its linear approximation at $(1, 1, 1)$ is $L(x, y, z) = x + y + z - 2$.

A. 1,2,3 are true.

B. 3,4,5 are true.

C. all are true.

D. none is true.

E. only 4 is true.

PROBLEM 8: Consider the function

$$g(s, t) = f(t\sin(\frac{\pi}{2}s), st^2)$$

with f differentiable. Use the table of values to calculate $g_t(1, 2)$

	f	g	f_x	f_y
$(1, 2)$	π	5	3	2π
$(2, 4)$	5	π	2	4

A. $3 + 8\pi$

B. $15 + 2\pi^2$

C. 9

D. 18

E. $2\pi + 20$

PROBLEM 9: Find the maximum rate of change of the function

$$f(x, y, z) = x^2y - 2yz + z^2x$$

at the point $(1, 1, -1)$.

A. $\sqrt{52}$
B. $\sqrt{44}$
C. $2\sqrt{10}$
D. $\sqrt{34}$
E. $2\sqrt{34}$

PROBLEM 10: Find all critical points of the function

$$f(x, y) = x^3 + 2xy - 2y^2 - 10x$$

and classify them.

A. $(2, -1), (\frac{5}{3}, \frac{5}{6})$ one min, one max.
B. $(-1, -2), (\frac{5}{6}, \frac{5}{3})$ one min, one saddle.
C. $(-2, -1), (\frac{5}{3}, \frac{5}{6})$ one min, one saddle.
D. $(-1, -2), (\frac{5}{6}, \frac{5}{3})$ one max, one saddle.
E. $(-2, -1), (\frac{5}{3}, \frac{5}{6})$ one max, one saddle.

Extra Page