MA 26100
Exam 1 - Spring 2024
02/20/2024
TEST/QUIZ NUMBER:

11

NAME _____ YOUR TA'S NAME _____

STUDENT ID # _____ RECITATION # _____

You must use a #2 pencil on the scantron answer sheet. Fill in the following on your scantron and blacken the bubbles

1. Your name. If there aren't enough spaces for your name, fill in as much as you can.
2. Your recitation section number. (If you don't know your recitation section number, ask your TA.)
3. Test/Quiz number: **11**
4. Student Identification Number: **This is your Purdue ID number with two leading zeros**
5. Blacken in your choice of the correct answer on the scantron answer sheet for questions 1–12.

There are **12** questions, each worth 8 points (you will earn 4 points for filling out your scantron correctly). Do all your work in this exam booklet. Use the back of the test pages for scrap paper. Turn in both the scantron and the exam booklet when you are finished.

If you finish the exam before 8:50pm, you may leave the room after turning in the scantron sheet and the exam booklet. You may not leave the room before 8:20pm. If you don't finish before 8:50pm, you MUST REMAIN SEATED until your TA comes and collects your scantron sheet and your exam booklet.

EXAM POLICIES

1. Students may not open the exam booklet 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, phone, 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, students must 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 SIGNATURE: _____

1. Consider the surface:

$$3x^2 - 12x + 5y^3 + z + 6 = 0.$$

Find the points on the surface at which the tangent plane is parallel to the xy-plane.

A. $(2, 1, 1)$

B. $(3, 0, 11)$

C. $(3, 1, 7)$

D. $(1, 1, -2)$

E. $(2, 0, 6)$

2. Where is $\vec{r}(t) = \langle \ln(t^2), \sqrt{t}, \cos(t) \rangle$ continuous?

A. $[0, \infty)$

B. $(0, \infty)$

C. $[0, 1)$

D. $(1, \infty)$

E. $(-\infty, \infty)$

3. Find the line of intersection between the planes $x - 2y = 4$ and $x + y + z = 1$.

A. $\langle 0, -2, 3\rangle + t\langle -2, -1, 3\rangle$

B. $\langle 0, 2, 3\rangle + t\langle -2, -1, 3\rangle$

C. $\langle -2, -1, -1\rangle + t\langle 0, 2, -1\rangle$

D. $\langle -2, 1, -1\rangle + t\langle 1, 1, 1\rangle$

E. $\langle 0, 2, -3\rangle + t\langle -2, 1, 3\rangle$

4. Let $f(x, y, z) = \sin(zy) + e^{y^2 z^3} + \sec 5y^2 + \ln(9z^5)$. Compute $f_{yxz}(2, 1, \frac{\pi}{2})$.

A. -2

B. 1

C. -1

D. 2

E. 0

5. A particle travels with position vector $\vec{r}(t) = \langle 4\cos t - 9, 3\cos t + 13, 5\sin t - 9, \rangle, t \geq 0$. Find the difference $t_2 - t_1$ such that during the interval of time from t_1 to t_2 the particle has traveled a distance 40.

A. 10

B. 8

C. 5

D. 4

E. 2

6. Compute $\text{Proj}_{\vec{w}}\vec{u}$, where $\vec{w} = \langle -1, -1, 0\rangle$ and $\vec{u} = \langle 1, 2, 1\rangle$.

A. $\frac{-1}{2}\langle -1, -1, 0\rangle$
B. $\frac{3}{2}\langle 1, 2, 1\rangle$
C. $\frac{-1}{2}\langle 1, 2, 1\rangle$
D. $\frac{-3}{2}\langle 1, 2, 1\rangle$
E. $\frac{-3}{2}\langle -1, -1, 0\rangle$

7. Suppose that z is defined implicitly as a function of x and y by the equation:

$$4\cos(xy) = e^{3z} - 1.$$

Use implicit differentiation to find $\dfrac{\partial z}{\partial y}$ at the point $(3, \dfrac{\pi}{2}, 0)$.

A. $\dfrac{4}{3}$

B. $\dfrac{4}{3}$

C. -4

D. 0

E. 4

8. Suppose,

$$\lim_{(x,y)\to(0,0)} \frac{x^6 - 8k\left(x^3 + y^3\right) - y^6}{x^3 + y^3} = 16,$$

then the number k must be equal to?

A. -2

B. 4

C. 2

D. -4

E. 8

9. Let M and m denote the maximum and the minimum values of $f(x, y) = x^2 + y^2 - 4y + 1$ on the disk $x^2 + y^2 \leq 9$. Find $M + m$.

A. 19

B. 25

C. 22

D. 24

E. 20

10. Find the directional derivative of the function $f(x, y, z) = x^4 + 3y^2 + \cos(z) + 3$ at the point $(1, 1, \frac{\pi}{4})$ in the direction of the vector $\vec{u} = \langle -1, 1, 0 \rangle$.

A. $2\sqrt{2}$

B. $-\sqrt{2}$

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

D. $5\sqrt{2}$

E. $\sqrt{2}$

11. Identify the surface:

$$-x^2 - \frac{y^2}{4} + \frac{z^2}{7} = 1$$

A. Hyperboloid of two sheets

B. Hyperboloid of one sheet

C. Hyperbolic paraboloid

D. Elliptic Paraboloid

E. Elliptic cone

12. If L is the tangent line to the curve $\vec{r}(t) = \langle 3t - 1, t^2 + 2, t^2 - 3 \rangle$ at (2, 3, -2), find the point where L intersects the xy-plane.

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

B. $(1, 1, 0)$

C. $(5, 5, 0)$

D. $(-5, -5, 0)$

E. $(0, 0, 0)$

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