MA 26100
Exam 1
10/03/2023
TEST/QUIZ NUMBER:

1111

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 3-digit recitation section number, e.g. **XYZ**. (If you don't know your recitation section number, ask your TA.)
3. Test/Quiz number: **1111**
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. A rocket travels through space with acceleration $\vec{a}(t) = \langle \cos(t), 4, e^{-t} \rangle$. At time $t = 0$ the rocket has position $\vec{r}_0 = \langle 0, 0, 0 \rangle$ and velocity $\vec{v}_0 = \langle 1, 2, 3 \rangle$. What is the position of the rocket at time $t = 2$?

A. $\langle 3 - \cos(2), 12, 7 + e^{-2} \rangle$

B. $\langle \cos(2), 8, e^{-2} \rangle$

C. $\langle -\cos(2), 8, 8 - e^{-2} \rangle$

D. $\langle 1 - \cos(2), 12, 7 + e^{-2} \rangle$

E. $\langle 1 - \cos(2), 12, 8 + e^{-2} \rangle$

2. Let $\mathbf{r}(t) = \langle \sqrt{3}\sin(t), \sin(t), 2\cos(t) \rangle$. Compute $\kappa(\frac{\pi}{2})$, the curvature evaluated at $\frac{\pi}{2}$.

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

B. 1

C. 2

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

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

3. Given $f(x,y) = 25 - x^2 - y^2$, find the direction of steepest descent at the point $(x,y) = (3,-4)$.

A. $\left\langle \frac{3}{5}, -\frac{4}{5} \right\rangle$

B. $\left\langle -\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right\rangle$

C. $\left\langle \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right\rangle$

D. $\left\langle \frac{\sqrt{3}}{2}, -\frac{1}{2} \right\rangle$

E. $\left\langle -\frac{3}{5}, \frac{4}{5} \right\rangle$

4. Determine a so that the line

$$\frac{x-3}{a} = \frac{y+5}{2} = \frac{z+1}{4}$$

is parallel to the plane $2x + 3y - 5z = 14$

A. 5

B. 3

C. -14

D. -4

E. 7

5. Let $f(x, y)$ be a function of two variables with partial derivatives:

$$\frac{\partial f}{\partial x} = \frac{-4}{x^5}, \qquad \frac{\partial f}{\partial y} = 6y - 2$$

Suppose that we have $x = r\cos(\theta)$ and $y = r\sin(\theta)$. Compute $\dfrac{\partial f}{\partial r}$ at the point $(r, \theta) = (1, \pi)$

A. -2

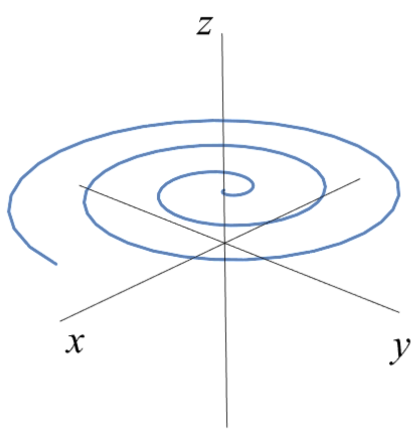
B. -4

C. -8

D. -6

E. 0

6. The graph below could be described by which of the following vector-valued functions?



A. $\vec{r}(t) = \langle t\cos(t), 3, \sin(t) \rangle$

B. $\vec{r}(t) = \langle \cos(t), \sin(t), 2t \rangle$

C. $\vec{r}(t) = \langle e^t, e^t, 1 \rangle$

D. $\vec{r}(t) = \langle 2\cos(t), \sqrt{2}\sin(t), \sqrt{2}\sin(t) \rangle$

E. $\vec{r}(t) = \langle t\cos(t), t\sin(t), 5 \rangle$

7. The point $(0, 0)$ is a critical point of the function

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

What does the second derivative test tell us about the point $(0, 0)$?

A. It is a local minumum of the function $f(x, y)$.

B. It is either a local maximum or a local minimum of $f(x, y)$.

C. The test is inconclusive and does not tell us how this point behaves.

D. It is a local maximum of the function $f(x, y)$.

E. It is a saddle point of the function $f(x, y)$.

8. Find the equation of the tangent plane to the quadric surface

$$x^2 - \frac{y^2}{16} - z^2 = 3$$

at the point $(2, 4, 0)$.

A. $8x + y = 12$

B. $4x - y = 4$

C. $z = 0$

D. $8x - y = 12$

E. $2\sqrt{3}x = 0$

9. Let $f(x, y) = \ln(x^2 + 4y^2 + 4)$. Compute $f_{yx}(2, 1)$.

A. $-\dfrac{32}{81}$

B. $-16\ln(81)$

C. $-\dfrac{16}{9}$

D. $-\dfrac{2}{9}$

E. $-\dfrac{2}{81}$

10. Identify the surface defined by the equation $x^2 - y^2 - 4x + z^2 = 4$

A. Ellipsoid.

B. Hyperboloid of one sheet.

C. Hyperboloid of two sheets.

D. Cone.

E. Hyperbolic paraboloid.

11. Evaluate

$$\lim_{(x,y)\to(0,0)} \frac{e^{x+y}-1}{2x-2y}$$

A. The limit does not exist

B. 0

C. 1

D. 2

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

12. The line through $(5,1,0)$ and $(0,2,1)$ intersects the plane $x+y+z=9$ at the point

A. $(12,0,-3)$

B. $(10,0,-1)$

C. $(3,5,1)$

D. $(2,-1,8)$

E. $(-1,12,-2)$

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