MA 26100
EXAM 1 Form 01
February 24, 2020

NAME ______________________ YOUR TA'S NAME ______________________

STUDENT ID # ____________________ RECITATION TIME ____________________

Be sure the paper you are looking at right now is GREEN! Write the following in the TEST/QUIZ NUMBER boxes (and blacken in the appropriate spaces below the boxes): **01**

You must use a #2 pencil on the mark–sense sheet (answer sheet). On the mark–sense sheet, fill in your TA's name and the COURSE number. Fill in your NAME and STUDENT IDENTIFICATION NUMBER and blacken in the appropriate spaces. Fill in your four-digit SECTION NUMBER. If you do not know your section number, ask your TA. Sign the mark–sense sheet.

There are **12** questions, each worth 8 points (you will automatically earn 4 points for taking the exam). Blacken in your choice of the correct answer in the spaces provided for questions 1–12. 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 7:20, you may leave the room after turning in the scantron sheet and the exam booklet. You may not leave the room before 6:50. If you don't finish before 7:20, 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 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: ____

1. A line l passes through the point $(1, 1, -2)$ and is perpendicular to the plane $x + y - 2z = 8$. At what point does this line intersect with the yz-plane?

A. (0, 1, 1)

B. (0, −1, 0)

C. (0, 1, −1)

D. (0, 0, 0)

E. (0, 1, 0)

2. Find the equation of the plane that passes through the point (1, 1, −2) and is perpendicular to both the planes $2x + 2y - z = 1$ and $x + 3z = 2$.

A. $6x - 7y - 2z = 3$

B. $6x + 7y - z = 15$

C. $3x - y + z = 0$

D. $6x - 8y - 2z = 2$

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

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

A. Elliptic paraboloid

B. Hyperboloid of one sheet

C. Hyperboloid of two sheets

D. Ellipsoid

E. Hyperbolic paraboloid

4. Find a vector function that represents the curve of intersection of the cylinder $y^2 + z^2 = 1$ and the plane $x + 2y + z = 1$.

A. $\mathbf{r}(t) =< 1 - 2\cos t - 2\sin t,\ \cos t,\ \sin t >,\ 0 \leq t \leq 2\pi$

B. $\mathbf{r}(t) =< 1 - 2\cos t - \sin t,\ \cos t,\ \sin t >,\ 0 \leq t \leq 2\pi$

C. $\mathbf{r}(t) =< 1 - \cos t - 2\sin t,\ \cos t,\ \sin t >,\ 0 \leq t \leq 2\pi$

D. $\mathbf{r}(t) =< 1 - \cos t - \sin t,\ 2\cos t,\ \sin t >,\ 0 \leq t \leq 2\pi$

E. $\mathbf{r}(t) =< 1 - \cos t + \sin t,\ \cos t,\ 2\sin t >,\ 0 \leq t \leq 2\pi$

5. Find the length of the curve $\mathbf{r}(t) = \langle t^2,\ t^3/3,\ 7\rangle,\ \ 0 \le t \le \sqrt{12}$.

A. $\dfrac{12^{3/2} - 1}{3}$

B. $\dfrac{12^{3/2} - 4}{3}$

C. $\dfrac{4^{3/2} - 1}{3}$

D. $\dfrac{49}{3}$

E. $\dfrac{56}{3}$

6. A particle is moving with acceleration $\mathbf{a} = \langle 0,\ 6t,\ 4\rangle$. If the position at time $t = 1$ is $\mathbf{r}(1) = \langle 0,\ 5,\ 1\rangle$ and the velocity at time $t = 0$ is $\mathbf{v}(0) = \langle -2,\ 2,\ -1\rangle$, then the position at time $t = 2$ is:

A. $\langle -1,\ 14,\ 2\rangle$

B. $\langle 1,\ -8,\ 12\rangle$

C. $\langle 3,\ -4,\ 5\rangle$

D. $\langle -2,\ 14,\ 6\rangle$

E. $\langle 1,\ 1,\ 2\rangle$

7. Evaluate

$$\lim_{(x,y)\to(0,0)} \frac{y^4 - x^4}{x^2 + y^2}\, e^{x^2+y^2}$$

A. 0

B. 1

C. -1

D. e^2

E. The limit does not exist

8. Let $f(x, y, z) = e^{x+y-z}$ and suppose that

$$x(s,t) = ts, \quad y(s,t) = 2s - 2t, \text{ and } z(s,t) = s - t.$$

Compute $\dfrac{\partial f}{\partial s} - 2\dfrac{\partial f}{\partial t}$ when $s = 0$ and $t = -1$.

A. $-3e$

B. $3e$

C. $5e$

D. $2e$

E. $-2e$

9. Which of the following is an equation for the plane tangent to the surface

$$z = (x^2 + y^2)^{1/3} \text{ at the point } (2, 2, 2)?$$

A. $z = x + y - 2$

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

C. $3z = x + 2y$

D. $4z = 6x + 8y - 20$

E. $4z = x + y + 4$

10. The function $f(x, y) = x^4 + y^4 - 2x^2 - 18y^2 + 20$ has nine critical points, and among them are $(1, 3)$, $(1, -3)$, $(-1, 0)$ and $(-1, -3)$. Which of the following is correct about these critical points which are listed?

A. Two are saddle points, one is a local maximum and one is a local minimum

B. Three are local minima and one is a local maximum

C. Three are saddle points and one is a local minimum

D. Two are minima and two are saddle points

E. Three are local minima and one is a saddle point

11. The absolute minimum of the function $f(x, y) = x^2 + y^2 + 5xy$ on the triangular region with vertices $(0, 0)$, $(1, 0)$ $(0, 1)$ is equal to zero. Its absolute maximum is equal to:

A. $\frac{9}{4}$

B. $\frac{5}{4}$

C. $\frac{7}{4}$

D. $\frac{7}{3}$

E. $\frac{8}{3}$

12. Find the directional derivative of the function $f(x, y, z) = \ln(1 + x^2 + y^2 + e^z)$ in the direction of the vector $\mathbf{u} = \langle 1, 2, 3 \rangle$ at the point $P(1, 1, 0)$.

A. $\frac{9}{4\sqrt{14}}$

B. $\frac{15}{2\sqrt{14}}$

C. $\frac{16}{7\sqrt{14}}$

D. $\frac{9}{2\sqrt{14}}$

E. $\frac{18}{7\sqrt{14}}$