MA 26100
EXAM 2 Form 01
March 23, 2023

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 on the scantron: **01**

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 space for your name, fill in as much as you can.
2. Section number. If you don't know your section number, ask your TA.
3. Test/Quiz number: **01**
4. Student Identification Number: **This is your Purdue ID number with two leading zeros.**

There are **12** questions, each worth 8 points (you will automatically earn 4 points for filling out your student ID number correctly). 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 follow the instructions 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 SIGNATURE: ____________________

1. Find the relative extrema of

$$f(x, y) = -\frac{2}{3}x^3 + 4xy - 2y^2 + 1$$

A. $(3, 2)$ local maximum

B. $(1, 3)$ local minimum

C. $(2, 3)$ local maximum

D. $(2, 2)$ local minimum

E. $(2, 2)$ local maximum

2. Consider the surface

$$z = 3 - x^2 - y^2 + 4y$$

Find the points on the surface at which the tangent plane is horizontal.

A. $(2, 0, 9)$

B. $(0, 2, 7)$

C. $(4, 6, 8)$

D. $(1, 2, 3)$

E. $(-1, 2, 3)$

3. Find the maximum of $f(x, y, z) = x + y + z$ subject to the constraint $(x-1)^2 + y^2 + z^2 = 1$

A. $1 + \sqrt{3}$

B. $1 - \sqrt{3}$

C. $\sqrt{3}$

D. $1 + 2\sqrt{3}$

E. $1 + 3\sqrt{3}$

4. The x-coordinate of the point on the plane $z = x + y$ that is closest to the point $(1, 1, 1)$ is equal to

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $\frac{3}{4}$

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

E. $\frac{1}{4}$

5. Find the average value of the function $f(x,y) = x^2y$ over the region R where R is the rectangle with vertices $(-1,0)$, $(-1,5)$, $(1,5)$, and $(1,0)$.

A. $\frac{10}{3}$
B. $\frac{25}{12}$
C. $\frac{25}{3}$
D. $\frac{5}{6}$
E. $\frac{25}{6}$

6. Evaluate

$$\iint\limits_R \frac{\sin x}{x}\, dA$$

where R is the region in the xy-plane bounded by the x-axis, the line $y = x$, and the line $x = 1$. Integrate with respect to y first and then with respect to x.

A. $1 - \cos(1)$
B. $1 + \cos(1)$
C. $-1 - \cos(1)$
D. $-1 + \cos(1)$
E. $2 + \cos(1)$

7. Rewrite the integral as an iterated integral in polar coordinates. Do not evaluate the integral.

$$\int_0^1 \int_{-\sqrt{1-y^2}}^{\sqrt{1-y^2}} (x^2+y^2)^{\frac{1}{2}}\, dx\, dy$$

A. $\int_0^{\pi} \int_0^1 r\, dr\, d\theta$

B. $\int_0^{2\pi} \int_0^1 r\, dr\, d\theta$

C. $\int_0^{\pi} \int_0^1 r^2\, dr\, d\theta$

D. $\int_0^{\pi/2} \int_0^1 r^2\, dr\, d\theta$

E. $\int_0^{\pi/2} \int_0^1 r\, dr\, d\theta$

8. Reverse the order of integration in the following iterated integral and evaluate.

$$\int_0^{2\sqrt{\ln 3}} \int_{y/2}^{\sqrt{\ln 3}} e^{x^2}\, dx\, dy$$

A. 80

B. 3

C. 1

D. e^3

E. 2

9. Convert the integral to cylindrical coordinates and evaluate

$$\int_0^{10} \int_0^{\sqrt{100-x^2}} \int_0^{\sqrt{x^2+y^2}} \frac{1}{\sqrt{x^2+y^2}}\, dz\, dy\, dx$$

A. 5π

B. 10π

C. 20π

D. 25π

E. 30π

10. Let V be the volume of the solid bounded the surfaces $z = 6 - x^2 - y^2$ and $z = x^2 + y^2$. If $V = \int_{-\sqrt{3}}^{\sqrt{3}} \int_a^{\sqrt{3-x^2}} \int_{x^2+y^2}^{b} dz\, dy\, dx$, what are a and b?

A. $a = x,\ b = \sqrt{3 - x^2}$

B. $a = \sqrt{6 - x^2},\ b = \sqrt{3 - x^2 - y^2}$

C. $a = -\sqrt{3 - x^2},\ b = 6 - x^2 - y^2$

D. $a = -\sqrt{3 - x^2},\ b = 3$

E. $a = 3,\ b = 6 - x^2 - y^2$

11. Which of the following integrals represents the volume of the solid inside a sphere of radius 2 centered at $(0,0,2)$ and outside a sphere of radius 2 centered at $(0,0,0)$?

A. $\int_0^{2\pi} \int_0^{\frac{\pi}{3}} \int_2^{4\cos\phi} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$

B. $\int_0^{2\pi} \int_0^{\frac{\pi}{3}} \int_0^{4\cos\phi} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$

C. $\int_0^{2\pi} \int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \int_0^{2} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$

D. $\int_0^{2\pi} \int_0^{\frac{\pi}{3}} \int_0^{4\sin\phi} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$

E. $\int_0^{2\pi} \int_0^{\frac{\pi}{3}} \int_{4\sin\phi}^{2} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$

12. Find the x−coordinate of the center of mass of a plate in the shape of the region bounded by $y = x$, $y = \frac{1}{2}x$, and $x = 1$ with a density of $\delta(x,y) = 2x$. Recall the mass moments about the $x-$ and $y-$ axes are $M_x = \iint\limits_R y\delta(x,y)\, dA$ and $M_y = \iint\limits_R x\delta(x,y)\, dA$, respectively.

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

B. $\frac{5}{6}$

C. $\frac{2}{3}$

D. $\frac{3}{4}$

E. $\frac{6}{7}$