MA 26100
EXAM 2 INSTRUCTIONS
VERSION 01
November 13, 2024

Your name ____________________ Your TA's name ____________________

Student ID # _______________ Section # and recitation time __________

1. You must use a #2 pencil on the scantron sheet (answer sheet).

2. Check that the cover of your exam booklet is GREEN and that it has VERSION 01 on the top. Write 01 in the TEST/QUIZ NUMBER boxes and blacken in the appropriate spaces below.

3. On the scantron sheet, fill in your **TA's name (NOT the lecturer's name)** and the course number.

4. Fill in your NAME and PURDUE ID NUMBER, and blacken in the appropriate spaces. Put TWO Zeroes in front of your ID number on your card.

5. Fill in the four-digit **SECTION NUMBER**. Put Zero in front of your section number.

6. Sign the scantron sheet.

7. Blacken your choice of the correct answer in the space provided for each of the questions 1–12. While mark all your work on the scantron sheet, you should show your work on the exam booklet. Although no partial credit will be given, any disputes about the grade or grading will be settled by examining your written work on the exam booklet.

8. There are 12 questions, each worth 8 points (you will automatically earn 4 point for taking the exam).The maximum possible score is 100 points.

9. NO calculators, electronic device, books, or papers are allowed. Use the back of the test pages for scrap paper.

10. After you finish the exam, turn in BOTH the scantron sheet and the exam booklet.

11. If you finish the exam before 7:25, you may leave the room after turning in the scantron sheets and the exam booklets. If you don't finish before 7:25, REMAIN SEATED until your TA comes and collects your scantron sheet and exam booklet.

Exam Policies

1. Students must take pre-assigned seats and/or follow TAs' seating instructions.
2. Students may not open the exam until instructed to do so.
3. No student may leave in the first 20 min or in the last 5 min of the exam.
4. Students late for more than 20 min will not be allowed to take the exam; they will have to contact their lecturer within one day for permission to take a make-up exam.
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 scantron sheet and the exam booklet.
6. Any violation of the above rules may result in score of zero.

Rules Regarding Academic Dishonesty

1. You are not allowed to seek or obtain any kind of help from anyone to answer questions on the exam. If you have questions, consult only your instructor.
2. You are not allowed to look at the exam of another student. You may not compare answers with anyone else or consult another student until after you have finished your exam, handed it in to your instructor and left the room.
3. You may not consult notes, books, calculators. You may not handle cell phones or cameras, or any electronic devices until after you have finished your exam, handed it in to your instructor and left the room.
4. Anyone who violates these instructions will have committed an act of academic dishonesty. Penalties for academic dishonesty can be very severe and may include an F in the course. All cases of academic dishonesty will be reported immediately to the Office of the Dean of Students.

I have read and understand the exam policies and the rules regarding the academic dishonesty stated above:

STUDENT NAME: ____

STUDENT SIGNATURE: ____________________________________

1. Consider the vector field

$$\mathbf{F} = \langle e^{yz} - y\sin(xy), zxe^{yz} - x\sin(xy), xye^{yz}\rangle.$$

Find a potential function ϕ for this field, if one exists.

A. xe^{yz}

B. e^{yz}

C. $xe^{yz} + \sin(xy)$

D. $xe^{yz} + \cos(xy)$

E. No potential function exists.

2. Let R be the triangle in $\mathbb{R}^2$ with vertices $(0,0)$, $(2,0)$, and $(1,1)$, and let C denote the boundary of R, oriented counterclockwise. Compute the line integral

$$\int_C \cos^3(x)dx + e^x dy$$

A. 1

B. $e^2 + 2e + 1$

C. $e^2 - 2e$

D. e^2

E. $e^2 - 2e + 1$

3. If $\mathbf{F} = \langle xy, \sin(z), \cos(y) \rangle$, then curl($\mathbf{F}$) is:

A. $\langle \sin(y)\cos(z), 0, -x \rangle$

B. $\langle -\sin(y) + \cos(z), 0, x \rangle$

C. $\langle -\sin(y) - \cos(z), 0, -x \rangle$

D. $\langle -\sin(y) - \cos(z), 0, x \rangle$

E. None of the above.

4. Find the volume of the solid under the plane $z = 2x$ and above the region R in the first quadrant of the xy-plane bounded by the coordinate axes and the line $x + y = 1$.

A. 1/3

B. 1/2

C. 2/3

D. 1/6

E. 1

5. Evaluate the integral $\int_0^1 \int_0^1 \int_0^{2-y} e^x \, dz \, dx \, dy$.

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

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

C. $\frac{3}{2}(e-1)$

D. $2(e-1)$

E. $\frac{1}{2}(e-1)$

6. The volume of the region inside the sphere $x^2 + y^2 + z^2 = 4$ and the cone $z = \sqrt{3x^2 + 3y^2}$ is given by $\int_0^{2\pi} \int_0^{a} \int_0^{b} c \, d\rho \, d\phi \, d\theta$, where the integral is using spherical coordinates. What are the values of a, b and c ?

A. $a = \pi/3,\ b = 2,\ c = \rho^2 \sin\phi$

B. $a = \pi/3,\ b = \sqrt{3},\ c = \rho^2 \cos\phi$

C. $a = \pi/6,\ b = 2,\ c = \rho^2 \cos\phi$

D. $a = \pi/6,\ b = 2,\ c = \rho^2 \sin\phi$

E. $a = \pi/6,\ b = \sqrt{3},\ c = \rho^2 \sin\phi$

7. The maximum and minimum values of the function

$$f(x, y) = (x - 2)^2 + (y - 4)^2$$

subject to the constraint $x^2 + y^2 = 5$ are, respectively,

A. 45 and 5

B. 50 and 4

C. 100 and 4

D. 20 and 5

E. At least one of the maximum and minimum values does not exist.

8. Compute $\int_0^1 \int_y^1 e^{x^2}\, dxdy$. (Hint: change the order of integration)

A. 0

B. $\frac{1}{2}(e-1)$

C. $\frac{1}{2}e$

D. $\frac{1}{2}(e+1)$

E. $-\frac{1}{2}(e-1)$

9. Compute $\iint_R e^{-(x^2+y^2)}\, dA$, where R is the region surrounded by the circle $x^2 + y^2 = 4$.

A. 0

B. $\pi(1 - e^4)$

C. $\pi(1 + e^{-4})$

D. $\pi(1 + e^4)$

E. $\pi(1 - e^{-4})$

10. Let $a \neq 0$ and let C be the curve $x^2 - 2y^2 = a$. Which of the following vector fields $\vec{F}$ is such that $\vec{F}(x_0, y_0)$ is orthogonal to the tangent line to the curve C at (x_0, y_0) for every point (x_0, y_0) on the curve C?

A. $\vec{F}(x, y) = \langle 2, -4 \rangle$

B. $\vec{F}(x, y) = \langle 2x, -4y \rangle$

C. $\vec{F}(x, y) = \langle 2x, 4y \rangle$

D. $\vec{F}(x, y) = \langle x^2, -4y^2 \rangle$

E. $\vec{F}(x, y) = \langle x + 2y, 2x - y \rangle$

11. Compute the line integral $\int_C f(x,y)\,ds$ of the function $f(x,y) = \sin(2\pi x) + xy$ along the curve C which is parametrized by $\vec{r}(t) = \langle t, t\rangle$ for $0 \le t \le 1$.

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

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

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

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

E. 0

12. Compute the flux of the vector field $\vec{F}(x, y) = \langle x, y\rangle$ across the curve $\vec{r}(t) = \langle 3\cos(t), 2\sin(t)\rangle$ for $-\pi \leq t \leq \pi$.

A. 24π

B. 0

C. 12

D. 12π

E. 6π