MA 16100
EXAM 3
11/15/2022
TEST/QUIZ NUMBER:

00

NAME _____ YOUR TA'S NAME _____

STUDENT ID # _____ RECITATION TIME _____

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 with a leading zero, e.g. **0302**. (If you don't know your section number, ask your TA.)
3. Test/Quiz number: **00**
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 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 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, 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 $f(x) = x^2 - 4\cos(x)$ on the domain $[0, 2\pi]$. The graph of $f(x)$ is concave **downward** on what interval(s)?

A. $\left(\frac{\pi}{3}, \frac{2\pi}{3}\right)$

B. $\left(\frac{2\pi}{3}, \frac{4\pi}{3}\right)$

C. $\left(0, \frac{\pi}{3}\right)$ and $\left(\frac{5\pi}{3}, 2\pi\right)$

D. $\left(0, \frac{2\pi}{3}\right)$ and $\left(\frac{4\pi}{3}, 2\pi\right)$

E. $\left(\frac{\pi}{3}, \frac{5\pi}{3}\right)$

2. A certain function $f(x)$ has the following first derivative: $f'(x) = x^2(x-4)(x-2)(x+2)^2$. How many local **minima** does $f(x)$ have?

A. 3

B. 4

C. 2

D. 1

E. 0

3. Consider the function $f(x) = \dfrac{x^6}{30} - \dfrac{x^4}{12}$. How many inflection points does $f(x)$ have?

A. 1

B. 4

C. 3

D. 2

E. 0

4. For the function $f(x) = 8x + \dfrac{6}{x^2}$, let $F(x)$ be the antiderivative that satisfies $F(1) = 1$. Find $F(2)$.

A. 14

B. 22

C. 16

D. 10

E. 32

5. Evaluate the limit:

$$\lim_{x \to 0} \frac{1 - \cos(2x)}{5x^3 + 4x^2}$$

A. $\frac{2}{15}$

B. $-\frac{1}{30}$

C. $\frac{1}{8}$

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

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

6. Use linear approximation to estimate $\sqrt{99.8}$.

A. 9.998

B. 9.98

C. 9.99

D. 9.9

E. 9.8

7. Consider the function $f(x) = xe^{-x}$. On what interval is $f(x)$ both decreasing and concave upward?

A. $(-\infty, 2)$

B. $(1, \infty)$

C. $(2, \infty)$

D. $(-\infty, 1)$

E. $(1, 2)$

8. A storage crate is to be built in the shape of a box with a square base. It is to have volume 10 cubic feet. The material for the base costs \$4 per square foot, the material for the lid costs \$1 per square foot, and the material for the sides costs \$2 per square foot. If a is the width of the crate and h is the height, what are the dimensions of the crate the minimizes the cost?

A. $a = 2$ and $h = \frac{5}{2}$

B. $a = \sqrt{10}$ and $h = 1$.

C. $a = \sqrt{5}$ and $h = 2$

D. $a = 1$ and $h = 10$

E. $a = \sqrt{2}$ and $h = 5$

9. Find the number c that satisfies the conclusion of the Mean Value Theorem for the function $f(x) = x + \dfrac{1}{x}$ on the interval $[1, 3]$.

A. $\sqrt{2}$

B. 1

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

D. $\sqrt{3}$

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

10. You are the owner of a rectangular orchard adjacent to a straight river. You have 600 feet of fence that you want to use to enclose it. No fencing is required along the river. If x is the length of a side perpendicular to the river and y is the length of the side parallel to the river, find the values of x and y that will maximize the enclosed area.

A. $x = 150$ and $y = 450$

B. $x = 150$ and $y = 300$

C. $x = 200$ and $y = 200$

D. $x = 100$ and $y = 400$

E. $x = 300$ and $y = 300$

11. Evaluate the limit:

$$\lim_{x \to 0} (1 + 3x)^{1/x}$$

A. e^3

B. e

C. 3

D. 1

E. $3e$

12. Approximate the area of the region bounded by the graph of $f(x) = 4x^2 + 1$ and the x-axis by dividing the interval $[0, 2]$ into $n = 4$ subintervals to find the left Riemann sum, L_4.

A. 13

B. 17

C. $\frac{25}{2}$

D. 9

E. $\frac{38}{3}$

(This page left intentionally blank for scratch work.)