MA 16100
EXAM 3 Form 01
April 12, 2022

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.

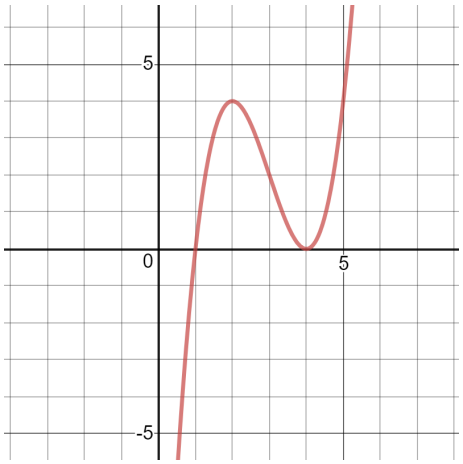
EXAM POLICIES

1. Students may not open the exam until instructed to do so.
2. Students must 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 SIGNATURE: _____

1. The graph of the **velocity** function of a particle is shown below. On what interval(s) do the velocity and the acceleration have opposite signs?



A. $(0, 1)$ only

B. $(1, 2)$ only

C. $(0, 1)$ and $(1, 2)$

D. $(1, 2)$ and $(4, \infty)$

E. $(0, 1)$ and $(2, 4)$

2. If $f(x) = (\ln x)^x$, then $f'(e) =$

A. 1

B. e

C. $\dfrac{1}{e}$

D. e^e

E. 2

3. If $f(x) = \ln(\sin(x^2))$, then $f'(x) =$

A. $2x\cot(x)$

B. $\dfrac{2x}{\sin(x^2)}$

C. $2x\cot(x)$

D. $2x\cot(x^2)$

E. $2x\cos x^2(\ln(\sin(x^2))$

4. The area of a right triangle is increasing at a rate of 2 m^2/s. If the two legs of the triangle are increasing at the same constant rate, how fast are the lengths of the legs increasing at the moment when each leg is 5 m?

A. $\frac{2}{5}$

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

C. $\frac{1}{5}$

D. $\frac{3}{5}$

E. 1

5. An airplane flying horizontally at a constant altitude of 3 miles and a constant speed of 800 miles per hour passes over a control tower. Find the rate of change, in miles per hour, of the distance between the plane and the tower when the plane is 5 miles away from the tower.

A. 1020

B. 640

C. 760

D. 780

E. 920

6. Use a linear approximation to estimate the value of $\sqrt{36.3}$

A. 6.030

B. 6.025

C. 6.020

D. 6.015

E. 6.010

7. Find the absolute maximum and minimum **values** of the function $f(x) = x^{8/3}$ on the interval $[-1, 8]$.

A. max: 256; min: none

B. max: 512; min: 0

C. max: 256; min: -1

D. max: 256; min: 0

E. max: 512; min: none

8. Determine whether Rolle's Theorem applies to the function $f(x) = -\sin(4x)$ on the interval $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$. If so, find the x-value(s) where horizontal tangent lines are guaranteed to exist.

A. Rolle's Theorem does not apply because the function is not continuous on $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$

B. Rolle's Theorem does not apply because the function is not differentiable on $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

C. Rolle's Theorem applies and a horizontal tangent line is guaranteed to exist at $x = \dfrac{3\pi}{8}$

D. Rolle's Theorem applies and a horizontal tangent line is guaranteed to exist at $x = \dfrac{\pi}{6}$

E. Rolle's Theorem applies and a horizontal tangent line is guaranteed to exist at $x = \dfrac{\pi}{6}$ and $x = \dfrac{3\pi}{8}$

9. Find the value(s) of c that satisfy the equation $\dfrac{f(b)-f(a)}{b-a} = f'(c)$ in the conclusion of the Mean Value Theorem for the function $f(x) = x^2 + 5x + 4$ on the interval $[2, 3]$.

A. $0, \frac{5}{2}$

B. $-\frac{5}{2}, \frac{5}{2}$

C. $\frac{5}{2}$

D. 2

E. $2, 3$

10. A certain function $f(x)$ has the following first and second derivatives: $f'(x) = 3x^5 - 6x^3$, $f''(x) = 15x^4 - 18x^2$. How many relative maxima does $f(x)$ have?

A. 0

B. 1

C. 2

D. 3

E. 4

11.

$$\lim_{x \to \pi} \frac{\cos(3x) - 1}{x^2} =$$

A. The limit does not exist

B. 0

C. 1

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

E. $-\frac{9}{2}$

12. A box with a square base and an open top must have a volume of 4 m^3. Find the height of the box that has the smallest possible surface area.

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

B. 4

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

D. 1

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