MA 16100
Exam 3
11/12/2024
TEST/QUIZ NUMBER:

31

NAME _____ YOUR TA'S NAME _____

STUDENT ID # _____ RECITATION # _____

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 spaces for your name, fill in as much as you can.
2. Your recitation section number. (If you don't know your recitation section number, ask your TA.)
3. Test/Quiz number: **31**
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 1–20.

There are **12** questions, each worth 8 points (you will automatically earn 4 points for taking the exam). 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.

You may not leave the room before 8:20pm. If you finish the exam between 8:20pm and 8:50pm, you may leave the room after turning in the scantron sheet and the exam booklet. If you don't finish before 8:50pm, 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, phone, 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. Suppose $f(x) = x - \dfrac{2}{x}$ on the domain $(0, \infty)$, compute $(f^{-1})'$ at the point $(1, 2)$.

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

B. $\dfrac{1}{4}$

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

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

E. 1

2. Given that

$$\lim_{x \to \frac{\pi}{2}} \left(1 + \frac{\cos(x)}{3}\right)^{k \sec(x)} = e^7.$$

Find the value of k.

A. 7

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

C. 21

D. -7

E. -21

3. Which of the following is the best linear approximation to $y = \sqrt{x+16}$ at the point $x = 9$.

A. $y = \frac{1}{6}x + \frac{21}{6}$

B. $y = \frac{1}{10}x + \frac{47}{10}$

C. $y = \frac{1}{8}x + \frac{15}{8}$

D. $y = \frac{1}{8}x + \frac{31}{8}$

E. $y = \frac{1}{10}x + \frac{41}{10}$

4. Determine the number of local extrema (max or min) of $f(x) = x + \sin(2x)$ on the interval $(0, 2\pi)$.

A. 6

B. 1

C. 0

D. 2

E. 4

5. A spherical balloon is being filled with air at the constant rate of 5 cm^3/sec. How fast is the radius of the balloon increasing when the radius is 2 cm? The volume of a sphere is $V = \frac{4}{3}\pi r^3$

A. $\dfrac{1}{4\pi}$ cm/s

B. $\dfrac{5}{16\pi}$ cm/s

C. $\dfrac{4}{5\pi}$ cm/s

D. $\dfrac{1}{50\pi}$ cm/s

E. $\dfrac{5}{8\pi}$ cm/s

6. A pumpkin patch located next to a river wants to set up a rectangular fenced area for growing pumpkins. Since one side will be along the river, only three sides need fencing. The owner has two types of fencing: spooky decorative fencing costing 5 Dollars per foot for the two widths (perpendicular to the river) and sturdy fencing costing 8 Dollars per foot for the length (parallel to the river). The owner wants to enclose the maximum possible area for a budget of 640 Dollars.

What should the length of the side parallel to the river be to maximize the area of the rectangular pumpkin patch while staying within budget?

A. 40 ft

B. 48 ft

C. 20 ft

D. 32 ft

E. 45 ft

7. Let $f'(x) = x(6-x)^2$ and $f(0) = 0$. Determine $f(2)$.

A. None of the other answers

B. $-\dfrac{128}{3}$

C. 32

D. 44

E. $\dfrac{128}{3}$

8. Suppose that $f(x)$ satisfies Mean Value Theorem on the interval $[1, 3]$. Given that $f(3) = 15$ and $f'(x) \leq 4$ for $1 \leq x \leq 3$. According to the Mean Value Theorem, what is the minimum possible value of $f(1)$?

A. 15

B. 7

C. 3

D. 11

E. 9

9. Two cars are driving away from the same building. Car A is driving east at 50 mi/h and car B is driving north at 30 mi/h. Find the rate at which the distance between the cars is changing when Car A is 3 miles east and Car B is 4 miles north of the building.

A. 40 mi/h

B. 54 mi/h

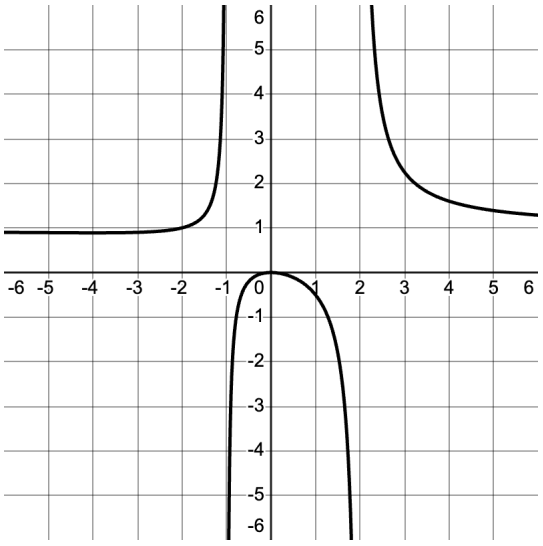
C. 58 mi/h

D. 42 mi/h

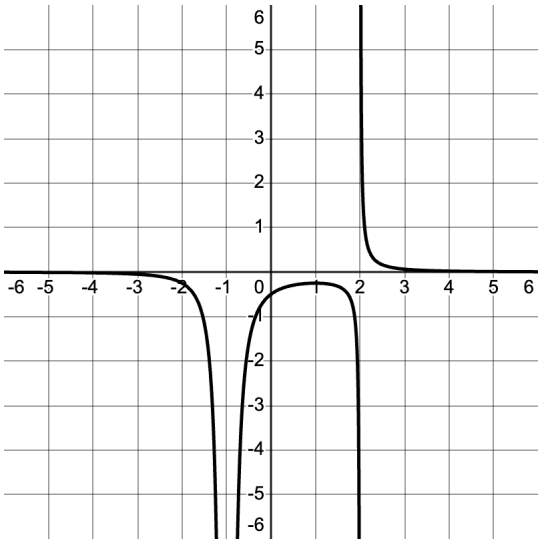
E. 65 mi/h

10. Suppose $f'(x) < 0$ on $(-5, -1)$, $f'(x) > 0$ on $(-1, 0)$ and $f''(x) < 0$ on $(0, 2)$. Which of the graphs below could be the graph of $f(x)$?

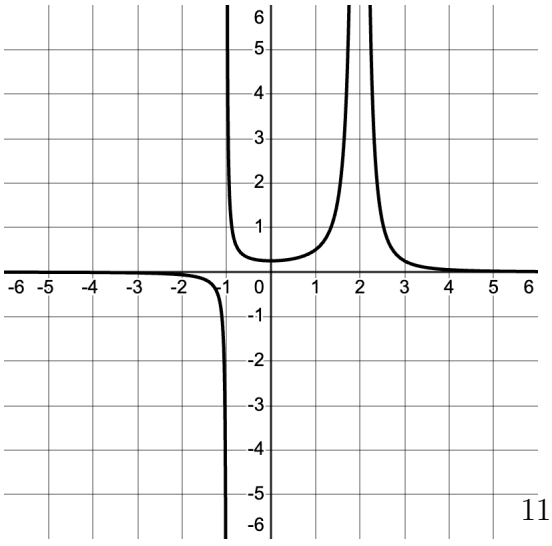
A.



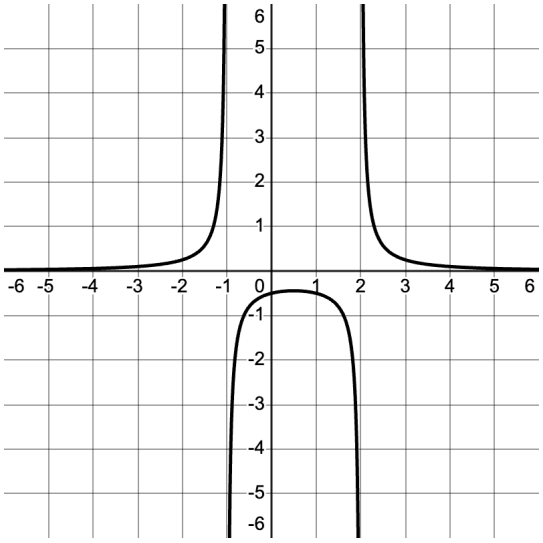
B.



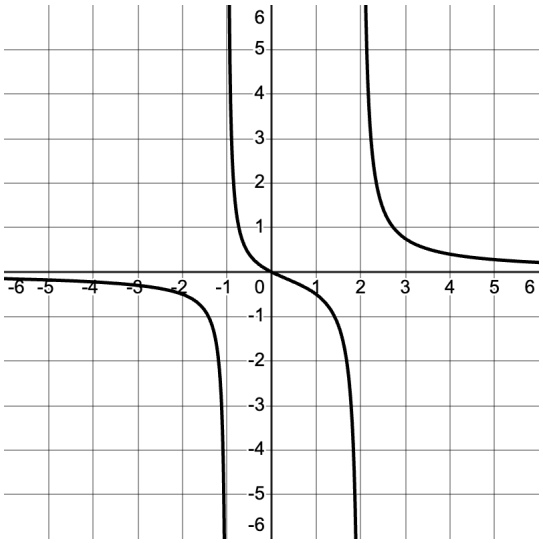
C.



D.



E.



11. Suppose $f(x) = \dfrac{x^3}{3} - 2x^2 + 3x + 1$. If M is the absolute maximum of f over the interval $[0, 2]$ and m is the absolute minimum of f on the same interval, what is $m + M$?

A. $\dfrac{5}{3}$

B. 4

C. $\dfrac{7}{3}$

D. $\dfrac{8}{3}$

E. $\dfrac{10}{3}$

12. Determine the interval(s) where $f(x) = x^4 e^x$ is concave up.

A. $(-\infty, -6) \cup (-2, \infty)$

B. $(-4, 0)$

C. $(-6, -2)$

D. $(-\infty, -4) \cup (0, \infty)$

E. $(-\infty, \infty)$

(This page left intentionally blank for scratch work.)