

MATH 165
Exam 2
Spring 2024

Student name: _____
Recitation instructor: _____
Section: _____

*This exam is closed book and closed notes. No electronic devices, including calculators and headphones, are allowed. Drawing pictures to help understand and solve the questions is encouraged. Answer each question completely using exact values; you do not need to simplify your answers unless otherwise indicated. Show your work neatly. Include correct notation. Show the steps in your work. Write legibly. **Answers without work and/or justifications will not receive credit.** Circle your final answer for each problem. Each problem is worth 10 points.*

1	
2	
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DO NOT BEGIN THIS EXAM UNTIL INSTRUCTED TO START

Do not write
in these boxes →
on the exam

score

1. Use logarithmic differentiation to find $\frac{dy}{dx}$ if $y = x (\cos x)^x$.

Your answer should be a function of x only. Do not simplify after computing derivative(s).

score

2. Find the equation for the tangent line to the implicit curve

$(\arctan(y))^2 + xy = \frac{\pi^2}{16}$ at the point $(0, 1)$.

score

3. Use linear approximation to estimate $f(0.01)$ where

$$f(x) = \frac{16}{\ln(x+1) + 2}.$$

score

4. When two resistors (R_1 and R_2) are connected in parallel in an electrical circuit, the total resistance (R), measured in ohms, is given by:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

At a certain time, $R = \frac{1}{6}$ ohm, $R_2 = \frac{1}{4}$ ohm, and R_2 is increasing at 5 ohms/min. If the total resistance is increasing at 2 ohms/min, find the rate at which R_1 is changing. Include units.

score

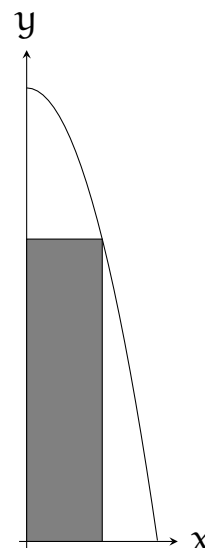
5. Let $f(x) = -x^5 - 5x^4 + 20x^3 + 15$.

(a) (4 points) Find all the open intervals where $f(x)$ is increasing or decreasing. Explain your answer.

(b) (6 points) Classify each critical point of $f(x)$ as a local maximum, a local minimum, or neither. Explain your answer.

score

6. Jack the gardener wishes to enclose a rectangular shaped garden within a given region, as is shown in the picture. Find the maximum area of the rectangular garden if the boundaries of the given region are the x -axis, the y -axis, and the curve $y = -x^2 + 12$.
Be sure to explain why your answer is the maximum area.



score
