

Math 103E Calculus with Analytic Geometry I

Common Final Examination

Sample 2

Name: _____

GCC ID # _____

Instructor: _____

INSTRUCTIONS

- To receive full credit, you must show all work and box final answers.
- If you need extra space, use the blank facing page.
- Simplify all answers completely and fully.
- Round all decimal answers to four places.
- No reference material of any kind is allowed.
- Keep your photo ID out on your desk during the entire exam.
- Only basic calculators and scientific calculators are allowed. No graphing calculators, computers, or any devices capable of storing alphabetic characters. No calculators embedded in other devices such as cell phones, watches, pagers, address books, etc. are allowed.

Problem 1. For the function $f(x) = \ln(x^2 + 1)$ answer the parts below.

- a) Find the intervals on which the function is increasing.
- b) Find the inflection points of the function.

Problem 2. Find the derivative of

$$y = \frac{x \sinh(x)}{3x^2 + 4x}.$$

Problem 3. Find the limit or prove it does not exist.

$$\lim_{x \rightarrow 3} \frac{x^2 - 9}{|x - 3|}$$

Problem 4. Find the limit or prove it does not exist.

$$\lim_{x \rightarrow \infty} x (e^{2/x} - 1)$$

Problem 5. Determine the values of constants a and b so that g is continuous at $x = 1$.

$$g(x) = \begin{cases} 5x - 2 & \text{if } x < 1 \\ a & \text{if } x = 1 \\ ax^2 + bx & \text{if } x > 1. \end{cases}$$

Problem 6. Suppose you are writing an epsilon-delta proof for $\lim_{x \rightarrow 2} x^2 + x - 2 = 4$. Show all side-work to determine how to select delta.

Problem 7. Use the limit definition of the derivative to find the derivative of $f(x) = \frac{1}{\sqrt{x-3}}$.

Problem 8. Evaluate the integral.

$$\int_{\pi/8}^{\pi/4} \frac{\cos(2x)}{\sin^4(2x)} dx$$

Problem 9. Use implicit differentiation to find $\frac{d^2y}{dx^2}$ for $2x^2 - 3y^2 = 8$.

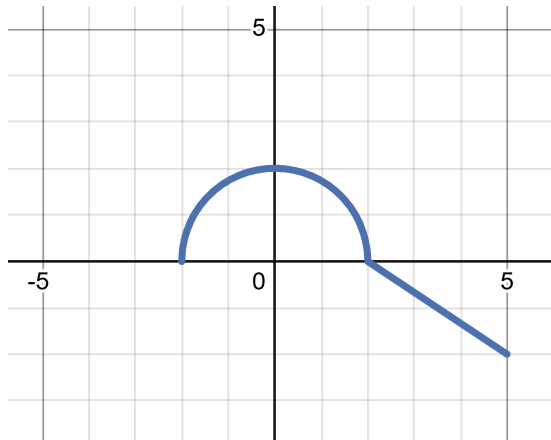
Problem 10. Find two positive numbers such that the sum of twice the first number and three times the second number is 192 and the product is a maximum.

Problem 11. For the function $f(x) = \ln(x - 1)$, find the value(s) of x which satisfy the Mean Value Theorem on the interval $[2, 4]$.

Problem 12. Identify the absolute maximum and minimum values of the function on the given interval:

$$f(x) = x\sqrt{4 - x^2} \quad \text{on } [-2, 2].$$

Problem 13. Evaluate $\int_{-2}^5 f(x) dx$ where f is the function whose graph is shown below.



Problem 14. Evaluate the integral.

$$\int_{-\pi}^0 3 \sin x \sqrt{1 + \cos(x)} dx$$

Problem 15. Use a linear approximation to estimate $\sqrt{25.04}$.

Problem 16. Evaluate the integral.

$$\int \frac{e^{\tan^{-1} x}}{3 + 3x^2} dx$$