Math 108-03
Spring 2026
Dr. Lily Yen

Midterm II

Show all your work

Name: ____________________

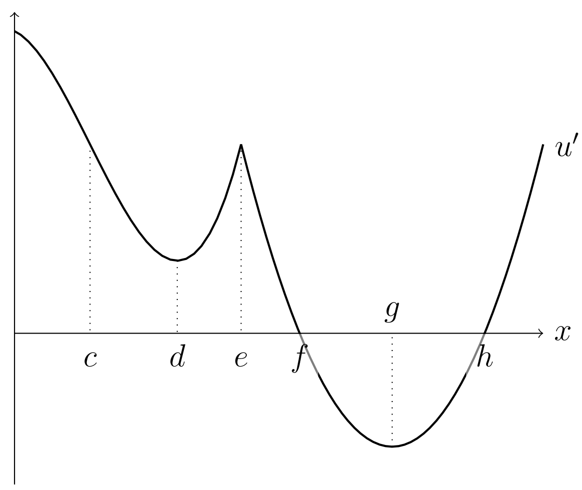
Number: ____________________

Signature: ____________________

Score: ___/40

No Calculator allowed in this part.

Problem 1: Given the derivative graph of u below, answer the following questions.



a. List the open interval(s) of x where the function u is increasing .

b. List open interval(s) where the graph of u is concave down.

c. List all values of x where the graph of u has an inflection point.

d. Give all values of x where the graph of u has relative extremum. Specify each as a relative maximum or a relative minimum.

e. Sketch the function u directly on the given coordinate system.

Score: /8

Problem 2: Sketch the graph of a single function satisfying all of the following conditions. • The function is continuous and differentiable for all real numbers except at $x = 3$ where it has a vertical asymptote; • $f'(x) < 0$ everywhere it is defined; • A horizontal asymptote at $y = 1$; • $f''(x) < 0$ on open intervals $(-\infty, 3) \cup (4, 7)$, and • $f''(x) > 0$ on the open interval $(3, 4) \cup (7, \infty)$. Asymptotes must be labelled in your graph.

Score: /4

/12

Math 108-03
Spring 2026
Dr. Lily Yen

Midterm II

Show all your work

Name: ____________________

Number: ____________________

Calculators allowed for this part.

Problem 3: Consider the following implicitly defined relationship:

$$y^2(x^2 + y^2) = 20x^3$$

a. Determine dy/dx.

Score: /3

b. Find the equation of the tangent line at the point $(1, 2)$.

Score: /3

Problem 4: Lake Capilano polluted by bacteria is treated with an antibacterial chemical. After t days, the number N of bacteria per millilitre of water is approximated by

$$N(t) = 15\left(\frac{t}{12} - \ln\left(\frac{t}{12}\right)\right) + 43$$

for t in $[1, 15]$. Use calculus techniques to answer the following.

a. When during this time will the number of bacteria be a minimum?

b. When during this time will the number of bacteria be a maximum? What is the maximum number?

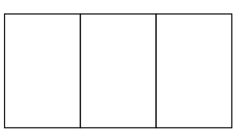
Score: /5

/11

Problem 5: Madame Blueberry is standing on an 8 ft ladder placed against a building trying to paint a window frame blue. The base of the ladder begins slipping away from the building at a rate of 2 ft/min. Find the rate at which the top of the ladder is sliding down the building at the instant when the bottom of the ladder is 3 ft from the base of the building.

Score: /4

Problem 6: The Count of Transylvania is conducting a research project on breeding Transylvanian dragons in captivity. He first must construct suitable pens. He wants a rectangular area with two additional fences across its width, as shown in the diagram. Find the maximum area he can enclose with 3500 m of fencing. Calculus techniques must be used.



Score: /5

/9

Problem 7: Use Linear Approximation to estimate $\sqrt[3]{8.001}$.

Score: /4

Problem 8: Sociologists have found that crime rates are influenced by temperature. In a prairie town of 100 000 people, the crime rate has been approximated as

$$C(T) = \frac{1}{10}(T - 60)^2 + 100$$

where C is the number of crimes per month and T is the average monthly temperature in degrees Fahrenheit. Given that the average temperature for May was 55°F, answer the following.

a. What was the number of crimes in May predicted by the crime rate function?

b. Suppose the maximum error for the average temperature in May was 1°F, how would such an error in average temperature affect a change in the crime rate?

Score: /4

/8