

MATH 117: MIDTERM 1B

Wednesday, October 28th, 2026

Name: _____

Student ID #: _____

Signature: _____

This is a closed-book and closed-note examination. Calculators are not allowed. Please show your work in the space provided. I will provide scratch paper—other forms of scratch paper are not permitted. If you continue a problem on the back of a page, please write “continued on back”. Partial credit will be given for partial answers. You have 1 hour and 15 minutes.

Question	Points	Score
3	16	
4	8	
Total	24	

Question 3 (16 points)

Let k, m be positive integers, and let $a, b, c, d \in \mathbb{R}$ with $a \neq 0$ and $c \neq 0$.

(a) State the theorem that the limit of a quotient is the quotient of the limits.

(b) Prove that

$$\lim_{n \rightarrow +\infty} (cn^m + d) = \begin{cases} +\infty, & c > 0, \\ -\infty, & c < 0. \end{cases}$$

(c) Using part (b), explain why $cn^m + d \neq 0$ for all sufficiently large n .

(d) Prove that

$$\lim_{n \rightarrow +\infty} \frac{an^k + b}{cn^m + d} = \begin{cases} 0, & k < m, \\ a/c, & k = m. \end{cases}$$

Question 4 (8 points)

Lightning Round!

You do not need to show your work or justify your answers.

(1) Consider the set $S = \cup_{n=2}^{\infty} (\frac{1}{2^n}, 1]$.

(i) Does the set have a maximum? What is $\sup(S)$?

(ii) Does the set have a minimum? What is $\inf(S)$?

(2) Circle the correct answer:

(i) Which example fails the criteria for the theorem that the limit of a product is the product of the limits?

(a) $(1 + \frac{1}{n}) \cdot (2 - \frac{1}{n})$

(b) $(1/2)^n \cdot n$

(c) $(1/n) \cdot (\sin(n\pi)/(1 + e^{-n}))$

(d) $(n^{1/n}) \cdot (1 + 3/n)$

(e) $2^{-n} \cdot (1 + 2^{-n})$

(ii) Suppose the limit of s_n does not exist. What property *couldn't* s_n satisfy?

(a) bounded

(b) monotone

(c) unbounded

(d) nonnegative

(e) $s_n = -s_{n+1}$