Math 2505: Introductory Analysis

Midterm 2 — Sample

16 March 2026

Your name:

Exam structure

There are four questions on this exam, each worth six points.

University academic honour statement:

Dalhousie University has adopted the following statement, based on "The Fundamental Values of Academic Integrity" developed by the International Center for Academic Integrity (ICAI):

> Academic integrity is a commitment to the values of learning in an academic environment. These values include honesty, trust, fairness, responsibility, and respect. All members of the Dalhousie community must acknowledge that academic integrity is fundamental to the value and credibility of academic work and inquiry. We must seek to uphold academic integrity through our actions and behaviours in all our learning environments, our research, and our service.

1. For each of the following statements, fill in the blank with either "always" (A), "sometimes but sometimes not" (S), or "never" (N). You do not need to justify your answers. Read carefully.

   - An unbounded sequence of real numbers _____ converges.
   - An unbounded sequence of real numbers _____ contains a convergent subsequence.
   - A sequence which alternates in sign _____ converges.
   - A sequence x_n whose absolute value converges to zero _____ converges.
   - An infinite subset of $\mathbb{R}$ _____ has a cluster point.
   - The product of two discontinuous functions is _____ discontinuous.

2. Each of the following sequences x_n converges to 0. Prove this by explicitly finding a formula for $N(\epsilon)$ such that if $n > N(\epsilon)$, then $x_n \in V_\epsilon(0)$.

   - $x_n = \dfrac{1}{n} + \dfrac{(-1)^n}{n+1}$

   - $x_n = \log(1 + 1/n)$

   - $x_n = \sqrt{n+1} - \sqrt{n}$

3. There are multiple theorems in the class and the textbook with the name "Squeeze Theorem." Carefully state one of them.

4. Prove that if the set $\{x_n : n \in \mathbb{N}\}$ has multiple cluster points, then the sequence x_n diverges.