Math 121A Midterm Exam Review Outline

Topics: The midterm exam will cover the mathematical topics from class meetings during week one through week four. The relevant homework assignments are HW1, HW2, HW3, HW4, and HW5. The relevant in-class problems are those from week one through week four (you can find copies of the in-class problems on the course calendar). If you know how to solve all of the in-class problems/proofs and all of the homework problems on your own and without any assistance, then you should do very well on this exam.

Theorems and Definitions: You are responsible for knowing the following definitions as well as the statements of the following theorems together with their proofs unless otherwise specified. You should be comfortable using the definitions and applying the theorems in contexts as in the homework and in-class problems.

- Def’n (and notation): Average rate of change of a function on an interval
- Thm: A function \( f : \mathbb{R} \to \mathbb{R} \) is linear if and only if its average rate of change is the same on any interval.
- Vocab: Be familiar with the terms “sequence of first differences”, “sequence of second differences”, etc. and know how to calculate them.
- Thm: A sequence is a linear (aka arithmetic) sequence if and only if its sequence of first differences is a constant (non-zero) sequence.
- Thm: A sequence is a quadratic sequence if and only if its sequence of second differences is a constant (non-zero) sequence.
- Thm’s: If the sequence of third difference of a given sequence is a constant (non-zero) sequence, then it is a cubic sequence. If the sequence of fourth difference of a given sequence is a constant (non-zero) sequence, then it is a quartic sequence, etc. You will not be asked to prove these higher degree analogs.
- Thm: A sequence is an exponential (aka geometric) sequence if and only if dividing any term in the sequence by the preceding term always results in the same (non-zero) number.
- Vocab: Be familiar with the term “percent error”, and know how to calculate a percent error by comparing an approximate value to an actual value.

Other notes:
- The exam is closed book and closed notes. You will be allowed to use a calculator that we provide.
- In case you find them useful, the following formulas will be written on your exam sheet.

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\begin{align*}
(1) \quad \sum_{i=1}^{n} i &= \frac{n(n + 1)}{2} \\
(2) \quad \sum_{i=1}^{n} i^2 &= \frac{n(n + 1)(2n + 1)}{6}
\end{align*}
\]