Calculus 101 Midterm 1
Review List, Prof. Donnay

The following are the topics we have covered and that could be on the test:

S. 1.1: ways to represent a function: graphical, via data table, formulas (analytic), in words. Be able to draw or interpret a function that is given by any of these ways.

S. 1.2 Essential Functions: Be able to graph/recognize: linear functions, quadratic functions, sin(x) and cos(x), 1/x. Be able to shift these basic functions to get new functions (S. 1.3). Take composition of functions.

Finding tangent line to a curve:
- get slope of tangent line as limit of slopes of secant lines.
  o Be able to estimate slope of tangent line using a data table and using numerical calculations (S. 2.1)
  o (S. 3.1, S. 3.2) Be able to calculate the slope of tangent line starting from the definition of derivative (fill in the following definition)

\[ f'(x) = \lim_{h \to 0} \frac{f(x+h)-f(x)}{h} \]

  o Calculate slope of tangent line using the Derivative Rules (S. 3.3).

- understand why the formula \[ f(x+h)-f(x) \]
  \[ h \]
  gives the slope of the secant line and

why \[ \lim_{h \to 0} \frac{f(x+h)-f(x)}{h} \]
gives the slope of the tangent line.

Understand that in addition to the slope of the tangent line, the derivative can give the (instantaneous) velocity or (instantaneous) rate of change.
- Be able to calculate velocity or rate of change using the same approaches listed above that one can use to find slope of tangent line. (S. 2.1, 3.1, 3.2, 3.3): i.e. find average velocity or average rate of change and then take limit as second point approaches the first.
- Instantaneous velocity is the limit of average velocity. Instantaneous rate of change is the limit of average rate of change.
- Be able to do word problems associated with velocity and with rate of change.

Limits (S.2.2, 2.3): In order to calculate \( f'(x) \) using the definition of derivative, we need to take a limit.
S. 2.2:
- Limit exists when both left hand limit and right hand limit exist and are equal
- Vertical asymptote is a special type of limit
Know how to take estimate limits when given a graph, or given data.

- Know how to take limits using the Limit Laws (S. 2.3) and how to handle special cases when limit = 0/0.
- Know how to take limit by “plugging in the value” but that you can do this only when the function is continuous.

**Continuous functions:** (S. 2.5)
- Know the definition of a continuous function: \( \lim_{x \to a} f(x) = f(a) \)
  and how to check whether a function is continuous.
- When a function is continuous, we can evaluate the limit by “plugging in” in the value.
- The following types of functions are continuous: *make a list*