The midterm will mostly cover Chapter 2, but Chapter 1 skills are needed at all times. The questions will be like assigned problems in Chapter 2. Note section 2.4 is skipped.

There are many old versions of Midterm Exam 1 on the "Exam" tab on the website.

Here are important topics which you should review and make sure you understand, with the sections where they appear. Find and do example problems from each topic!

- average velocity and secant line slope §2.1
- definition of the basic (two-sided) limit $\lim_{x\to a} f(x)$ as a sentence §2.2
- one-sided limits §2.2
- infinite limits §2.2
- limits at infinity §2.6
- vertical and horizontal asymptotes are defined by limits §2.2, 2.6
- using values close to $x = a$ to estimate the limit §2.2
- using algebra and limit laws to compute limits §2.3, 2.6
- getting limits from a given graph *or* using given limits and values to generate (sketch) a graph §2.2, 2.3, 2.5, 2.6
- definition of continuity §2.5
- common functions are continuous on their domains §2.5
- using the Intermediate Value Theorem to show equations have solutions §2.5
- definition of the derivative as a limit §2.7
- computing a derivative from the limit definition §2.7, 2.8
- tangent line slope and instantaneous velocity: they are derivatives §2.7
- find equation of a tangent line §2.7
- the derivative as a new function derived from $f(x)$ §2.8
- sketching $f'(x)$ based on $f(x)$ §2.8
- notation: $f'(x) = y' = \frac{df}{dx} = \frac{dy}{dx}$ §2.8
- higher derivatives (and notation for them) §2.8

The reverse side has a few example problems; it is a worksheet not a sample of the Midterm Exam.

1. (§2.6 #9) Sketch the graph of a function that satisfies all these conditions:

$$f(0) = 3,\ \lim_{x\to 0^-} f(x) = 4,\ \lim_{x\to 0^+} f(x) = 2,\ \lim_{x\to -\infty} f(x) = -\infty,\ \lim_{x\to 4^-} f(x) = -\infty,\ \lim_{x\to 4^+} f(x) = \infty,\ \lim_{x\to \infty} f(x) = 3$$

2. Find $f'(x)$ using the definition if $f(x) = \sqrt{x}$.

3. (§2.7 #7) Using the result of the last problem, find an equation of the tangent line to $y = \sqrt{x}$ at the point $(1, 1)$.

4. (§2.6 #50) Find the horizontal and vertical asymptotes of the curve, and state the limits which justify these asymptotes:

$$y = \frac{1 + x^4}{x^2 - x^4}$$

5. (§2.3 #49) Let $g(x) = \frac{x^2+x-6}{|x-2|}$. (a) Find $\lim_{x\to 2^-} g(x)$ and $\lim_{x\to 2^+} g(x)$. (b) Does $\lim_{x\to 2} g(x)$ exist?