MATH 125 EXAM I REVIEW

Exam 1 will cover 4.9, 5.1 - 5.5, and 6.1 - 6.3. This review sheet discuss, in a very basic way, the key concepts from these sections. This review is not meant to be all inclusive, but hopefully it helps you remember basics. Please notify me if you find any typos on this review sheet.
If you understand the concepts behind all the homework problem and if you can complete them quickly and completely, then you will do well on the exam. The exam will test you on the same concepts and ideas as the homework problems.

1. A Chronological Review

- Section 4.9: Know how to find antiderivatives. Understand the significance of "+C". Understand how to find distance from velocity and velocity from acceleration by using antidifferentiation and initial values.
- Section 5.1, 5.2: Understand the development of the Reimann integral and the definition of the definite integral.

$$\int_a^b f(x)dx = \lim_{n\to\infty}\sum_{i=1}^{n} f(x_i^*)\Delta x$$

  Be comfortable with this right hand side and how to interpret the part $\sum_{i=1}^{n} f(x_i^*)\Delta x$ as the sum of approximating rectangles. In conjunction with these ideas, you should know how to approximate an integral by using n rectangles and either left-endpoints, right-endpoints, or midpoints.
- Section 5.3: The Fundamental Theorem of Calculus (FTOC). Know parts 1 and 2. By now you should understand the importance of the FTOC.

  Part 1: If $g(x) = \int_a^x f(t)dt$, then $g'(x) = f(x)$.

  Part 2: If F is any antiderivative of f (that is, $F'(x) = f(x)$), then

$$\int_a^b f(x)dx = F(b) - F(a).$$

  Part 1 gave us a derivative rule for integral functions with variables as endpoints. You should how and why to use the chain rule, and how and when to break up the integral into two parts. Part 2 is used in evaluating definite integrals. It is vital that you understand both of these parts.
- Section 5.4: The indefinite integral was defined as the general antiderivative and use the following notation

$$\int f(x)dx = \text{'the general antiderivative of } f(x) \text{ (don't forget "+C")'}.$$

  You should memorize all the basic integrals. Including $\int x^n\, dx$, $\int \frac{1}{x}\, dx$, $\int e^x\, dx$, $\int \sin(x)\, dx$, $\int \cos(x)\, dx$, $\int \sec^2(x)\, dx$, $\int \csc^2(x)\, dx$, $\int \csc(x)\cot(x)\, dx$, and $\int \sec(x)\tan(x)\, dx$. You should also know (from Calculus I) $\int \frac{1}{x^2+1}\, dx$ and from class $\int \tan(x)\, dx$.

- Section 5.5: Here we introduce the first major integral techniques. Know how to set up and use the u-substitution template (as described in class). You should know how to choose your u effectively and efficiently. I have stressed this material in class and via practice sheets online, you should know this well.
- Section 6.1: Understand how to find the area between two curves. In particular, you should be able to draw a 'typical rectangle' and you should be able to decide if x or y is a better choice.

$$\text{Using } dx\text{: } \int_a^b \text{TOP} - \text{BOTTOM } dx$$

$$\text{Using } dy\text{: } \int_c^d \text{RIGHT} - \text{LEFT } dy$$

- Section 6.2: Understand how to find volumes using the method of slicing. You should be able to draw a typical slice by cutting across the axis of rotation.

$$\text{Volume} = \int_a^b (\text{Area Formula for a Typical Slice})\ (dx \text{ or } dy)$$

  For solids of revolution, the slices are typically disks (Area = π(radius)^2) or washers (Area = π(outer radius)^2-π(inner radius)^2).
- Section 6.3: Understand how to find volumes using the method of cylindrical shells. You should be able to draw a typical shell and don't forget to label the radius as x or y.

$$\text{Volume} = \int_a^b (\text{Surface Area Formula For a Typical Shell})\ (dx \text{ or } dy)$$

$$\text{Volume} = \int_a^b 2\pi(\text{Radius Formula})(\text{Height Formula})\ (dx \text{ or } dy)$$

  Using either of these methods takes practice (there is plenty of problems to practice on in your book).

2. Miscellaneous

- One interpretation of the integral was: 'the integral of a rate of change of a quantity gives the net change in that quantity'.
  (a) Big Example: $\int_a^b v(t)dt = s(b) - s(a)$ We used this to answer questions about 'falling tomatoes' and 'falling rocks'. We also discussed particles moving on a straight line. You should know how to answer questions about 'displacement' and 'total distance traveled'.
- You should know what L_n, R_n and M_n represent as approximations to integrals and how to compute them (even if you don't have a picture).