• By-Hand Exam 2 covers 3.7, 4.1, 4.2, 4.3, 5.1, 5.2, 5.4, 5.5, 5.8, 6.1, 6.2, 6.3, 6.4 unless otherwise noted below.

• For Sec 3.7 - Related Rates: A question from this section could be like the one given on Quiz 7 which came from problems 16 & 17 and relied on the use of right triangles and Pythagorean’s Theorem. Other problems to be comfortable with are 1-6 in 3.7.

• For 4.1 - Implicit Differentiation: Any implicit differentiation problem given to you will be one that you can solve for $y$ and then differentiate (like problem 9/Quiz 8) or one that has $y$ terms by themselves and you can apply the generalized power rule to them (like problem 11). The generalized power rule on $y^n$ gives the following result: $\frac{d}{dx}[y^n] = ny^{n-1}\frac{dy}{dx}$. Note you may also be asked to take a derivative for functions like those in Quick Check #1.

• For 4.2 - Derivatives of Logs: You need to be able to use the derivative rules: $\frac{d}{dx}[\ln(x)] = \frac{1}{x}$ and $\frac{d}{dx}[\ln(ax)] = \frac{1}{x}$. Note that you may need to apply rule for simplifying logs before differentiating. See problems 1, 2, 9, 10, quick check 2bc, and Quiz 8.

• For 4.3 Derivatives of Exponentials: You need to be able to use the derivative rules: $\frac{d}{dx}[e^x] = e^x$ and $\frac{d}{dx}[ae^{ax}] = ae^{ax}$. You may need to simplify your function first than apply the derivative rule. See problems 11 and quick check 3ad. You do not need to study the material on inverse functions and their derivatives from this section.

• For 5.1 - Analysis of Functions I: You need to be able to find intervals on which a function $f$ is increasing, decreasing, concave up, concave down and points of inflection for $f$ when you are given a graph (problem 7), a sign chart (problems 9 and 10) or a function (problems 11 - 16). You should also be able to sketch a continuous curve with stated properties of $f$, $f'$ and $f''$ (problems 35 and 36). See also Quiz 9.

• For 5.2 - Analysis of Functions II: Be able to use the First Derivative Test or the Second Derivative Test to locate relative extrema for a function - like in problems 3, 19, 20, 27, 28, 31. You should also be able to sketch a continuous function with stated properties like problems 1, 2. See also Quiz 9.

• For 5.4 - Absolute Maxima and Minima: Be able to find the absolute extrema on a closed interval like problems 7 - 10, Bonus Quiz 2. Be able to graph functions with specified extrema (absolute or relative) and end behavior like problems 3 and 4, Bonus Quiz 2.

• For 5.5 - Applied Maximum and Minimum Problems: You will have a problem like one of the following from this section - 3, 5, 11, 17, 19, 20, 21, 22, Quiz 10. You may need to solve the problem or like on Quiz 10 you may just need to set-up the problem – read the directions carefully!

• For 5.8 - Rectilinear Motion: Be able to interpret graphs like in problems 1, 2 and 4. You may also be asked to solve a problem like 13, 14 or Quiz 11 using a polynomial functions.
• For 6.1 - Overview of the Area Problem: Be able to do a problem like 13 - 18 where you graph a line and determine the area using geometry formulas. You may also be given a graph which you can use geometry to find the exact area (based on rectangles and triangles.)

• For 6.2 - The Indefinite Integral: You need to be able to find integrals using the following integration rules:

\[
\int dx = x + C \\
\int x^r \, dx = \frac{x^{r+1}}{r+1} + C \quad r \neq -1
\]

\[
\int e^x \, dx = e^x + C \\
\int e^{-x} \, dx = -e^{-x} + C
\]

\[
\int \frac{1}{x} \, dx = \ln |x| + C
\]

\[
\int cf(x) \, dx = c \int f(x) \, dx
\]

\[
\int [f(x) + g(x)] \, dx = \int f(x) \, dx + \int g(x) \, dx
\]

\[
\int [f(x) - g(x)] \, dx = \int f(x) \, dx - \int g(x) \, dx
\]

• For 6.3 - This is not on your By-Hand exam!

• For 6.4 - Area as a Limit; Sigma Notation: Be able to write a given expression in sigma notation (problems 3 - 8), using the given formulas \( \sum_{k=1}^{n} k = \frac{n(n + 1)}{2} \), \( \sum_{k=1}^{n} k^2 = \frac{n(n + 1)(2n + 1)}{6} \) and \( \sum_{k=1}^{n} k^3 = \left[ \frac{n(n + 1)}{2} \right]^2 \) be able to find the sum of an expression (problems 11 - 16). Given a function and its graph on an interval, you may also be asked to draw in 4 or 5 rectangles to approximate the area and then calculate the approximate area. The rectangles you will use will either be with height from the left endpoint, right endpoint or midpoint of each subinterval.

• You will have one question that includes three derivatives - one each from Chapter 4 sections.

• You will have one question that includes three integrals from Chapter 6.

• You will have one sketching problem.

• Your exam will consist of 8 - 10 problems.