

The following is a study guide. It lists the topics that will definitely be on the final and those that a few questions will be selected from. You can look at it as one of those travel guides that gives you a plan according to the amount of time you have to spend in a city or a region: if you have 3 hours to study, definitely review those topics that will be on the final. If you have 6 hours to study, in addition to those topics mentioned above, review the concepts that could be on the final. If you have 10 or more hours to study, do practice problems from the chapter reviews, review your old midterms and the practice midterms and the examples done in class, and if possible your homeworks. Most of the questions on the final will be questions you have already seen, changed a bit. You should also know the basic theorems, derivative tests and definitions that we learned in class. Good luck!

- Topics that will DEFINITELY be covered on the final:
  - Note that some of these will be covered directly in questions while others will be parts of other questions.
  - Functions and their domains (1.4)
  - Limits - what are they, their properties, finding them (1.5)
  - The slope of a graph and the definition of a derivative - and how to find the derivative of a function using the definition of the derivative (using the limit  $h \rightarrow 0$ ... (2.1)
  - Derivatives and all the different rules - product rule, quotient rule, chain rule... (2.2, 2.4, 2.5)
  - Using derivatives to answer application questions - such as velocity/acceleration or rates of change (2.3, 2.8)
  - Trigonometric functions and their properties (including their derivatives!). In particular, values of the trig functions on the unit circle (8.1-8.4)
  - Finding critical points of functions in order to find intervals on which the function is increasing or decreasing (3.1)
  - Finding maximum and minimum points (3.2)
  - Finding the points of inflection of a function and the intervals on which its concave up or down (3.3)
  - Using the second derivative test to find if a point is a maximum or a minimum (3.3)
  - Sketching a curve by analyzing its domain, its extrema points, the intervals on which its increasing/decreasing/concave up/concave down and its inflection points (3.7)
  - Optimization problems (3.4, 3.5)
  - Finding differentials of functions (3.8)
- From the following list, a few topics will be covered, though not all of them will be on the final for certain.
  - Topics that could be covered on the Final:
    - The distance formula (1.1)
    - Writing the equation of a circle and graphing a circle **correctly** (1.2)
    - One-sided limits (1.5)
    - Definition of continuity (1.6)
    - Average rate of change (2.3)
    - Marginals (2.3)

- Implicit differentiation (2.7) (note that implicit differentiation is an extremely important part of rates of change problems and will be covered through those)

- The difference between relative extrema and absolute extrema (3.2)

- Asymptotes will be covered through section 3.7, direct questions such as in section 3.6 may or may not appear.

For possible questions, look at old midterms and practice midterms, class notes and homeworks. For practice, you can do the chapter review questions on the subject or other problems in the book.

- Here are sample questions that we hadnt covered yet on any midterm (sections 3.3-3.5, 3.7, 3.8):

1) Identify all relative extrema and points of inflection for the following, as well as intervals of concavity: (many more problems like these in section 3.3 or 8.4)

a)  $f(x) = x^3 - 12x$

b)  $f(x) = \frac{x}{x^2 - 1}$

c)  $f(x) = x^{2/3} - 3$

d)  $y = 2\sin(x) + \cos(2x)$

2) Analyze the functions above and graph them.

3) The difference of two numbers is 50. Find the two numbers such that their product is a minimum. What if the they both have to be positive?

4) Find the point on the line  $2x + 3y + 5 = 0$  that is closest to the point (-1, -2). (There are many more such problems in section 3.4 and in the chapter review).

5) Find the differential  $dy$  of the following:

a)  $y = x^2 + 17$

b)  $y = \frac{5x - 8}{9}$

c)  $y = 6x^4 - 5x^3 + 18$

6) For 5a) above, find the value of  $dy$  when  $x = 2$  and  $dx = 0.01$ .