This is a review sheet for the second midterm in Hillel's MAT 16A. It is a list of the topics that will be covered on the exam along with sample questions. The exam itself will **not** be this long!!! Some of the questions on it though will be very similar to questions on this review sheet and/or the homework. Good luck studying!

Chapter 2

- Sections 2.4 - 2.7, 8.4

  - Know how to take derivatives using the product rule, the quotient rule and the chain rule (2.4-2.5)

  - It might be wise to simply ask yourself which rule you should use before using it, just to think about the problem first.

  - Know how to take derivatives of trigonometric functions (8.4) (you should also know the different trig functions and their values on the unit circle as we did in class - (8.1-8.3))

  - Know how take the second, third, fourth... derivatives of different functions. (2.6)

  - Know how to take the implicit derivative of a function (2.7)

  Sample problems:
  1) For the following, find their derivatives:
  a) $f(x) = (3x^5 - 17)(x^4 - 18x^2 + 29)$

  b) $\cos(x), \sin(x), \tan(x), \csc(x), ...$

  c)$f(x) = \dfrac{\cos(x) + 4}{8x^2 + 1}$

  c) $f(x) = \sqrt[5]{8x + \frac{2}{x}}$

  d) $\dfrac{(4x^5 - 3x + 7)^2}{5x + 1}$

  e) $\cot(3x + 1)$

  You could find many more examples in the book, homework, class notes, etc.

  2) For the following, find $f''(x)$ and $f^{(3)}(0)$:
  a) $f(x) = \cos(x)$

  b) $f(x) = \sqrt[3]{x + 1}$

  3) Solve for $\frac{dy}{dx}$:
  a) $y^2 + x^3 = 8x$

  b) $3xy^2 + 15x = \frac{\cos(x)}{3}$

  c) $(2x^2y^4 - 5)^3 = 8$
- Sections 2.3, 2.8 - Applications!

- Know the difference between average rate of change and instantaneous rate of change (2.3)

- Given a position or height function, know how to find the velocity and/or acceleration functions (2.3)

- Know how to solve word problems with related rates (2.8)

Sample problems:

4) Find the average of change of $f(x) = \dfrac{2x+7}{x^2}$ on [0, 2] and on [-5, -1].

5) A diver jumps from a diving board that is 64 feet high. She jump up with an initial velocity of 48 feet a second. Use that information to write the height function, $h = -16t^2 + v_0 t + h_0$. Then calculate the time she hits the water and her velocity and acceleration at that time.

6) A 30 foot ladder is leaning against a house. The base of the ladder is pulled away from the house at a rate of 4 feet a second. How fast is the top of the ladder moving down when the base is 8 feet away.

There are many more related rates and/or velocity/marignals questions in the book. You are responsible for those that were covered in class or in the homework. If we didn't cover them, you are not responsible for them. Make sure though you get enough practice doing these! You can also look in the chapter review - p. 166-169.

- Chapter 3

Sections 3.1-3.2 - Know what it means for a function to be increasing or decreasing (3.1)

- Know how to find the intervals where a function is increasing or decreasing (3.1)

- Know the difference between relative and absolute extrema (3.2)

- Know how to find extrema and how to classify them as relative/absolute max/min (3.2)

- Know the extreme value theorem (3.2)

7) For the following functions, find the intervals on which they are increasing or decreasing and label them as such.

a) $f(x) = \frac{x^2}{4} - 4x$

b) $f(x) = (x^2 - 9)^{4/5}$ on [-4, 5] (watch out for the undefined part...)

c) $f(x) = 2\cos(x)$ on $[0, 2\pi)$

8) For the functions above, find their relative max/min and absolute max/min.