Midterm I Review Problems
Math 140B

1. Chapter 1

   (a) page 62, problems 2 - 7, 13, 16, 17, 18, 19 - 22, 27, 38 - 42.

   (b) page 65, problems 2, 3, 5, 6, 9, 20 - 22, 30.

2. Chapter 2

   (a) page 155, problems 4 - 21, 24 - 40, 42, 44

   (b) page 157, problems 4 - 45.

3. Additional Material

   (a) Show that the function $f(x) = x^4 + x - 2$ has a real root on the interval $[1, 2]$ (i.e., crosses the x-axis.)

   (b) Show that the function $f(x) = 4x^3 - 6x^2 + 3x - 2$ has at least one real root.

   (c) Show that the equation $\sin(x) = x^2 - x$ has at least one solution

4. (Chapter 3) For each of the given functions,

   (a) Find the x- and y- intercepts.

   (b) Find the intervals where $f(x)$ is increasing or decreasing.

   (c) Find and classify all local extrema.

   (d) Find the intervals where $f(x)$ is concave up or concave down.

   (e) Find all points of inflection (if any).

   (f) Sketch a graph of the function $f(x)$ on the set of axis given below. *Also please be sure to label your graph with* **all** *points found in parts (a)-(e).*

       i. $f(x) = 2 - x^2$

       ii. $f(x) = 2x^3$

       iii. $f(x) = x^2 + x - 2$

       iv. $f(x) = 3x^4 - 16x^3 + 18x^2$ (§3.2, problem 7)

       v. $f(x) = 3x^3 - 36x - 3$ (§3.2, problem 4)

       vi. $f(x) = x + \cos(2x)$ (§3.2, problem 19)

       vii. $f(x) = \sin(x) + \cos(x)$ (§3.2, problem 33)

       viii. $f(x) = 1 - x^3$

       ix. $f(x) = 3x^4 + 4x^3$ (§3.2, problem 13)

       x. $f(x) = (x + 2)^3$ (§3.2, problem 20)

       xi. $f(x) = 2x^3 + 3x^2 - 36x$

       xii. $f(x) = x^4 - 2x^2 + 3$

       xiii. $f(x) = 4x^3 - x^4$

5. (Chapter 3) For each of the given functions,

   (a) Find the y- intercept only (the x-intercepts are messy).

   (b) Find the intervals where $f(x)$ is increasing or decreasing.

   (c) Find and classify all local extrema.

   (d) Find the intervals where $f(x)$ is concave up or concave down.

   (e) Find all points of inflection (if any).

   (f) Sketch a graph of the function $f(x)$ on the set of axis given below. *Also please be sure to label your graph with **all** points found in parts (a)-(e).*

       i. $f(x) = 5x^3 - 3x^5$

       ii. $f(x) = 2x^3 - 3x^2 - 36x + 28$ (§3.2, problem 3)

       iii. $f(x) = 3x^3 - 36x - 3$ (§3.2, problem 4)

       iv. $f(x) = 80 - 9x^2 - x^3$ (§3.2, problem 6)

       v. $f(x) = x^4 - 6x^2$ (§3.2, problem 11)

       vi. $f(x) = x^2(3 - x^2)$ (§3.2, problem 22)

       vii. $f(x) = 3x^4 + 4x^3$ (§3.2, problem 13) item $f(x) = x^3 - 12x + 2$

       viii. $f(x) = 36x + 3x^2 - 2x^3$

6. (Chapter 3) Let $T(t)$ be the function that measures temperature (in degrees Fahrenheit) in State College as a function of time t during a 24-hour period. Assume $t = 0$ is midnight and it is the Summer Solstice (June 21, the longest day of the year). What do you think is true of $T(7)$ and $T'(7)$? How about $T(20)$ and $T'(20)$? Is it reasonable to conclude that at some point in the day $T(t) = 0$? How about $T'(t) = 0$?