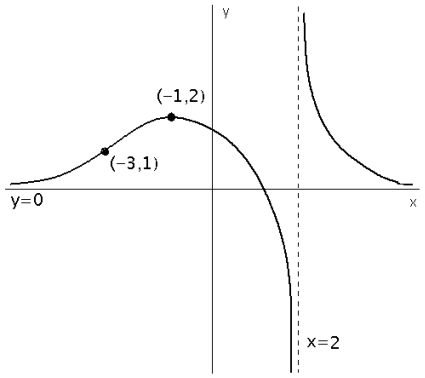
Math 1000 – Dalhousie University – Summer 2010

Assignment 7.5 – will not be graded

You should complete this assignment for your own benefit in preparation for Midterm 2. Solutions will be available online on Friday, July 30.
You are encouraged to schedule an appointment or come by during office hours to receive feedback on your completed assignment.

∗Bonus questions can be submitted for bonus marks on Wednesday August 4.∗

1. The graph of a function f is shown below.



   (a) What is the domain of f?

   (b) Estimate the x- and y-intercepts of f.

   (c) Is f an even function, an odd function, or neither?

   (d) Give the values of the following limits, and identify the corresponding asymptotes:

$$\lim_{x\to\infty} f(x) \qquad \lim_{x\to-\infty} f(x) \qquad \lim_{x\to 2^+} f(x) \qquad \lim_{x\to 2^-} f(x).$$

   (e) On what intervals is f increasing and decreasing?

   (f) Identify any relative extrema of f.

   (g) What are the intervals of concavity and point(s) of inflection of f?

2. Use the guidelines from class (A–G) to sketch the curve of each of the following functions.

   (a) $f(x) = \dfrac{x^2}{x^2+9}$

   (b) $f(x) = \dfrac{x^2+x+1}{x^2}$ (Note: Sometimes functions don't have x and/or y-intercepts!)

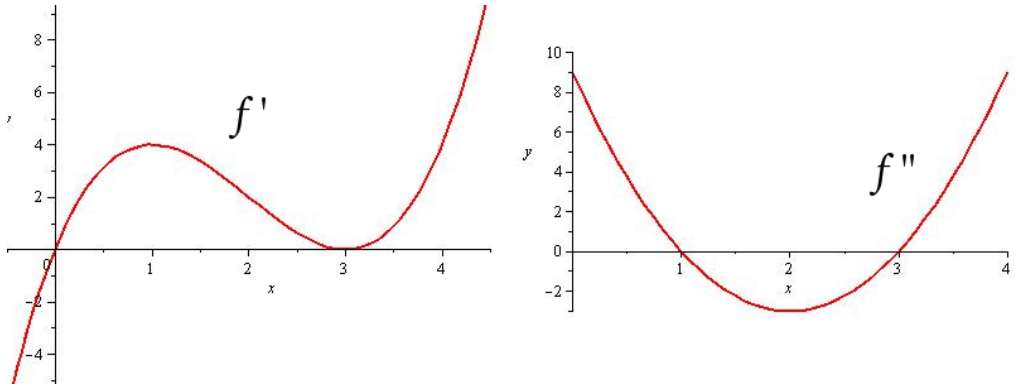
3. You are told to make a box with a square base and open top so that the volume of the box is 32000cm^3. Find the dimensions of the box that minimize the amount of material used. [Volume of a rectangular prism is $l \times w \times h$. To get surface area, add up the areas of each side, and remember there is no top side.]

4. Of all the pairs of positive numbers that multiply to give you 100 (that is, 2 numbers whose product is 100), which pair has the smallest sum?

5. I give you a piece of wire that is 10m long. I tell you to cut it into 2 pieces and to use one piece to make a square, the other to make an equilateral triangle. How should you cut the wire (how much wire for each shape) so that the total area enclosed by the two shapes is as big as possible?

[Hint: In an equilateral triangle, all sides are equal and all angles are equal. What is the total degree of all angles in a triangle? So what is the degree of each angle in an equilateral triangle? The height of an equilateral triangle is $\frac{\sqrt{3}}{2}$ times the length of one side.]

BONUS QUESTION (1): The graphs of the first derivative f' and the second derivative f'' of a function f are shown below.



(a) On what interval(s) is the *original* function f increasing? Explain.

(a) At what value(s) of x does f have a local maximum or minimum? Explain.

(a) On what interval(s) is f concave down? Explain.

(a) At what value(s) of x does f have a point of inflection? Explain.

BONUS QUESTION (2): Find the point on the line $y = -6x + 9$ that is closest to the point $(-3, 1)$. [Hint: See example 3, page 325 of the text.]