Math 320 – Review Questions
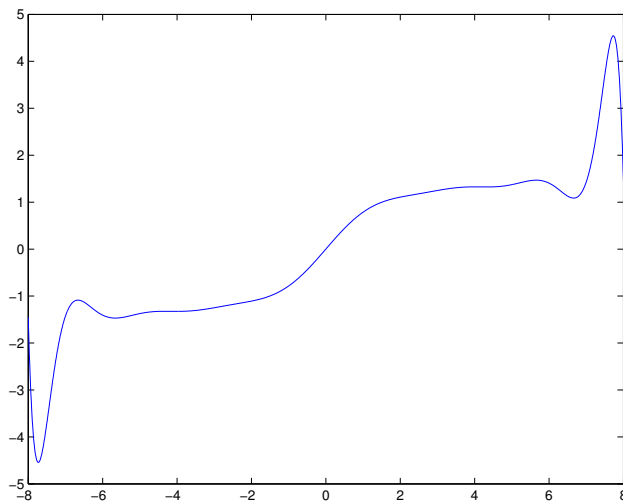
(10)   1. The polynomial $\chi(t) = t^7 - 12t^6 + 67t^5 - 230t^4 + 529t^3 - 814t^2 + 775t - 352$ is important in graph theory.

    (a) Write this polynomial in nested form.

    (b) How many multiplications are needed to compute $\chi(t)$ using Horner's algorithm?

(10)   2. The "logarithmic integral" function li is defined by $\mathrm{li}(x) = \int_0^x \frac{dt}{\ln t}$.

    (a) Given that $\mathrm{li}(4) = 2.96759$ and $\mathrm{li}(5) = 3.63459$, use linear interpolation to compute an approximation to $\mathrm{li}(4.3)$.

    (b) Give a good bound on the error in your approximation from part (a).
   (Hint: By the fundamental theorem of calculus, $\frac{d}{dx}\,\mathrm{li}(x) = \frac{1}{\ln x}$)

(10)   3. Find a cubic polynomial p that takes all of the following values:

x	0	1	2	3	4	5
$p(x)$	-82	-19	0	-1	2	33

(10)   4. A smooth function f has values

x	-.2	-.1	0	.1	.2
$f(x)$	0.67474	0.73282	0.78540	0.83298	0.87606

Compute $f'(0)$ as well as you can. Explain your method.

(10)   5. We used a MATLAB function `polyinterp(x,y,u)` to compute $P(u)$ where P is the interpolating polynomial with $P(x_i) = y_i$.

    (a) Write a MATLAB command (or commands) make a plot of P on the interval $[-8, 8]$, where P interpolates $\mathrm{atan}(x)$ for $x = -8, -7, -6, -5, \ldots, 5, 6, 7, 8$.

    (b) The result of part (a) would look like this:

Explain the picture.