MAT 331, Fall 2004. Problem Set 1

Due Sept 21st

(1) Factor the polynomial $x^4 - 2x^3 - 19x^2 + 70x - 50$, then find all its complex roots. [Hint: See factor and/or solve.]

(2) Plot the function $f(x) = 2sinx - x^3 - 5$, for $x \in [-4, 4]$. Find all the real zeros of the function with an accuracy of 20 decimal digits

(3) Consider the planar curve defined by $x^2y^3 + y^2 + y - 2e^x = 0$. Using only Maple, find the slope of the tangent line to the curve at (0,1) [Hint: See implicitdiff]. Then plot the curve and the tangent line on the same graph. [Hint: implicitplot belongs to the library plots.]

(4) Define a Maple function g that, given $k \in N$, yields the sum of the first k primes. Find a k such that $g(k) \le 90,000$ but $g(k+1) > 90,000$. Write the solution as text in the Maple worksheet. [sum, ithprime]

(5) For $i = 1, 2, .., 100$, write a list of pairs $[i, d(i)]$, where $d(i)$ is the ith decimal digit of π. Use this list to plot a polyline joining the points $(i, d(i))$ sequencially. [seq, floor and one or more of evalf, mod, modp]

Extra credit *The next problem is designed partly to frustrate you and partly to show that Maple can give you trouble, even when you do everything correctly. Hints are scattered throughout the text.]*

Define h(x) = (1+x) ex. Use Maple to evalute the following quantities: and h"(x)-h(x). Then solve the differential equation

$$y"(x) - y(x) = 2e^x, y(0) = 1, y'(0) = 2.$$

[It might take some time to find out how to use dsolve to solve a differential equation with initial conditions.] If there are no mistakes, the solution should coincide with h(x), but it doesn't look that way, even if you simplify it! At any rate, tell Maple to call f(x) this solution. [Cool Maple users try to never re-type what the computer just churned out; in this case rhs and unapply can help.] Plot f(x)-h(x), between–say–0 and 20. What happens? Can you explain why?

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