HOMEWORK #1

Due: January 24 (Wednesday) by midnight

Instructions:

- The assignment consists of *two* questions, worth 2 and 6 points.
- Submit your assignment *electronically* (via Email) to the instructor; hardcopy submissions will not be accepted.
- It is obligatory to use the MATLAB template file available at `http://www.math.mcmaster.ca/~bprotas/MATH3Q03/template.m` (see also the link in the "Computer Programs" section of the course website on the left); submissions non compliant with this template will not be accepted.
- Make sure to enter your name and student I.D. number in the appropriate section of the template.
- Late submissions and submissions which do not comply with these guidelines will not be accepted.

---

1. Write a MATLAB code which will estimate the level of round–off errors in a computer; more specifically do the following:

   (a) without using the intrinsic function `eps`, determine the value of ε for which $1.0+\varepsilon$ becomes indistinguishable from 1.0,

   (b) display where the round–off error appears by drawing a log–linear plot of $\frac{(1.0+\varepsilon)-1.0}{\varepsilon}$ as a function of ε.

   (2 points)

2. Write a MATLAB function `[R1, P1, R2, P2, K] = residue2(A,B)` that will perform a partial decomposition of a rational function $Q(x)=\frac{A(x)}{B(x)}$ with irreducible *quadratic* factors (cf. Exercise 2.2 on page 60). The returned vectors `R1(1:Kc,1:2)` and `P1(1:Kc,1:3)` should contain coefficients of the polynomials defining the Kc quadratic factors, whereas the vectors `R2` and `P2` should contain the coefficients of the polynomials defining the remaining linear factors (same as returned by the function `residue`). The vector `K` should contain coefficients of the quotient polynomial of $Q(x)$. Then:

   (a) use this new function to perform the partial fraction decomposition of

   $$Q(x)=\frac{x^5+3x^4+7x^3+16x^2+17x+18}{x^3+2x^2+4x+8}.$$

   Write out all the vectors returned by the function `residue2`.
   HINT — use the functions `residue`, `isreal` and `conv`; for simplicity, assume that in the vectors returned by the function `residue` complex conjugate roots occupy neighboring entries.

   (b) plot the function $Q(x)$ in the interval $[-1:1]$ with the step size of 0.01 and using a black solid line.

   (6 points)