# Homework #1 • MATH 322 • The Arithmetic of Complex Numbers

- please respect page limits. Have each problem start at the top of a new page.
- read the *Guideline* for assignments as posted on the class webpage.
- submit your write-up into your Section's box by noon, Friday 15 September.
- remember that webct is an open forum for discussion.
- please acknowledge collaborations & assistance from colleagues.
- attach another info sheet to the back of your assignment. Include your last name!

A) **Complex-Valued Solution to the Quadratic** (2 pages max, 10pts) As an alternative to invoking the quadratic formula, carry out the solution to the quadratic polynomial as posed in #10 on page 5 of the text. But, use the rectangular notation as your starting point, $z = x + iy$. During your solution, indicate at which steps you invoke the *new* arithmetic laws (i.e. commutative, associative, distributive & inverse) for complex numbers.

B) **A Trig Identity** (2 pages max, 10pts) As an application of Euler's formula, derive Lagrange's identity as set up for #10 on page 22 of the text. (This is a key identity in the development of Fourier series.) Annotate your derivation with the keywords describing each mathematical step.

C) **Computing Warm-up** (2 pages + 2 plotpages, 10pts) Download and execute the Matlab scripts *code01a.m*, *code01c.m* and the Maple worksheets *code01b.mw*, *code01d.mw* to reproduce the demo as shown in lecture. Modify the files to make the plots for a new polynomial $P(z)$ of your choice for which there are at least 3 non-real roots in the plotting domain. (The lines you need to edit are identified by comment lines containing CAPS.)
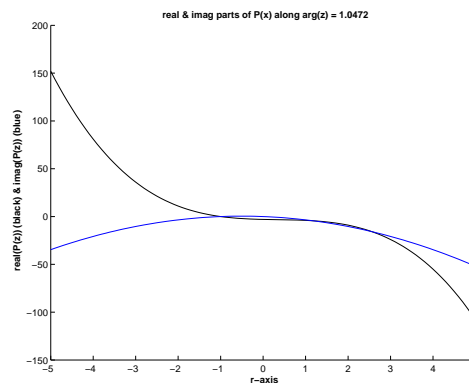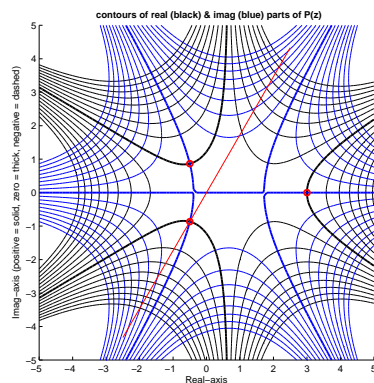


To become more familiar with the software, you should try experimenting with changes to the scripts/worksheets, or running them line-by-line. For your example polynomial, you might want to adjust some of the plot parameters/titles (especially the contour spacing).

It is NOT necessary to submit colour plots – although you may need to add some comments or hand-colouring for clarity. In any case, add hand-written annotations to your plots. Note that a complete set of annotations should allow the reader to essentially recreate the plot. Indicate important features & any observations/conclusions that you identify on the plot (for ease of grading, thanks).

The main point of this exercise is to familiarize yourself with the editing, executing & printing from Matlab & Maple. However, there is a key theorem hidden in the geometry of your plots. List some geometric observations that you can make about the pattern of contours.

\*) **Extra Problems to Note** (optional) For those who are concerned about their understanding of the basics of complex numbers, I consider the problems listed below as introductory material for this class. Please read through them, you may offer them up as a discussion the in next tutorial if you wish.

- #5; page 5
- #1; page 7
- #3; page 11
- #1; page 13
- #11; page 14
- #1,5; page 21
- #2,3,6; page 28