MATH 149 **03/17/09**

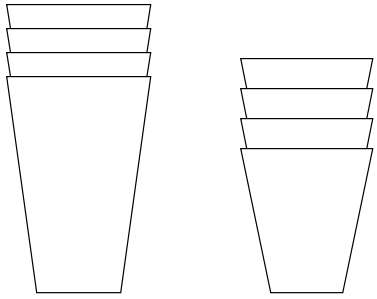
Problems

1. Factor $2x^4 + x^3 - 4x^2 - 10x - 4$ over $\mathbb{C}$. (Hint: use a calculator to graph this polynomial.)

2. Use a calculator to study the following limit: $\lim_{t \to 0} \dfrac{\sqrt{t^2+9} - 3}{t^2}$.
   First calculate the exact value of the limit (by hand).
   Try smaller and smaller values of t. What does the quotient in the limit approach?
   Graph the function in the limit and zoom in (a few times) around 0. What graph do you get? Explain why this happens.

3. When a few cups of each of two kinds, plastic and styrofoam, are stacked, the heights of the stacks are as given in the table below.

number of cups	height of plastic cups	height of styrofoam cups
1	12 cm	8 cm
2	12.8 cm	9 cm
3	13.6 cm	10 cm
4	14.4 cm	11 cm



   For each kind of cups, express the height of a stack of n cups as a function of n.
   Graph the two functions.
   For what number n will the two stacks of n cups have the same height?

4. We are busy making plans for our homecoming game. Since our team has been doing quite well, and because our facilities are very small, we will be faced with the unusual dilemma of limiting our ticket sales. We will use a technique called linear programming to determine the maximum number of adult tickets and student tickets that we can sell.

   1. There are only 200 seats in our stadium, so the sum of adult tickets and student tickets must be less than or equal to 200.

   2. For security purposes, we want to have at least one adult for every five students.

   3. The total from ticket sales must be at least $600. Student tickets are set at $3, and adult tickets are set at $5 each.

   4. For spirit purposes, we want the number of students to be at least twice as much as the number of adults.

   Introduce variables for the number of adults and the number of students, and write the inequalities.

   Using a graphing calculator, graph the corresponding equation for each of these inequalities. Copy that line to your graph paper. Since we are interested in eliminating those values that do not fit our conditions, shade in the area that does not fit the inequality. In a sense, you are reversing the shading.

   You should have created a polygon. Any point within this polygon will satisfy all of the conditions. Find the coordinates of each vertex. Find the total income at each vertex.