**MATH 149**

Problem Solving with Calculators

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: $\displaystyle\lim_{t\to 0} \frac{\sqrt{t^2 + 9} - 3}{t^2}$.
   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
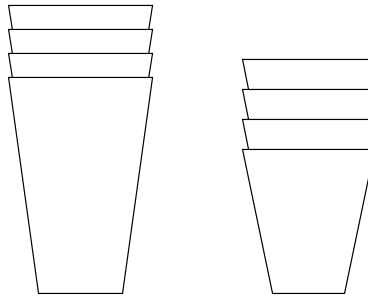
   For each kind of cups, express the height of a stack of n cups as a function of n.
   Graph the two functions.
   For what number n will the two stacks of n cups have the same height?

4. Solve the following inequalities by hand first. Give your answer in the interval notation. Then use a calculator to graph each left-hand side and check your answer.

   (a) $(x + 3)(x + 1)^2(x - 1)^3(x - 3) > 0$

   (b) $(x - 2)(x - 3) > 0$

   (c) $(x + 1)x(x - 1) < 0$

   (d) $(x + 2)(x - 1)^2 \geq 0$

   (e) $(x + 2)x^3(x - 3)^2(x - 5) \leq 0$