Math 341 ASSIGNMENT 2, WINTER 2017 **Due at the start of class on Mon, Jan 30th**

In this assignment you will be trying to find polynomials $y = a + bx + cx^2 + dx^3 + \cdots$ of various degrees whose graphs go through the points

$$(1, 2)\ , \qquad (4, 5)\ , \qquad (6, -3).$$

1. Suppose that we try to find a first degree polynomial $y = a + bx$ whose graph (a line) goes through the three points.

   (a) Give the system of equations obtained by substituting each of the three ordered pairs into $y = a + bx$.

   (b) Give the augmented matrix for your system and the result when you *rref*. What is it telling you, in terms of obtaining the equation of a line through the three points? **Answer with a complete sentence.**

2. Now we'll try to find a second degree polynomial $y = a + bx + cx^2$ whose graph (a parabola) goes through the three points.

   (a) Give the system of equations obtained by substituting each of the three ordered pairs into $y = a + bx + cx^2$.

   (b) Give the augmented matrix for your system and the result when you *rref*. What is it telling you, in terms of obtaining the equation of a parabola through the three points? **Answer with a complete sentence.**

3. Finally, we'll attempt to find a third degree polynomial $y = a + bx + cx^2 + dx^3$ through the same points. Begin by doing parts (a) and (b) of Exercise 1, but for this third degree polynomial. You can see that there are infinitely many solutions!

   (c) Give the general solution to the system. There should be one free variable - to make it easier to talk about, let's all use t for the free variable.

   (d) Substitute your a, b, c and d into $y = a + bx + cx^2 + dx^3$ to get a polynomial in the variable x, but with the additional parameter t. Give that polynomial, **with the constant term and each of the coefficients of x, x^2 and x^3 in parentheses**.

4. For this exercise you will use a web graphing utility called *Desmos*. Find it at www.desmos.com and choose "Start Graphing" when you get there.

   (a) On the first line enter the three points as ordered pairs separated by commas. You will see large dots appear at each of the three points.

   (b) Enter your polynomial from 3(d), with parentheses around the expressions for a, b,c and d. Click the little t that shows up in the blue box with add slider: next to it.

   (c) At this point you should see a curve going through the three points. If you work the slider, you will see the graph of the polynomial change, but every graph passes through the three points! Sketch **two separate graphs** of what you see when $t = -0.3$ (you can type in the value of t rather than using the slider) and $t = 0.3$.

   (d) What happens to the graph when $t = 0$? (**Write a sentence!**) Give the equation when $t = 0$ and tell where you've seen it before.