**wxMaxima Project II: Algebra Basics and Graphing**

**Instructions:**
Go to:

http://www.scotchildress.com/wxmaxima/Variables_Functions_Equations/Variables_Functions_and_Equations.html

and

http://www.scotchildress.com/wxmaxima/Plotting/Plotting.html

Read and follow along with the calculations for:

- Variables, Functions, and Equations
- Graphing Funcitons Using Maxima

Then do the following:

**Title and Stuff:**

1. Create a title cell: ctrl+2 and type "wxMaxima Project II"
2. Below that create a text cell (ctrl+1) and write your name
3. Below that create a text cell (ctr+1) and write the date

**Variables and Functions:**

1. Create a section title by typing (ctrl+3) "Variables and Functions"
2. Define the variable Q to have the value of 3π/7 by typing:

   Q:3%pi/7;

   Use wxMaxima to calcuate:

   a) 5Q-70/Q
   b) $Q^2 + \cos(2Q^3)$
   c) Clean up by killing Q. Issue the command:

   kill(Q);

3. Define the function:

$$P(x)=\frac{x^3-2\cos(x)}{x^2+1}$$

   by typing in:

   P(x):= (x^3 – 2*cos(x))/(x^2 + 1);

   Then find:

   a) P(π/4)
   b) 8P(π/3) – 2P(π/6)
   c) Use float() to approximate P(π/7).

d) $(\sqrt[3]{x}+1)P(x^{1/6})$ ; For this one note that Maxima understands $\sqrt[3]{x}$ as a fractional power.
e) Clean up by killing P.

4. Define $f(x)=\sqrt{x}-2\sqrt[3]{x}$ and $g(x)=x^6-2x^3+3x$ .
   a) Find g(f(x))
   b) Force Maxima to carry out the exponentiation using: expand(g(f(x)).
   c) Expand: $g(f(x^{12})+x^3)$

**Equations**

1. Create a new section titled: “Equations”
2. Name an equation and define it by issuing the commands:

   E: 3*x+2 = 7;

   a) Solve the equation by issuing the command: solve(E).
   b) See what happens if you try: $E^2$ or expand($E^3$).

3. Try solving the equation: $4x^6-16x^5+17x^4+3x^3-11x^2+x+2=0$ using the solve() command by:
   a) defining p(x) to be the polynomial above.
   b) Enter: solve(p(x)=0,x)
   c) Entering solve(p(y)=0)
   d) Entering solve(p(z))

4. Using the p(x) from the previous example:
   a) solve the equation:

   p(x+y) = 0

   for y.
   b) Catch the solutions for the equation by: S: solve(p(x+y)=0,y);
   c) solve the second equation in the solution set for x by: solve(S[2],x);

5. In this example, we will solve an equation and catch the solutions. Define the functions:

$$f(x)=x^2\ln(x)+\frac{x^2}{2}$$

$$g(x)=\ln(x)+\frac{1}{2}$$

   Recall that Maxima calls ln(x) “log(x)”. Now solve and catch the solutions of f(x)=g(x) by:
   a) issuing the command: S: solve(f(x)=g(x));
   b) store the solutions into three variables r, s, and t by using rhs(S[1]), rhs(S[2]) and rhs(S[3]). Recall that setting a variable requires “:” not “=” !
   c) Find r(s)(t) – $s^3$ (recall that you have to put * between parentheses when you want multiplcation!)

d) Kill r, s, t, S, f, and g all at once.

6. Solve the equation: $\sqrt{5x-1}+\sqrt{x+1}=5$ by:
   a) First loading to_poly_solve with the command: load(to_poly_solve)
   b) then defining E to be the equation,
   c) and finally by using: to_poly_solve(E,x).

**Graphing**

1. Create one final section titled "Graphing"
2. Use wxdraw2d() to graph $y=x^3\sin(x-\pi/4)$ over the interval [-2π, 2π]. (The computers in the TMARC are a little slow, it might take a second).

3. Use wxdraw2d() to graph all of the following functions on the same set of axes over the interval [0,2]:
   a) f(x) = $x^2$
   b) g(x) = (1-x)^3 +1/2
   c) h(x) = sin(4π x)
4. Redo problem #2 but this time:
   a) First define functions s1(x)=$x^2$ , s2(X)=$(1\text{-}X)^3$+1/2, s3(x) = sin(4πx)
   b) Then plot all three on the same axes using the function names s1, s2, and s3 over [0,2] in the plot command and
   c) add a legend to your graph that points out that the curves are the functions named: "s1, s2," and "s3" and
   d) add a label on the x-axis that reads: "Candy Bars Eaten" and a label on the y-axis that reads: "Disappointment" and
   e) restrict the range so that $-1\le y\le 3/2$, and finally
   f) add a title to the graph that reads "Sugar Sadness Study"

5. Assign the equation

$$3x^2+2x=e^x-2$$

   to the name EQN. (Recall that to get the exponential function you need to type: exp(x) or use %e^x ). Then:

   a) Using lhs() and rhs() functions, graph the left hand side and the right hand side of EQN on the same set of axes over the interval [-1,5].
   b) Redo the above over the interval [-0.5,0.5] to ensure that there is no solution of the equation at x=0.
   c) Change the domain values ( using xrange and yrange ) in the wxdraw2d command to "zoom into" the intersection of the two curves. Zoom in to a point that gives the solution to the nearest hundredth.
   d) Create a text cell (ctrl+1) to write down the approximate solution: "The solution to the equation is approximately..."

Export your solutions to HTML and print! Some of your answers will get clipped off the page – that's o.k.