Math 229 Calculus Computer Lab Spring 16 Sample Final

- You may only use `julia` during this exam. No calculators or cell phones. Write down your `julia` commands to receive partial credit.

(1) Convert the following `julia` expressions to standard mathematical expressions. Use parentheses to clearly indicate the order of operations:

   (a) `(x+y)/z+x`

   (b) `exp(1/2x^3)*1/2*x^2`

   (c) `a/c/5*2+(a-b)/c`

(2) You want to compute a decimal approximate to $1/\sqrt{13}$. Explain what the following `julia` commands compute, or why they give an error.

   (a) `1/13^1/2`

   (b) `1/(13^1/2)`

   (c) `1/sqrt(13^(-1))`

   Write down a `julia` command which produces a decimal approximate to $1/\sqrt{13}$. Explain how to check your result.

(3) Find all solutions (to 3 decimal places) to the equation $12\sin(2x) = 5x - 200$. Write down the `julia` command you use.

(4) Write down `julia` commands to define a function $f(x)$ which has value $\sin(x)$ for $-\pi \leq x \leq \pi$ and 0 for other values of x, and plot its graph to check you are correct.

(5) Use `julia` to find $\lim_{x\to 0} \dfrac{\cos(5x^2) - 1}{\sin^4(2x)}$, by any method.

(6) Consider the function $f(x) = 15\sin(x)e^{-x^2/4} - x - 5$. Use `julia` to find all the critical points; write both the `julia` commands and your answers.

(7) Consider a function $f(x)$ for which $f'(x) = 4\sin(x) + x/2$. Use `julia` to find all the critical points; write both the `julia` commands and your answers. Where is the function concave up and concave down?

(8) Use the built in Newton's method `newton(f, fp, x)` to find all zeros of $f(x) = \dfrac{20\sin(x)}{(x^2 - x + 1)} + 2$, where `fp(x) = D(f)(x)`.

(9) You wish to build a space ship in the shape of a cylinder with a hemisphere attached on each flat end. If the total volume should be 500m^3, what is the smallest surface area possible?

(10) Use `julia` to find the area under the curve of $f(x) = 4e^{-2x^2}$ between $x = 2$ and $x = 4$. Find the volume of revolution obtained by rotating this region around the x-axis.