

## APPM 2450 - Calculus III Computer lab

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#### Lab 11 - More Odds and Ends

Create a *Mathematica* notebook that does all of the following. This lab will not be collected for a grade, but will be very beneficial to go through if you plan to proceed on to Diff Eq.

⇒ Recursive Sequences:

- Let  $\phi[0] = 2$  and  $\phi[1] = 3$ . If  $\phi_{n+1} = \phi_n + \phi_{n-1}$  find the ratio  $\phi[30] / \phi[29]$
- Do the same for the case where  $\phi[0] = 0$  and  $\phi[1] = 1$ .
- Compare these numbers to `GoldenRatio`, a built in *Mathematica* constant

⇒ Limits:

- Find the following limits:

- $\lim_{x \rightarrow 0} \frac{1 - \frac{1}{2}x^2 + \frac{1}{24}x^4 - \cos[x]}{x^6}$

- $\lim_{x \rightarrow \infty} \frac{1 - \frac{1}{2}x^2 + \frac{1}{24}x^4 - \cos[x]}{x^4}$

- $\lim_{\substack{(x,y) \rightarrow (0,0) \\ x=y}} \frac{xy}{x^2+y^2}$  (that is, the limit as  $(x, y) \rightarrow (0, 0)$  along the line  $x = y$ )

⇒ Taylor Series:

- Make a series plots plotting the function  $f(x) = e^{\sin(x)}$  along with all of its taylor series about the point  $x = \pi$  up to 4<sup>th</sup> order. Comment on what you see.
- Give the third order Taylor series of  $g(x, y) = x^2 y^3$  about the point  $(1, 2)$ . What do you get when you simplify that expression (use the `Simplify[ ]` command)? Why does that make sense?

⇒ Diff Eq:

- *Note: For this section, you'll find it useful to refer to the Intro to Differential Equations notebook*
- Use `DSolve[]` to find a solution to the diff eq  $y'(t) = 2y(t)$  with initial condition  $y(0) = 5$
- Use `DSolve[]` to find a solution to the diff eq  $y''(t) + 4y(t) = t$  with initial conditions  $y(0) = 2, y'(0) = 3$