This is the fifth homework assignment for Math 122 and it is broken into two parts. The first part of the homework consists of textbook exercises you should do (and I'll expect you to do) but you needn't turn in. As these exercises will not be graded, if you would like help with them or just want to make sure you're doing them correctly, you should (always) feel free to come to office hours (mine or those of the TAs). The second part consists of written exercises, which again, you should do, but you need not turn in. As always, please come and see me early if you get stuck on any part of this assignment. I am here to help!

Part 1 (Do not turn in)

Exercise 1. *Please do Exercises #17-19, 29, 31, 33, 40, 42 from Section 11.6 of the textbook.*

Exercise 2. *Please do Exercises #3,4 from Section 11.7 of the textbook. Note: it's possible to complete #3, 4(a) without computing derivatives, why?*

Part 2 (Do not turn this in either!)

Problem 1. *Compute the Taylor Series for the following functions at the given basepoint* x_0.

1. $f(x) = \cos(x)$ *at* $x_0 = 0$
2. $f(x) = \sin(x)$ *at* $x_0 = \frac{\pi}{2}$
3. $f(x) = \frac{1}{1-x}$ *at* $x_0 = 0$
4. $f(x) = e^{2x}$ *at* $x_0 = 1$

Problem 2. *We have used Taylor series as one way to understand complicated functions like* e^x *or* $\sin(x)$ *which can be difficult to evaluate. In this problem, you will consider what happens if you construct a Taylor series for a simpler function - namely, a polynomial.*

(a) *Let* $f(x) = x^2 + 4x + 7$. *Compute the first, second, third, fourth, and fifth derivatives of* $f(x)$.

(b) *Using your work in part (a), construct the Taylor Series for* $f(x)$ *at the basepoint* $x_0 = 0$. *What pattern do you notice?*

(c) *Again using your work in part (a), construct the Taylor series for* $f(x)$ *at the basepoint* $x_0 = 1$. *How does this compare to the series you found in Part (b)?*

(d) *If you have not already done so, simplify the series you found in Part (c) by multiplying out all terms (i.e., get rid of parentheses). Compare the result to Part (b). Based on this, make a general conjecture about what happens when you find the Taylor series of a polynomial function* $f(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_1 x + a_0$.