Math 1023, Taylor Polynomial Lab

For each exercise involving Desmos graphs, take a screen shot of your work (both the equations and the graphs).

Only do one exercise at a time. Don't try to put all the exercises in one screen shot.

Submit a single PDF with your work and collection of screenshots.

Do not forget to put your name(s) in the filename as well as in your document.

(Ex: Smith_Jones_lab3.pdf)

1. Construct the degree 0, 1, 2, 3, & 4 Maclaurin polynomials for the function
$$f(x) = e^{bx}. \tag{1}$$
Show your derivation and explicitly write each of your polynomials.

   (a) Using the Desmos Graphing Calculator, https://www.desmos.com/calculator, create a plot of $y = e^{bx}$ and the Maclaurin polynomials that you have constructed.

   (b) Consider the case where $b = 2$ and thus
$$f(x) = e^{2x}. \tag{2}$$
   Use each of your polynomials in your Desmos graph to approximate $f(0.2)$ using 4 digits to the right of the decimal point, and give the magnitude of the error of each approximation,
$$|\text{Error}| = |f(0.2) - \text{approximation}|. \tag{3}$$

   (c) What can you conclude about the accuracy of your approximations as the polynomial degrees increase?

2. Construct the degree 1, 2, 3, & 4 Maclaurin polynomials for the function

$$g(x) = \ln(1 + bx). \tag{4}$$

(a) Using the Desmos Graphing Calculator create a plot of

$$y = \ln(1 + bx)$$

and the Maclaurin polynomials that you have constructed.

(b) Consider the case where $b = 2$ and thus

$$g(x) = \ln(1 + 2x). \tag{5}$$

Use each of your polynomials in your Desmos graph to approximate $g(0.3)$ using 4 digits to the right of the decimal point, and give the magnitude of the error of each approximation,

$$|\text{Error}| = |g(0.3) - \text{approximation}|. \tag{6}$$

(c) For what x values is this approach valid? Describe what you observe in your graphs regarding the x values outside of this region versus the x values inside of this region.