Math 151 Lab 4

Use Python to solve each problem.

1. Find the following derivatives:

   a) Find and simplify $f'(v)$ if $f(v) = \dfrac{v^{1/3} - 2ve^v}{v}$. Repeat, but this time enter the exponent using **Rational(1,3)** instead of **1/3**. (The "Rational" command keeps 1/3 as a fraction instead of dividing it and creating a floating point decimal)

   b) Find and simplify the derivative of $f(x) = \dfrac{Ax + B}{Cx + D}$, where A, B, C, and D are constants. (**HINT:** to make the numerator nicer, use **simplify,** then **expand**)

   c) Find the derivatives of $f_1(x) = e^{3x}$, $f_2(x) = e^{-x^2}$, and $f_3(x) = e^{e^x}$. In a print statement, make a conjecture about the derivative of $f(x) = e^{g(x)}$ based on these answers.

2. Given $f(x) = \dfrac{1}{x^3}$:

   a) Find $\dfrac{f(x+h) - f(x)}{h}$, then **expand** and **simplify** the result (in that order)

   b) Substitute $h = 0$ into your result. In a print statement, explain the significance of your answer.

3. Given $g(x) = \dfrac{1 - x + x^2 - xe^x}{1 + x + x^2 + xe^x}$:

   a) Find the equation of the line tangent to g at $x = 0$.

   b) Plot the function and tangent line on the same axes in the domain $x \in [-2, 2]$.

   c) From the graph, you should see the tangent line intersects the curve in a second point. Find the approximate x-coordinate of this point.

4. The **normal line** to a curve is the line perpendicular to the tangent line at a point. The point $(-1, -2)$ is on the graph of $f(x) = x - x^2$.

   a) Find all other x-coordinates whose normal line also passes through the point $(-1, -2)$.

   b) Plot f and the normal lines found in part a) on the same axes in the domain $x \in [-2, 2]$.