MATH 3025 NAME: _____

Computer Lab #1 Due Monday February 5th 2023 by noon.

All work is to be done in a notebook with both code and written comments. Please utilize the notebook structure to type comments in their own text boxes.
Please refer to the blackboard and GitHub for commands and examples.
Submissions must be made electronically on blackboard.
You will be graded on the output that I am able to generate from your commands.

1. Let the last digit of your student number be a (if it happens to be a zero use $a = 10$). Consider the function

$$f(x) = \frac{1}{\sqrt{ax+1}}.$$

   (a) Graph the function from 0 to 1.

   (b) Make an estimate of the area under the curve based on the graph. There should be complete sentences explaining your estimate.

   (c) Calculate the area under the curve in mathematica.

2. Consider the functions, where a is as defined above,

$$y = e^x \qquad \text{and} \qquad y = \sqrt{ax} + 1.$$

   (a) Graph both functions on the same coordinate axis.

   (b) Find the points of intersection using the numerical solver and inspection of the graph.

   (c) Calculate the area between the two curves.

   (d) Calculate the volume of the solid obtained by rotating about the y-axis.

3. Integration by parts can be used to prove the following reduction formula.

$$\int (\ln x)^n \, dx = x\,(\ln x)^n - n \int (\ln x)^{n-1} \, dx$$

   (a) Find the integral on the left-hand-side when $n = a$.

   (b) Explain why the reduction formula is preferred to the above output. (If you had a=1 or 2 you might try a different number)

   (c) Prove the reduction formula by having programming language take the derivative of the right-hand-side.