Please show all work as neatly as possible to receive credit! Do NOT use a computer program UNLESS instructed to do so! Do not return this paper with answers on it! When turning in MATLAB problems, provide both the script (code) and sample output (graphs and/or numerical results) generated.

1. (6 pts) Using the Euler formula, find all of the complex roots of $\sqrt[4]{-1}$ and $\sqrt[4]{1}$.

2. (9 pts) Without using any computer program, use any techniques, INCLUDING implicit differentiation to determine $dy/dx$ for the following:
   a. $e^{xy} + y^2 = \cos(x)$
   b. $x = a(\theta - \sin(\theta)), y = a(1 - \cos(\theta))$
   c. $y = x^2[\ln(2x + 1)]^2$

3. (8 pts) Write a MATLAB script that numerically calculates and PLOTS the derivative of $y = x^2[\ln(2x + 1)]^2$ (question 2c) for three different $\Delta x$ values. On the same graph, plot the function you derived in 2c to see if they are the same. The range of $x$’s should be $0 \leq x \leq 2$, and you are free to choose your segment sizes ($\Delta x$).

4. (8 pts) Perform the following integrals WITHOUT using any computer program:
   a. $\int_{\frac{1}{\ln x}} e^x dx$
   b. $\int e^{x-1} dx$
   c. $\int x\ln(x) dx$
   d. $\int_{\pi/2}^{\pi} \sqrt{1 - \cos(x)} dx$

5. (6 pts) Write a MATLAB script that uses the trapezoid rule and Simpson’s rule (quadrature) to evaluate the definite integral:

   \[ \int_0^1 \frac{1}{x^2+1} dx \]

To do this, you will have to break the range into the following number of segments: 5, 10, 20. The analytical solution is $\pi/4$. Does your numerical calculation give the same number?