MATH.2720 Introduction to Programming with MATLAB
Homework on Array Operations and Two-Dimensional Plots (Due 2/12)

Please email me a script file containing the commands you used to answer these questions at `stephen_pennell@uml.edu`.

1. Let
$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 4 \end{bmatrix}$$
a) Find the determinant of A.
b) Find A^{-1}.
c) Solve the system
$$\begin{aligned} x + 2y + 3z &= 2 \\ 2x + 3y + 4z &= 2 \\ 3x + 4y + 4z &= 1 \end{aligned}$$

2. Use MATLAB to graph $y = \dfrac{\sin(2\pi x)}{1+x^2}$, $y = \dfrac{1}{1+x^2}$, and $y = -\dfrac{1}{1+x^2}$ on the same set of axes for $-1 \le x \le 1$.
Please use the following formatting instructions.
   - Draw the graph of $y = \dfrac{\sin(2\pi x)}{1+x^2}$ using a solid blue line, draw the graph of $\dfrac{1}{1+x^2}$ using a dashed red line, and draw the graph of $y = -\dfrac{1}{1+x^2}$ using a dashed green line.
   - Create a legend to indicate which curve is which. **The only variables in the problem are x and y. Don't use other letters in your legend.**
   - Be sure to label your axes. **The only variables in the problem are x and y. Don't use other letters in your axis labels.**
   - Use enough points so your graphs look like smooth curves.

3. A *cycloid* is specified by the parametric equations $x = r\,(t - \sin(t))\,,\ y = r\,(1 - \cos(t))$. Draw a cycloid with $r = 1.5$ and $0 \le t \le 8\pi$. Use the `axis` command to make the x axis run from 0 to 40 and the y axis run from 0 to 10.

4. Generate a figure with a 1×2 array of windows. In one window draw a loglog plot of the function $C(\omega) = \dfrac{1}{\sqrt{1+\omega^2}}$ for $10^{-2} \le \omega \le 10^3$, and in the other window draw a plot of $C(\omega)$ with the horizontal axis scaled logarithmically and the vertical axis scaled linearly. Be sure to label the axes. (The string `'\omega'` will produce the Greek lower case letter ω.)

5. Draw a polar plot of $r = 1 + \sin(\theta)$ for $0 \le \theta \le 2\pi$.

6. The temperature (in K) of one mole of an ideal gas occupying a volume of 1 m^3 is given by $T = p/8.314$, where p is the pressure (in Pa). The volume (in m^3) of one mole of an ideal gas at a temperature of 300 K is given by $V = 2.49 \times 10^3/p$. Use the plotyy command to graph T and V as functions of p for $2500 \le p \le 3500$. Label the horizontal axis and both vertical axes. Include the units in your axis labels.