Assignment 02: A New Way of Thinking

1. Create the following vectors:

$$\boldsymbol{u} = [-4, -2, 0, 2, 4] \tag{1}$$

$$\boldsymbol{v} = \left[0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi\right] \tag{2}$$

2. Calculate 10! using <MINTED> and store it into variable <MINTED>.

3. Create the following matrices:

   (a)

$$\boldsymbol{A} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \tag{3}$$

   Hint: Look at the documentation for the <MINTED> function.

   (b)

$$\boldsymbol{B} = \begin{bmatrix} 1 & 9 & 2 & 10 \\ 3 & 11 & 4 & 12 \\ 5 & 13 & 6 & 14 \\ 7 & 15 & 8 & 16 \end{bmatrix} \tag{4}$$

   Hint: MATLAB stores matrices in column major order. An intermediate <MINTED> with a transpose can give you a "nice" matrix to play with.

4. We can "perfectly"[1] represent a square wave with a Fourier series like so:

$$a_n = 2n + 1 \tag{5}$$

$$s = \sum_{n=0}^{\infty} \frac{sin(a_n t)}{a_n} \tag{6}$$

   Plot the resultant approximation for $n \in [0, 50]$ over 1000 evenly spaced points for $t \in [-\pi, \pi]$. Assuming you stored your approximation in <MINTED> and values for t in <MINTED>, you can plot your solution with <MINTED>.

   Hint: Use broadcasting to create a matrix with your a_n and t values so that you can efficiently <MINTED> over your different sine waves!

[1] Well, not quite due to the Gibbs phenomenon.

