# MATH661 - Background Quiz

Name:

1. Write the row echelon form $\boldsymbol{E}$ of $\boldsymbol{A}$ by observation, without carrying out any calculations

| $\boldsymbol{A}$ | $\boldsymbol{E}$ |
|---|---|
| $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ | $\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}$ |
| $\begin{bmatrix} 2 & 0 & 1 \\ 1 & 0 & \frac{1}{2} \\ 0 & 4 & 0 \end{bmatrix}$ | $\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}$ |
| $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 2 \\ 3 & 0 & 0 \end{bmatrix}$ | $\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}$ |

2. For $\boldsymbol{u} = [\ 2\ \ 1\ ]^T$, $\boldsymbol{v} = [\ -1\ \ 3\ ]^T$, compute the following

   a) $\boldsymbol{u}^T \boldsymbol{v}$

   b) $\boldsymbol{u}\boldsymbol{v}^T$

3. For $f : [-1, 1] \to \mathbb{R}$, $f$ differentiable an infinite number of times

   a) Write the MacLaurin series of $f$ (Taylor series around $x_0 = 0$)

   b) What is the codomain of $f$?

   c) What is the domain of $f$?

4. For $f : [-\pi, \pi] \times [-\pi, \pi] \to \mathbb{R}$, $f(x, y) = \sin x \cos y$ differentiable an infinite number of times

   a) Write the MacLaurin series of $f$ (Taylor series around $x_0 = 0$)

b) What is the gradient of $f$?

5. Compute the products showing your calculation procedure

$$C = AB = \begin{bmatrix} 1 & 0 & -2 & 1 \\ 0 & 1 & 1 & 2 \\ -1 & 2 & 1 & 0 \\ 2 & 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -2 & 1 \\ 0 & 1 & 1 & 2 \\ -1 & 2 & 1 & 0 \\ 2 & 1 & 0 & 1 \end{bmatrix}, D = BA.$$

6. Write pseudo-code that evaluates a polynomial through Horner's scheme

$$p_n(x) = (\ldots ((a_n x + a_{n-1}) x + a_{n-2}) x + \cdots + a_1) x + a_0$$

7. Write code in some language (e.g., Python, C, ... ) to implement Horner's scheme.

8. After class, use ChatGPT to obtain an implementation of Horner's scheme.