

• You have 5 minutes

• No calculators

• Show sufficient work

1. Find the rank of the matrices below. Justify your answer for full credit.

(a)

Rank = 2

$$\begin{array}{cccc}
 1 & 2 & 3 & 4 \\
 1 & 1 & 1 & 1 \\
 2 & 3 & 4 & 5
 \end{array} - I = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} - II = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} - II \\
 = \begin{bmatrix} 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} - I \\
 = \begin{bmatrix} 0 & 1 & 2 & 3 \\ 0 & 0 & -1 & -2 \\ 0 & 0 & 0 & 0 \end{bmatrix} \\
 = \begin{bmatrix} 1 & 0 & -1 & -2 \\ 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(b)

Rank = 3

$$\begin{array}{ccc}
 1 & 0 & 0 \\
 1 & 1 & 0 \\
 1 & 0 & 1
 \end{array} - I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(c)

Rank = 1

$$\begin{array}{ccc}
 1 & 3 & 2 \\
 1 & 3 & 2 \\
 1 & 3 & 2
 \end{array} - I = \begin{bmatrix} 1 & 3 & 2 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$