The test cannot be taken out from the examination room.
No calculators are allowed. Show your work.

Duration: 50 minutes **Total marks: 30**
NAME: **STUDENT NO :**

1 [8 Marks]
a) Two linear systems are equivalent if they have the same solution set.

Answer (circle one): TRUE FALSE
b) For any $m \times n$ matrix A, the matrix AA^T is always symmetric.

Answer (circle one): TRUE FALSE
c) If the augmented matrix [*A b*] in REF has a pivot position in every row, then the equation $Ax = b$ is inconsistent.

Answer (circle one): TRUE FALSE
d) The equation $Ax = b$ is homogeneous if the zero vector is a solution.

Answer (circle one): TRUE FALSE

2. [8 Marks] Answer the following. **(Show your work)**
i) [2 marks] Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$. Find $B - 4A$.

ii) [2 marks] Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$. Find AB.

iii) [2 marks] Let $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$. Find $(5A)^T$

iv) [2 marks] Let $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$. Find A^3.

3. [10 Marks] Let $A=\begin{bmatrix} 1 & -3 & 7 \\ 3 & -9 & 5 \\ -2 & 6 & 4 \end{bmatrix}$.

a) Express the general solution of the equation $AX=\begin{bmatrix} -4 \\ -12 \\ 8 \end{bmatrix}$ in parametric vector form.

b) Show that $\begin{bmatrix} 2 \\ 2 \\ 0 \end{bmatrix}$ is solution of the equation $AX=\begin{bmatrix} -4 \\ -12 \\ 8 \end{bmatrix}$.

c) Find the general solution of the homogeneous equation $AX=0$.

4. [4 Marks] Determine the value(s) of *h* and *k* such that the following system has
a) no solutions, **b)** infinitely many solutions, **c)** exactly one solution:

$$2x+ky=3+h$$
$$-4x+2y=-6$$