

No aids are permitted. **Show all your work.** Correct answers with little or no supporting work will not be given credit. Write legibly.

1. (9 pts) Row reduce the matrix to reduced echelon form. Indicate elementary row operations applied in each step.

$$\begin{bmatrix} 1 & 2 & 4 & 8 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 9 & 12 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 4 & 8 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 9 & 12 \end{bmatrix} \xrightarrow[\substack{(-2)R_1 + R_2 \\ (-3)R_1 + R_3}]{(-2)R_1 + R_2} \begin{bmatrix} 1 & 2 & 4 & 8 \\ 0 & 0 & -2 & -8 \\ 0 & 0 & -3 & -12 \end{bmatrix} \xrightarrow{(-\frac{1}{2})R_2} \begin{bmatrix} 1 & 2 & 4 & 8 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & -3 & -12 \end{bmatrix}$$

$$\xrightarrow{(3)R_2 + R_3} \begin{bmatrix} 1 & 2 & 4 & 8 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix} \xrightarrow{(-4)R_2 + R_1} \begin{bmatrix} 1 & 2 & 0 & -8 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(+3)  
 (+3)  
 (+3)

2. (6 pts) Write the system first as a vector equation and then as a matrix equation.

$$5x_1 + x_2 - 3x_3 = 8$$

$$2x_2 + 4x_3 = 0$$

Vector equation:  $x_1 \begin{bmatrix} 5 \\ 0 \end{bmatrix} + x_2 \begin{bmatrix} 1 \\ 2 \end{bmatrix} + x_3 \begin{bmatrix} -3 \\ 4 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \end{bmatrix}$  (+3)

Matrix equation:  $\begin{bmatrix} 5 & 1 & -3 \\ 0 & 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \end{bmatrix}$  (+3)