Name _____

1) Row reduce the matrix below until it is in reduced echelon form. Show your work.

$$\begin{bmatrix} 3 & 6 & 18 & 0 \\ 2 & 4 & 8 & 16 \\ 1 & 2 & 4 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 6 & 18 & 0 \\ 2 & 4 & 8 & 16 \\ 1 & 2 & 4 & 8 \end{bmatrix} \sim_R \begin{bmatrix} 1 & 2 & 6 & 0 \\ 2 & 4 & 8 & 16 \\ 1 & 2 & 4 & 8 \end{bmatrix} \sim_R \begin{bmatrix} 1 & 2 & 6 & 0 \\ 0 & 0 & -4 & 16 \\ 0 & 0 & -2 & 8 \end{bmatrix} \sim_R \begin{bmatrix} 1 & 2 & 6 & 0 \\ 0 & 0 & 1 & -4 \\ 0 & 0 & -2 & 8 \end{bmatrix} \sim_R \begin{bmatrix} 1 & 2 & 0 & 24 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$R_1 \to \frac{1}{3}R_1 \qquad \begin{matrix} R_2 \to R_2 - 2R_1 \\ R_3 \to R_3 - 1R_1 \end{matrix} \qquad R_2 \to -\frac{1}{4}R_2 \qquad \begin{matrix} R_1 \to R_1 - 6R_2 \\ R_3 \to R_3 + 2R_2 \end{matrix}$$

Partial credit varies based on your work and how close your final matrix is to echelon form.

2) Assume the matrix A is an invertible 5×5 matrix. How many solutions does the matrix equation below have?

$$A\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 4 \\ 7 \end{bmatrix}$$

Because A is invertible, it has exactly one solution. Namely:

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = A^{-1}\begin{bmatrix} 0 \\ 0 \\ 0 \\ 4 \\ 7 \end{bmatrix}$$

Half credit: One of the other possible answers to similar but different questions: 0 or ∞

No credit: Impossible answers such as a set, vector, or 7.

3) Find the length of the vector below.

$$\begin{bmatrix} 0 \\ 0 \\ 3 \\ 4 \end{bmatrix}$$

$$\sqrt{0^2 + 0^2 + 3^2 + 4^2} = 5$$

Half credit: any other number.

No credit: Impossible answers such as a set, vector, or matrix.