Name:_____ Math 260
Start Time:_____ Quiz 1 (25 min)
End Time:_____
Date:_____

1. (1 point) What does it mean for 2 systems of equations to be equivalent?

The 2 systems have exactly the same set of solutions

2. (3 points) What are the 3 elementary row operation?

(1) You can switch any 2 rows
(2) You can multiply any row by a nonzero number
(3) You can multiply a row by a number and add to another row.

3. (6 points) Solve the following system of equations by row reducing an augmented matrix to reduced row-echelon form (RREF). Do this problem completely by hand, show every step, and only do 1 row operation at a time. (NO CALCULATOR)

$$\begin{aligned} 3x_1 + x_2 + 2x_3 &= 1 \\ x_1 + 4x_2 - x_3 &= 9 \\ 4x_1 - 5x_2 &= 3 \\ -2x_1 - 7x_2 + 3x_3 &= -20 \end{aligned}$$

$$\left[\begin{array}{ccc|c} 3 & 1 & 2 & 1 \\ 1 & 4 & -1 & 9 \\ 4 & -5 & 0 & 3 \\ -2 & -7 & 3 & -20 \end{array}\right] \xrightarrow{R_1 \leftrightarrow R_2} \left[\begin{array}{ccc|c} 1 & 4 & -1 & 9 \\ 3 & 1 & 2 & 1 \\ 4 & -5 & 0 & 3 \\ -2 & -7 & 3 & -20 \end{array}\right]$$

$-3R_1+R_2\to R_2$

$$\left[\begin{array}{ccc|c} 1 & 4 & -1 & 9 \\ 0 & -11 & 5 & -26 \\ 4 & -5 & 0 & 3 \\ -2 & -7 & 3 & -20 \end{array}\right]$$

$-4R_1+R_3\to R_3$

$$\left[\begin{array}{ccc|c} 1 & 4 & -1 & 9 \\ 0 & -11 & 5 & -26 \\ 0 & -21 & 4 & -33 \\ -2 & -7 & 3 & -20 \end{array}\right]$$

$2R_1+R_4\to R_4$

$$\left[\begin{array}{ccc|c} 1 & 4 & -1 & 9 \\ 0 & -11 & 5 & -26 \\ 0 & -21 & 4 & -33 \\ 0 & 1 & 1 & -2 \end{array}\right]$$

$R_2\leftrightarrow R_4$

$$\left[\begin{array}{ccc|c} 1 & 4 & -1 & 9 \\ 0 & 1 & 1 & -2 \\ 0 & -21 & 4 & -33 \\ 0 & -11 & 5 & -26 \end{array}\right]$$

$-4R_2+R_1\to R_1$

$$\left[\begin{array}{ccc|c} 1 & 0 & -5 & 17 \\ 0 & 1 & 1 & -2 \\ 0 & -21 & 4 & -33 \\ 0 & -11 & 5 & -26 \end{array}\right]$$

$21R_2+R_3\to R_3$

$$\left[\begin{array}{ccc|c} 1 & 0 & -5 & 17 \\ 0 & 1 & 1 & -2 \\ 0 & 0 & 25 & -75 \\ 0 & -11 & 5 & -26 \end{array}\right]$$

$11R_2+R_4\to R_4$

$$\left[\begin{array}{ccc|c} 1 & 0 & -5 & 17 \\ 0 & 1 & 1 & -2 \\ 0 & 0 & 25 & -75 \\ 0 & 0 & 16 & -48 \end{array}\right]$$

$\frac{1}{25}R_3\to R_3$

$$\left[\begin{array}{ccc|c} 1 & 0 & -5 & 17 \\ 0 & 1 & 1 & -2 \\ 0 & 0 & 1 & -3 \\ 0 & 0 & 16 & -48 \end{array}\right]$$

$5R_3+R_1 \to R_1$

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 1 & 1 & -2 \\ 0 & 0 & 1 & -3 \\ 0 & 0 & 16 & -48 \end{array}\right]$$

$-1R_3+R_2 \to R_2$

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & -3 \\ 0 & 0 & 16 & -48 \end{array}\right]$$

$-16R_3+R_4 \to R_4$

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & -3 \\ 0 & 0 & 0 & 0 \end{array}\right]$$

$x_1 = 2$

$x_2 = 1$

$x_3 = -3$

Solution set $= \{(2, 1, -3)\}$