Using Row Operations and Augmented Matrices

Name ______________________

Date ______________ Period ______

Turning a system of two equations into an augmented matrix.

$$3x - 4y = -2$$
$$-x + 3y = 4$$

$$-2x = 10$$
$$5x + y = -14$$

$$x + y = 8$$
$$x - y = 6$$

$$\left[\begin{array}{cc|c} 3 & -4 & -2 \\ -1 & 3 & 4 \end{array}\right] \qquad \left[\begin{array}{cc|c} -2 & 0 & 10 \\ 5 & 1 & -14 \end{array}\right] \qquad \left[\begin{array}{cc|c} 1 & 1 & 8 \\ 1 & -1 & 6 \end{array}\right]$$

Row Operations can be performed on each row to manipulate the values in each row.

Three Row Operations

1. Interchange any two rows.
2. Replace a row by a nonzero multiple of that row.
3. Replace a row by the sum of that row and a constant nonzero multiple of some other row.

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$$\begin{array}{c} r_1 \\ r_2 \end{array} \left[\begin{array}{cc|c} 3 & -4 & -2 \\ -1 & 3 & 4 \end{array}\right]$$

interchange r_1 with r_2

$$\begin{array}{c} r_1 \\ r_2 \end{array} \left[\begin{array}{cc|c} -1 & 3 & 4 \\ 3 & -4 & -2 \end{array}\right]$$

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$$\begin{array}{c} r_1 \\ 3(r_2 \end{array} \left[\begin{array}{cc|c} 3 & -4 & -2 \\ -1 & 3 & 4\ ) \end{array}\right]$$

$R_2 = 3 \cdot r_2$

$$\begin{array}{c} r_1 \\ r_2 \end{array} \left[\begin{array}{cc|c} 3 & -4 & -2 \\ -3 & 9 & 12 \end{array}\right]$$

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$$\begin{array}{r} r_1 \\ 3(r_2 \end{array} \left[\begin{array}{cc|c} 3 & -4 & -2 \\ -1 & 3 & 4\ ) \end{array}\right]$$

$$R_2 \boxed{= r_1 + 3 \cdot r_2}$$

$$\begin{array}{r} r_1 \\ 3 \cdot r_2 \end{array} \left[\begin{array}{cc|c} 3 & -4 & -2 \\ -3 & 9 & 12 \end{array}\right] \qquad \begin{array}{r} r_1 \\ r_2 \end{array} \left[\begin{array}{cc|c} 3 & -4 & -2 \\ 0 & 5 & 10 \end{array}\right]$$

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Row Echelon Form

$$\left[\begin{array}{cc|c} 1 & a & d \\ 0 & 1 & e \end{array}\right]$$

create a diagonal of 1's
with 0's under the 1's

Use a, d, and e to solve for our x and y variables.

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Solve the following

$$-3x + 5y = -4$$
$$x - 2y = 7$$

$$\left[\begin{array}{cc|c} 1 & a & d \\ 0 & 1 & e \end{array}\right]$$

Solve the following

$$-2x - 3y = 14$$
$$-x - 2y = 9$$

$$\left[\begin{array}{cc|c} 1 & a & d \\ 0 & 1 & e \end{array}\right]$$

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Solve the following

$$3x + 6y = 12$$
$$x + 2y = 4$$

$$\left[\begin{array}{cc|c} 1 & a & d \\ 0 & 1 & e \end{array}\right]$$

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