# MA 16020 Quiz 13 (Lessons 30-31)

Write your name, section number (054 for 11:30, 039 for 12:30), and quiz number on the top of your quiz, **front and back.**

You may use a one-line calculator.

1. Find all solutions to the system of linear equations

$$3x + 2y = 4,$$
$$2x + 5y = 1.$$

2. Reduce the augmented matrix into a **reduced** row echelon form:

$$\left[\begin{array}{ccc|c} 2 & 3 & -1 & 2 \\ 3 & 0 & 2 & 8 \\ 4 & -3 & -2 & 7 \end{array}\right]$$

$\boxed{1.}$

$$\left[\begin{array}{cc|c} 3 & 2 & 4 \\ 2 & 5 & 1 \end{array}\right] \xrightarrow{-R_2+R_1\to R_1} \left[\begin{array}{cc|c} 1 & -3 & 3 \\ 2 & 5 & 1 \end{array}\right] \xrightarrow{-2R_1+R_2\to R_2} \left[\begin{array}{cc|c} 1 & -3 & 3 \\ 0 & 11 & -5 \end{array}\right] \xrightarrow{\frac{1}{11}R_2\to R_2} \left[\begin{array}{cc|c} 1 & -3 & 3 \\ 0 & 1 & -\frac{5}{11} \end{array}\right]$$

$$\sim y = -\frac{5}{11}, \quad x - 3\left(-\frac{5}{11}\right) = 3 \to x = 3 - \frac{15}{11} = \frac{18}{11} \qquad (x,y) = \left(\frac{18}{11}, -\frac{5}{11}\right)$$

$\boxed{2.}$

$$\left[\begin{array}{ccc|c} 2 & 3 & -1 & 2 \\ 3 & 0 & 2 & 8 \\ 4 & -3 & -2 & 7 \end{array}\right] \xrightarrow{-R_1+R_2\to R_2} \left[\begin{array}{ccc|c} 2 & 3 & -1 & 2 \\ 1 & -3 & 3 & 6 \\ 4 & -3 & -2 & 7 \end{array}\right] \xrightarrow{R_1\leftrightarrow R_2} \left[\begin{array}{ccc|c} 1 & -3 & 3 & 6 \\ 2 & 3 & -1 & 2 \\ 4 & -3 & -2 & 7 \end{array}\right] \xrightarrow{-2R_1+R_2\to R_2} \left[\begin{array}{ccc|c} 1 & -3 & 3 & 6 \\ 0 & 9 & -7 & -10 \\ 4 & -3 & -2 & 7 \end{array}\right]$$

$$\xrightarrow{-4R_1+R_3\to R_3} \left[\begin{array}{ccc|c} 1 & -3 & 3 & 6 \\ 0 & 9 & -7 & -10 \\ 0 & 9 & -14 & -17 \end{array}\right] \xrightarrow{-R_2+R_3\to R_3} \left[\begin{array}{ccc|c} 1 & -3 & 3 & 6 \\ 0 & 9 & -7 & -10 \\ 0 & 0 & -7 & -7 \end{array}\right] \xrightarrow{-\frac{1}{7}R_3\to R_3} \left[\begin{array}{ccc|c} 1 & -3 & 3 & 6 \\ 0 & 9 & -7 & -10 \\ 0 & 0 & 1 & 1 \end{array}\right] \xrightarrow{7R_3+R_2\to R_2} \left[\begin{array}{ccc|c} 1 & -3 & 3 & 6 \\ 0 & 9 & 0 & -3 \\ 0 & 0 & 1 & 1 \end{array}\right]$$

$$\xrightarrow{\frac{1}{9}R_2\to R_2} \left[\begin{array}{ccc|c} 1 & -3 & 3 & 6 \\ 0 & 1 & 0 & -\frac{1}{3} \\ 0 & 0 & 1 & 1 \end{array}\right] \xrightarrow{-3R_3+R_1\to R_1} \left[\begin{array}{ccc|c} 1 & -3 & 0 & 3 \\ 0 & 1 & 0 & -\frac{1}{3} \\ 0 & 0 & 1 & 1 \end{array}\right] \xrightarrow{3R_2+R_1\to R_1} \left[\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & -\frac{1}{3} \\ 0 & 0 & 1 & 1 \end{array}\right]$$