# 2.14H Solving Systems with Matrices
*A Practice Understanding Task*

In the task "To Market with Matrices" you developed a strategy for solving systems of linear equations using matrices. An efficient and consistent way to carry out this strategy can be summarized as follows:
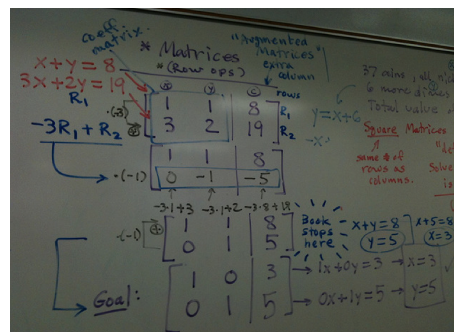
To row reduce a matrix:
- Perform elementary row operations to yield a "1" in the first row, first column.
- Create zeros in all of the other rows of the first column by adding the first row times a constant to each other row.
- Perform elementary row operations to yield a "1" in the second row, second column.
- Create zeros in all of the other rows of the second column by adding the second row times a constant to each other row.
- Perform elementary row operations to yield a "1" in the third row, third column.
- Create zeros in all of the other rows of the third column by adding the third row times a constant to each other row.
- Continue this process until the first m × m entries form a square matrix with 1s in the diagonal and 0s everywhere else.

Practice this strategy by creating a sequence of matrices for each of the following that begins with the given matrix and ends with the left portion of the matrix (the first m × m entries) in row-reduced form. Write a description of what you did to get from one matrix to another in each step of your sequence of matrices.

1. $\begin{bmatrix} 2 & 4 & 0 \\ 3 & 5 & -2 \end{bmatrix}$

2. $\begin{bmatrix} 4 & -2 & 2 \\ 1 & 3 & 11 \end{bmatrix}$

3. $\begin{bmatrix} 4 & -2 & 1 & 3 \\ 2 & 1 & -1 & 1 \\ 3 & -1 & 2 & 7 \end{bmatrix}$

4. Each of the above matrices represents a system of equations. For each problem, write the system of equations represented by the original matrix. Determine the solution for each system using the row-reduced matrix you obtained, and then check the solutions in the original system.

5. Solve the following problem by using a matrix to represent the system of equations described in the scenario, and then changing the matrix to row-reduced form to obtain the solution.

   *Three of Carlos' and Clarita's friends are purchasing school supplies at the bookstore. Stan buys a notebook, three packages of pencils and two markers for $7.50. Jan buys two notebooks, six packages of pencils and five markers for $15.50. Fran buys a notebook, two packages of pencils and two markers for $6.25. How much do each of these three items cost?*

6. Create a linear system that is either dependent (both equations in the system represent the same line) or inconsistent (the equations in the system represent non-intersecting lines). What happens when you try to row reduce the 2 × 3 matrix that represents this linear system of equations?