

# Handout 1: Row Reduction

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## Casio ClassPad 300 & ClassPad Manager Software

You can use your ClassPad to do Gaussian Elimination, i.e. to put a matrix in reduced form. The relevant functions and their syntax are given below. You can find the functions in the Matrix-Calculation submenu of the Action pull-down menu.

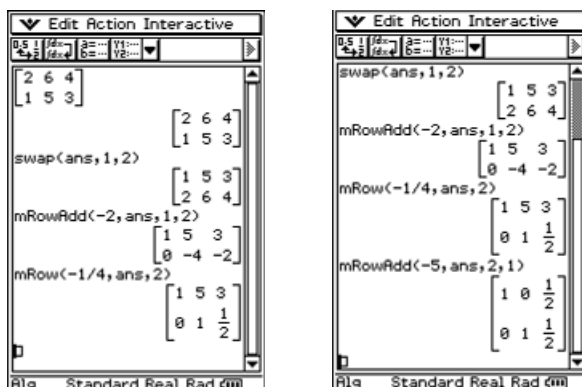
`swap(matrix,row_a,row_b)`: swaps row\_a and row\_b in **matrix**

`mRow(multiplier,matrix,row)`: multiplies the entries in row in matrix by multiplier

`mRowAdd(multiplier,matrix, row_a,row_b)`: replaces row\_b in **matrix** with the sum of row\_b and multiplier times row\_a

A simple example, in a pair of overlapping screen captures, is given below. Note that ans refers to the result of the previous computation.

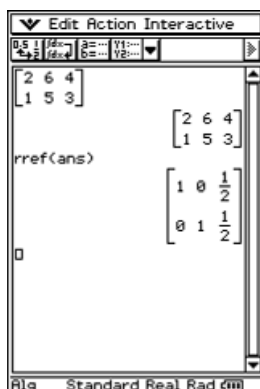
You can see that we begin and end with the matrices  $\begin{bmatrix} 2 & 6 & 4 \\ 1 & 5 & 3 \end{bmatrix}$  and  $\begin{bmatrix} 1 & 0 & \frac{1}{2} \\ 0 & 1 & \frac{1}{2} \end{bmatrix}$  respectively.



We can interpret the result of the calculations above as telling us that the solution to the equations  $2x + 6y = 4$  and  $x + 5y = 3$  is  $x = y = 1/2$ .

However, when you are not required to actually show the steps in the Gaussian Elimination procedure, you can use the `rref` function to perform in the Gaussian Elimination automatically. This is illustrated in the screen capture below.

The `rref` function is located in the Matrix-Calculation submenu of the Action pull-down menu.



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(continued)

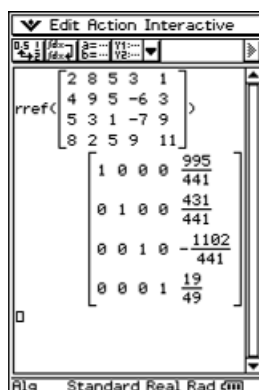
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Now that you know how to carry out Gaussian Elimination on your ClassPad you should try it out on the following matrix to be sure that you have the functions under control. You should first put the following matrix in reduced form using step-by-step Gaussian Elimination with mRowAdd, mRow and Swap. Then you can check your answer with rref.

$$\begin{bmatrix} 2 & 8 & 5 & 3 & 1 \\ 4 & 9 & 5 & -6 & 3 \\ 5 & 3 & 1 & -7 & 9 \\ 8 & 2 & 5 & 9 & 11 \end{bmatrix}$$

## SOLUTION:

Gaussian Elimination and rref yield the following reduced form.



The screenshot shows the ClassPad interface with the following matrix displayed:

$$\text{rref}\left(\begin{bmatrix} 2 & 8 & 5 & 3 & 1 \\ 4 & 9 & 5 & -6 & 3 \\ 5 & 3 & 1 & -7 & 9 \\ 8 & 2 & 5 & 9 & 11 \end{bmatrix}\right) = \begin{bmatrix} 1 & 0 & 0 & 0 & \frac{995}{441} \\ 0 & 1 & 0 & 0 & \frac{431}{441} \\ 0 & 0 & 1 & 0 & -\frac{1102}{441} \\ 0 & 0 & 0 & 1 & \frac{19}{49} \end{bmatrix}$$