

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.

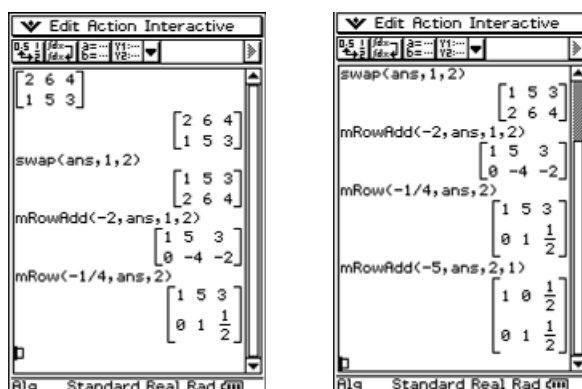
`swap(matrix,row_a,row_b)`: swaps row_a and row_b in **matrix**

`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.

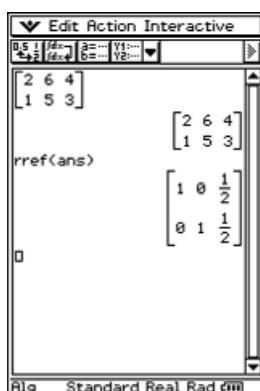
You can see that we begin and end with the matrices $\begin{bmatrix} 2 & 6 & 4 \\ 1 & 5 & 3 \end{bmatrix}$ and $\begin{bmatrix} 1 & 0 & \frac{1}{2} \\ 0 & 1 & \frac{1}{2} \end{bmatrix}$ respectively.



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)

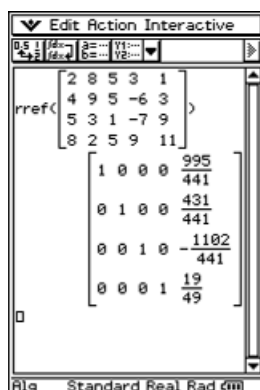
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Now that you know how to carry out Gaussian Elimination on your ClassPad you should try it out on the following matrix to be sure that you have the functions under control. You should first put the following matrix in reduced form using step-by-step 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 'Edit Action Interactive' window of a ClassPad calculator. The 'rref(' function is applied to the matrix $\begin{bmatrix} 2 & 8 & 5 & 3 & 1 \\ 4 & 9 & 5 & -6 & 3 \\ 5 & 3 & 1 & -7 & 9 \\ 8 & 2 & 5 & 9 & 11 \end{bmatrix}$. The resulting reduced row echelon form is displayed as $\begin{bmatrix} 1 & 0 & 0 & 0 & \frac{995}{441} \\ 0 & 1 & 0 & 0 & \frac{431}{441} \\ 0 & 0 & 1 & 0 & -\frac{1102}{441} \\ 0 & 0 & 0 & 1 & \frac{19}{49} \end{bmatrix}$. The calculator interface includes a menu bar with 'Edit Action Interactive', a toolbar with icons for undo, redo, and other functions, and a status bar at the bottom showing 'Alg Standard Real Rad'.