

### Clearing pre-set variables

It is good practice to clear all pre-set variables when starting a new question. There are 2 ways:

1. Press 'CTRL' – 'N' : this will delete all pages
2. Press: 'MENU' – '1: ACTIONS' – '4: CLEAR a – z'

### Storing a matrix

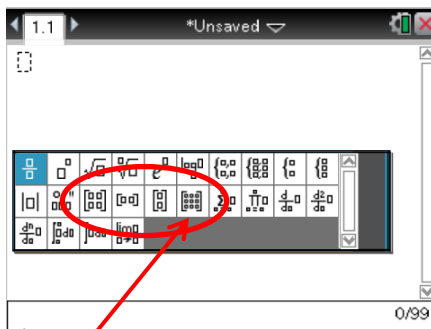
- From the home menu select calculator



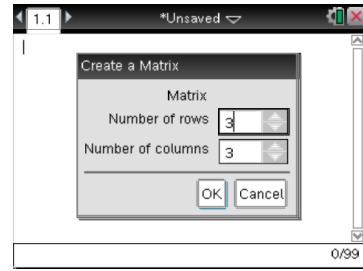
- Press the matrix default button:



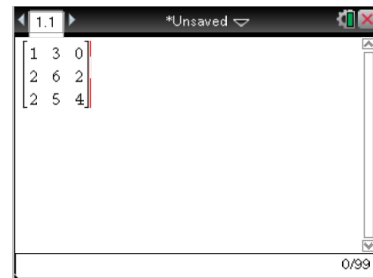
- Select the size of the matrix you need



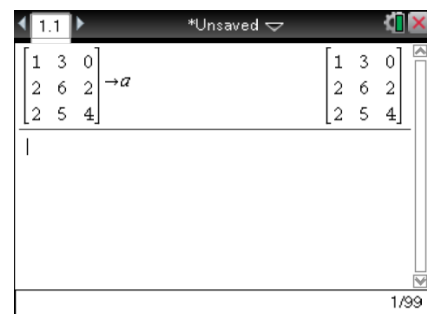
- The 3 x 3 matrix will let you create any size matrix



- Enter the matrix as it is in the question and then press the right arrow to move outside the matrix brackets:



- Press: 'CTRL' – 'STO →' and choose a letter that you would like to store the matrix as and press 'ENTER':



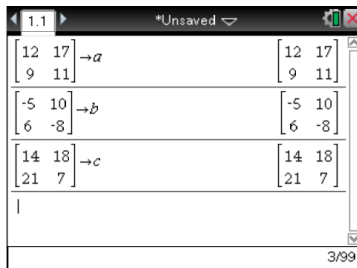
**Matrix addition, subtraction and multiplication**

**Example 1:**

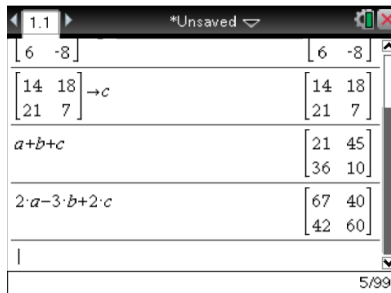
If  $A = \begin{bmatrix} 12 & 17 \\ 9 & 11 \end{bmatrix}$ ,  $B = \begin{bmatrix} -5 & 10 \\ 6 & -8 \end{bmatrix}$ ,  $C = \begin{bmatrix} 14 & 18 \\ 21 & 7 \end{bmatrix}$  find:

- a)  $(A + B) + C$                       h)  $2A - 3B + 2C$

- Store in the matrices from the question:



- Once stored you can simply type the question as it appears. Stored variables should appear in bold on your CAS when typing the equation



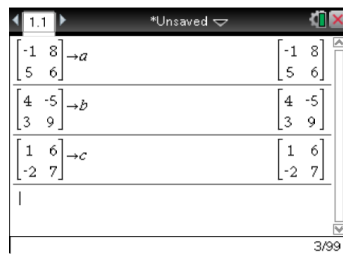
- a)  $(A + B) + C = \begin{bmatrix} 21 & 45 \\ 36 & 10 \end{bmatrix}$
- h)  $2A - 3B + 2C = \begin{bmatrix} 67 & 40 \\ 42 & 60 \end{bmatrix}$

**Example 2:**

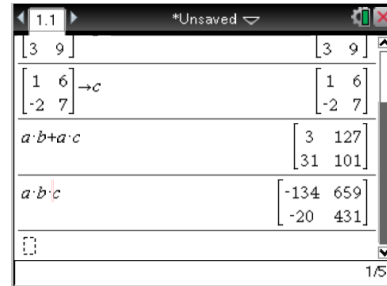
If  $A = \begin{bmatrix} -1 & 8 \\ 5 & 6 \end{bmatrix}$ ,  $B = \begin{bmatrix} 4 & -5 \\ 3 & 9 \end{bmatrix}$ ,  $C = \begin{bmatrix} 1 & 6 \\ -2 & 7 \end{bmatrix}$  find:

- b)  $AB + AC$                       c)  $A(BC)$

- Store in the matrices from the question. Remember to clear any pre-set variables:



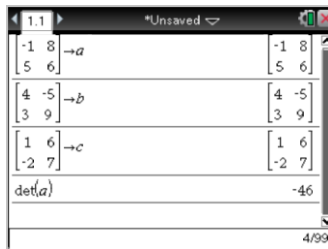
- Type the question as it appears remembering to add an x (multiply) between letters if they are multiplied between each other.
- Hint: if you simply write AB the calculator will look for a something stored as AB and not do  $A \times B$ .



- b)  $AB + AC = \begin{bmatrix} 3 & 127 \\ 31 & 101 \end{bmatrix}$
- c)  $A(BC) = \begin{bmatrix} -134 & 659 \\ -20 & 431 \end{bmatrix}$

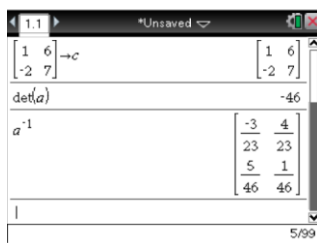
### Determinant, inverse and solving simultaneous equations

**DETERMINANT:** Once your matrices are stored press: **'MENU' – '7: MATRIX & VECTOR' – '3: DETERMINANT'** then in the brackets put the letter of the pre-stored matrix that you wish to find the determinant of:



The determinant of matrix A is -46

- Remember an inverse exists if the determinant does not equal zero
- As long as the determinant does not equal zero a solution will exist to simultaneous equations.
- INVERSE:** Once the matrices are stored, raise the matrix to the power of -1. i.e: press: **'A' – '(-)' – '1'**:



- The inverse of A =  $\begin{bmatrix} -3 & 4 \\ 5 & 1 \end{bmatrix}$

### Solving simultaneous equations

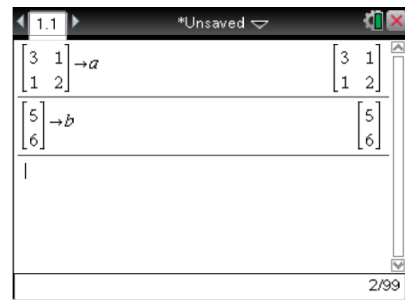
**Example 3:** Solve the following pair of simultaneous equations using matrices.

a)  $3x + y = 5$  and  $x + 2y = 6$

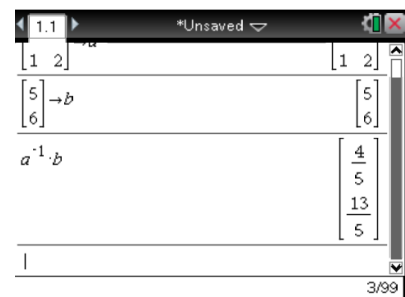
- Write the equations in matrix form. Your first matrix is your coefficient matrix (ie. The numbers in front of the letters. Each column is a different variable (letter)) Your second matrix is your variable matrix and your third matrix will be your answer matrix

$$\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \end{bmatrix}$$

- Store your coefficient matrix as A and your answer matrix as B. Remember to clear all pre-set variables first.



- Multiply the inverse of matrix A with matrix B. Remember to press right after you have entered the power of -1 so 'b' does not appear in the power.



- The solution to the equations is:

$$x = \frac{4}{5} \text{ and } y = \frac{13}{5}$$

## Transition Matrices

For transition matrices (T) you need to create your initial state matrix (S) and your transition matrix.

**Example 4:** At a large retail outlet 55% of people drink coffee and 45% drink tea. The catering company has introduced a new brand of tea and market research shows that of those who drink tea 15% will change to coffee each week and of those who drink coffee 75% will change to tea each week

$$T = \begin{matrix} & \text{From:} \\ & \begin{matrix} C & T \end{matrix} \\ \begin{matrix} C \\ T \end{matrix} & \begin{bmatrix} 0.25 & 0.15 \\ 0.75 & 0.85 \end{bmatrix} \end{matrix}$$

$$S = \begin{matrix} C \\ T \end{matrix} \begin{bmatrix} 0.55 \\ 0.45 \end{bmatrix}$$

- To find the percent of people who drink each drink after a certain period: eg after 5 weeks:

$$T^5 \times S = \begin{bmatrix} 0.166671 \\ 0.833333 \end{bmatrix}$$

- To change to percent, multiply by 100
  - Coffee drinkers after 5 weeks: 16.7%
  - Tea drinkers after 5 weeks: 83.3%