1.15 Eigenvalues and eigenvectors

1.15.1 Find eigenvalues of a matrix

Suppose you want to know the eigenvalues of the following matrix:

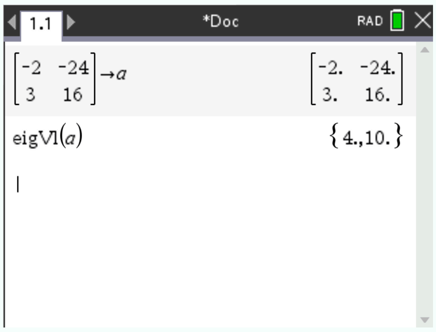
$$A = \begin{pmatrix} -2 & -24 \\ 3 & 16 \end{pmatrix}$$

① Create a new document, select Add Calculator.

② Create the matrix. To do this, press menu and select Matrix & Vector > Create > Matrix. Enter the number of rows (2) and the number of columns (2). Press enter . Write the matrix values.

③ Store the matrix and name it a : press ctrl sto→ var and write **'a'** . Press enter .

④ Press menu , select Matrix & Vector > Advanced > Eigenvalues. Write **'a'** inside the brackets of **'eigVl()'**. Press enter .



The results should be 4 and 10, giving us the eigenvalues.

1.15.2 Find eigenvectors of a matrix

Consider the following matrix :

$$A = \begin{pmatrix} -2 & -24 \\ 3 & 16 \end{pmatrix}$$

We want to know the eigenvector (x, y) associated to it.

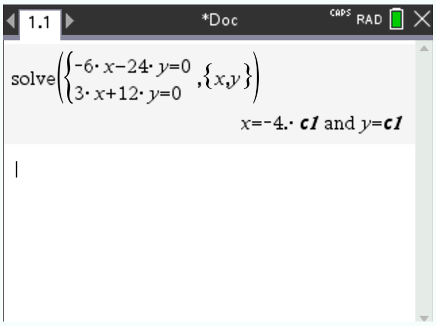
① Write the homogeneous linear system associated to the eigenvalue:

$$\left[A-\begin{pmatrix}\lambda & 0\\ 0 & \lambda\end{pmatrix}\right]\begin{pmatrix}x\\ y\end{pmatrix}=\begin{pmatrix}0\\ 0\end{pmatrix}.$$

Here:

$$\begin{cases}-6x-24y=0\\ 3x+12y=0\end{cases}$$

② Solve the linear system on your calculator. To do this, menu and select Algebra > Solve System of Equations > Solve System of Linear Equations. The calculator should display the following:



y is free, and $x=-4y$

This means that the vectors

$$t\begin{pmatrix}-4\\ 1\end{pmatrix}$$

(here we replaced y with t, which is more commonly used for a free variable) are the eigenvectors. A possible eigenvector is

$$x_1=\begin{pmatrix}-4\\ 1\end{pmatrix}$$

By the same process you can compute the eigenvector x_2 associated to $\lambda_2=10$. One possibility is

$$x_2=\begin{pmatrix}-2\\ 1\end{pmatrix}$$

2 Functions