

Eigenvectors and Eigenvalues

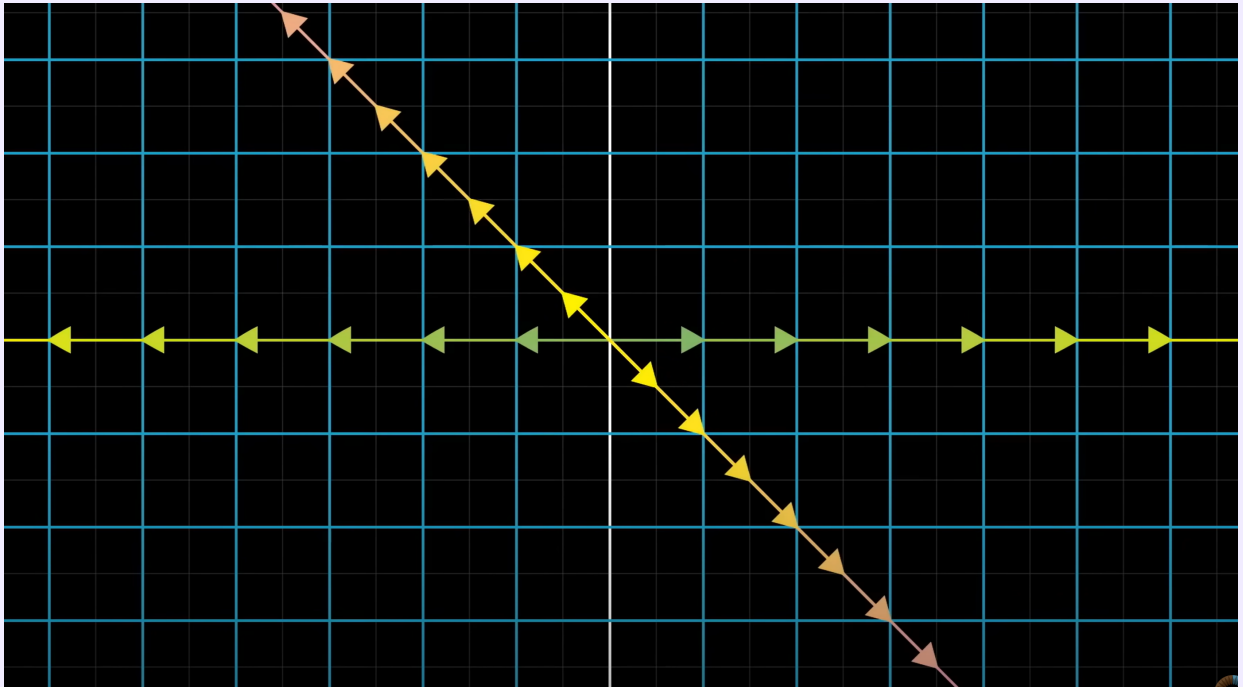
In a transformation, eigenvectors are the [vectors](#) that don't change direction, but get just scaled.

The factors by which they get scaled is called eigenvalue, and each eigenvector has an associated eigenvalue.

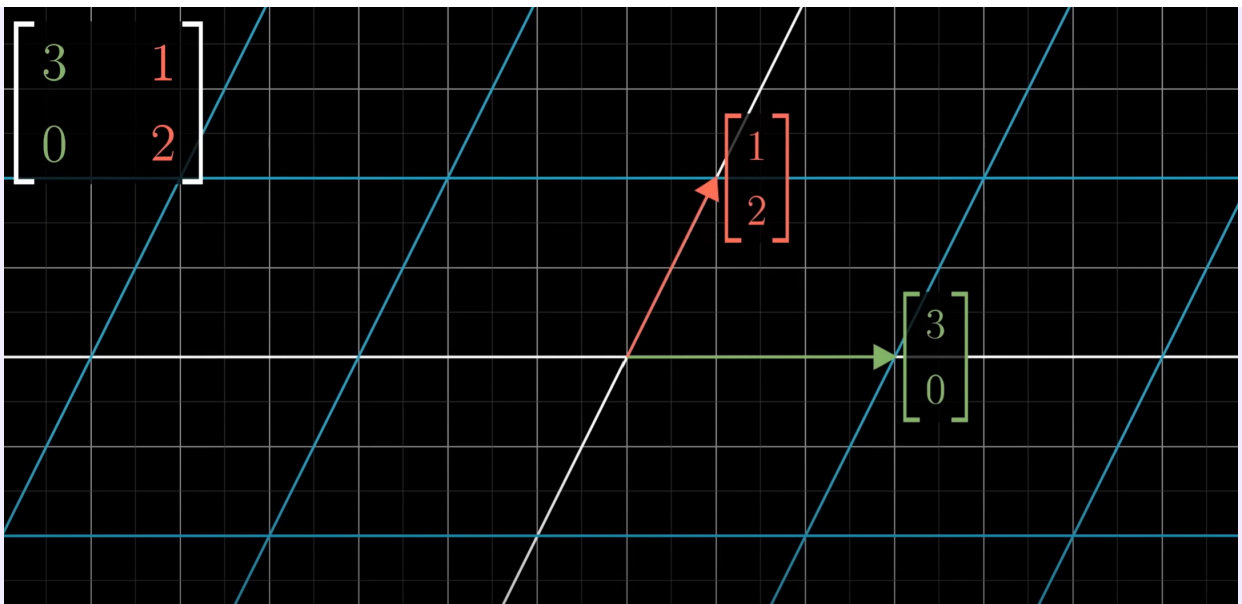
There can also be no eigenvectors.

Example

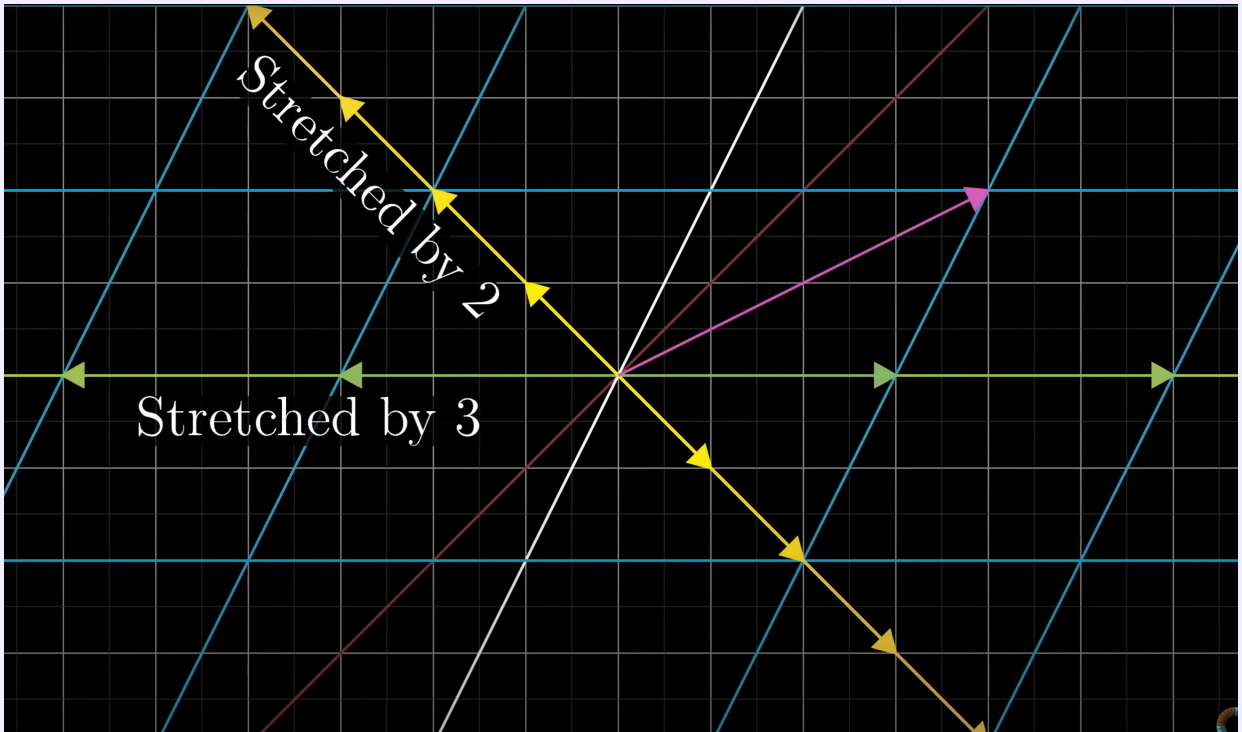
Imagine we have two vectors in the basic plane:



We put the plane through the transformation: $\begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$



Every other vector drifts to another direction, but not these guys.



These vectors just get scaled.

Info

The determinant of a [matrix](#) is the product of eigenvalues.

Info

In a 3D rotation, the axis of rotation is an eigenvector. It doesn't change direction.

Formal definition

The diagram shows the equation $A \vec{v} = \lambda \vec{v}$ on a black background. Below the equation, four labels are connected to their respective terms by white lines: 'linear transformation' points to A , 'eigen vector' points to the first \vec{v} , 'eigen value' points to λ , and 'original direction' points to the second \vec{v} .

$$A \vec{v} = \lambda \vec{v}$$

linear transformation eigen vector eigen value original direction

The **eigen vectors** are such that when receiving a **linear transformation**, they stay on the same **original direction**, only scaled by their **eigenvalue**(λ).