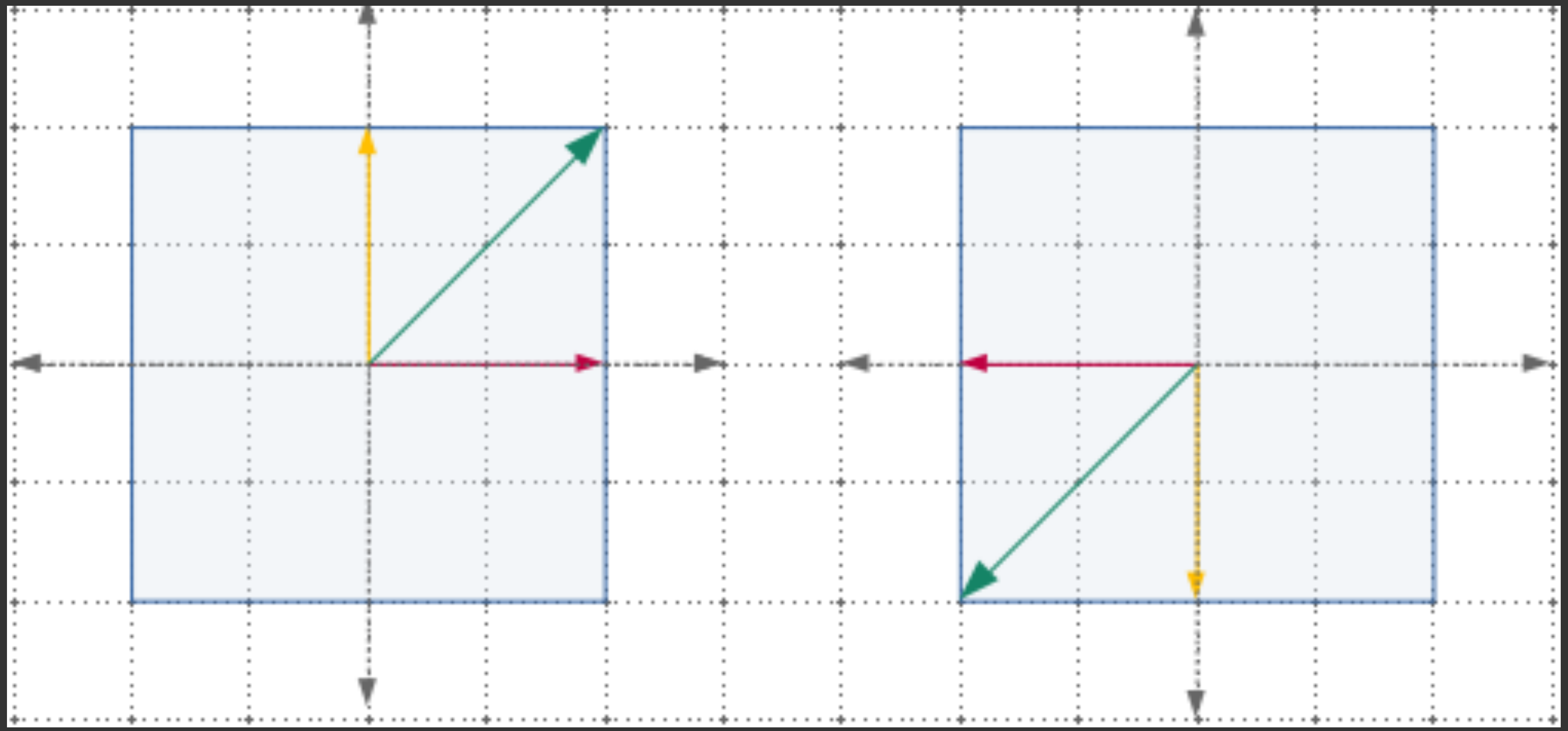
eigenvectors and eigenvalues: intuitively

another example

In 180 degree rotation of square, all vectors are still laying on the same span, but their direction is reversed. Hence, all vectors are eigenvectors, having an eigenvalue of -1.



Note: In case of 3d rotation transformation of cube, the eigenvector gives the axis of rotation.

eigenvectors and eigenvalues

Let A be a $n \times n$ matrix.

1. An eigenvector of A is a nonzero vector $\vec{v}$ in $\mathbb{R}^n$ such that $A\vec{v} = \lambda\vec{v}$, for some scalar λ
2. An eigenvalue of A is a scalar λ such that the equation $A\vec{v} = \lambda\vec{v}$ has a *non-trivial** solution

If $A\vec{v} = \lambda\vec{v}$ for $\vec{v} \neq 0$, we say that λ is the eigenvalue for $\vec{v}$, and that $\vec{v}$ is an eigenvector for λ.

*means that the solution vector $\vec{v}$ is not the zero vector ($\vec{v} \neq \vec{0}$), and ensures that it represents a meaningful direction in the vector space.