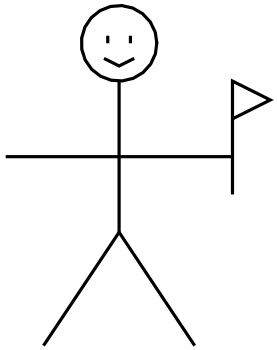
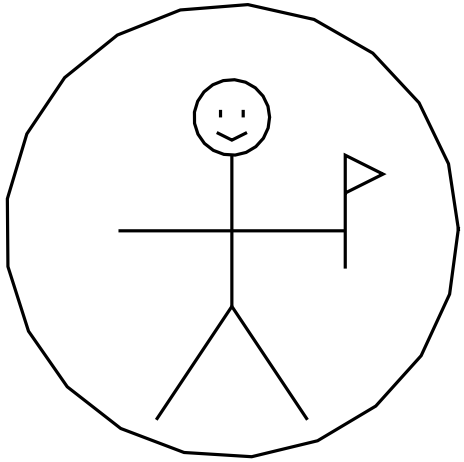
The Adventures of Eigenvalue Guy

This is Eigenvalue Guy. He is about to embark on a great adventure.

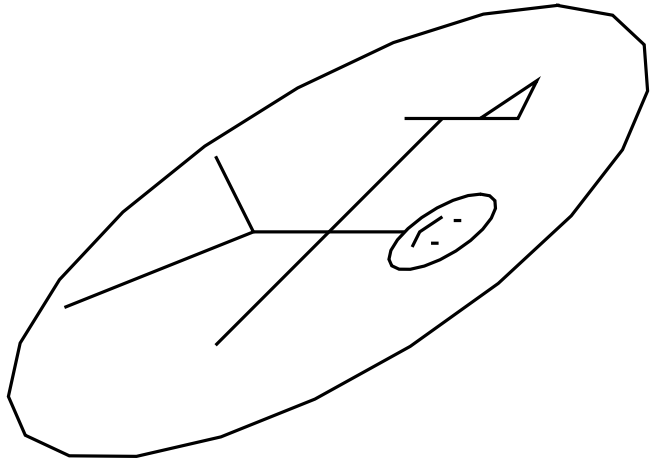


He is going to demonstrate the effects of the linear transformation corresponding to the matrix $A = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$.

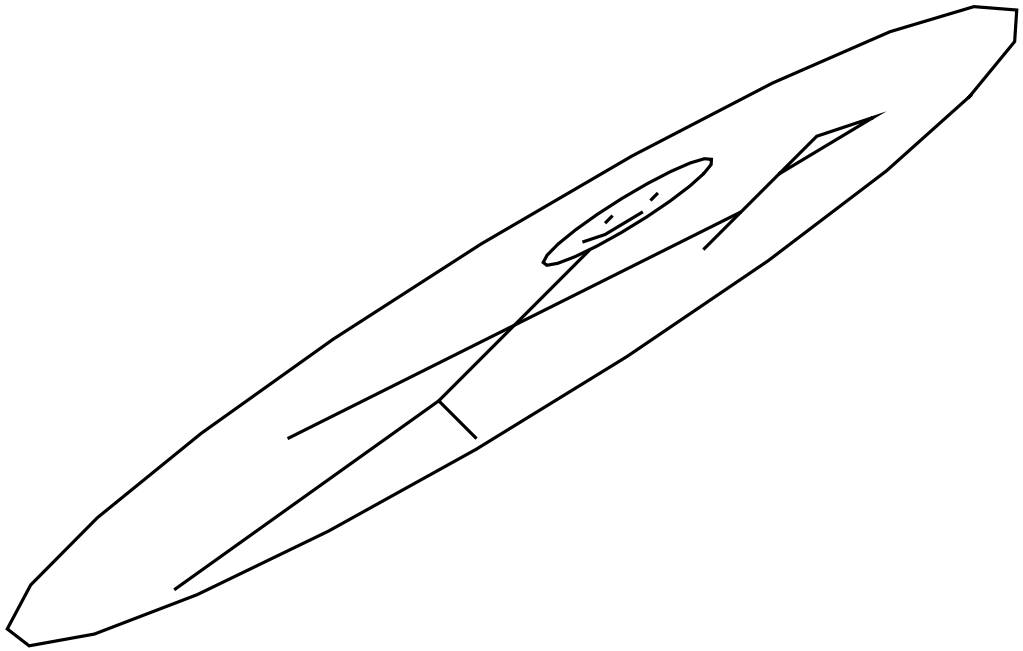
First, we place him inside a protective bubble.



Now we multiply every vector in his body by $\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$. I assure you that he will feel no pain!



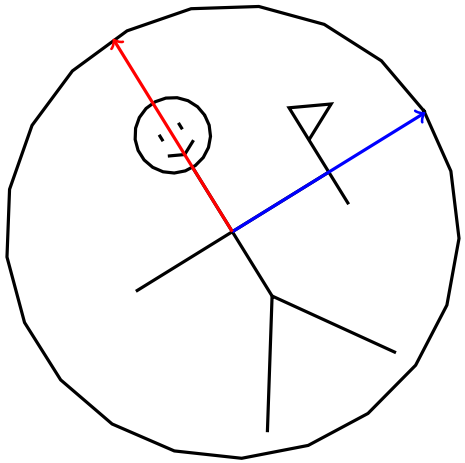
Here he is after a second transformation by the same matrix.



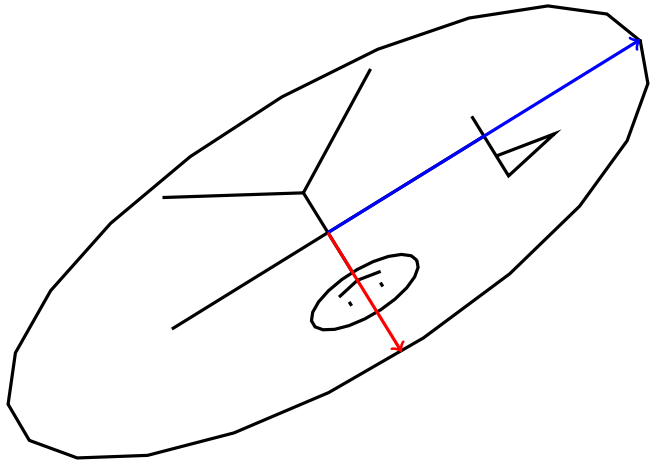
Can you tell what the transformation is doing?

Now with Eigenvectors!

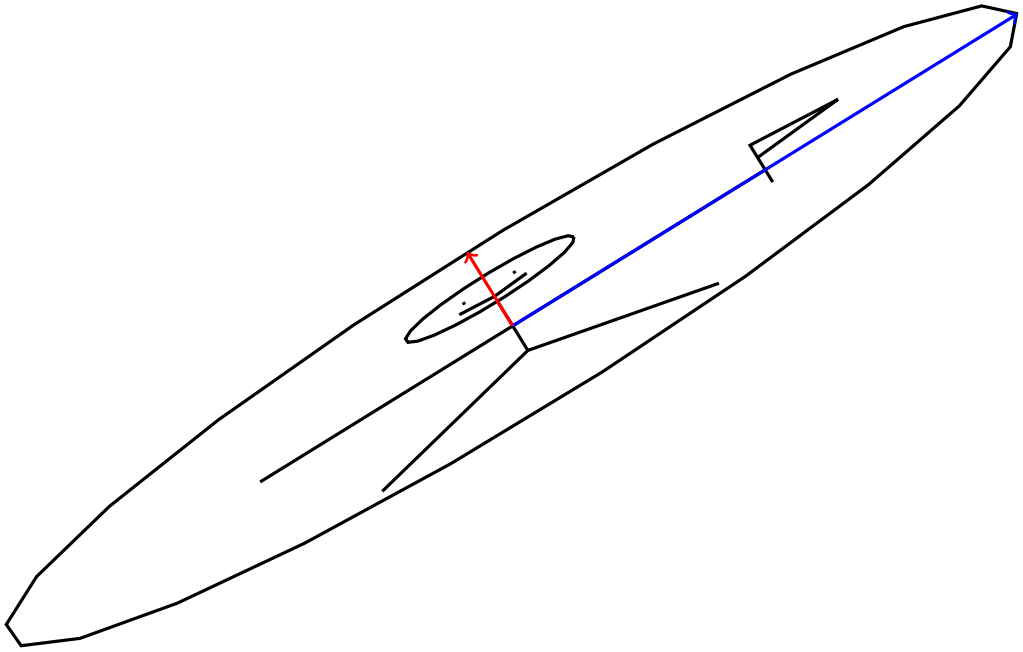
Watch what happens to Eigenvector Guy when we use the same transformation, but he has aligned his body with the two eigenvectors of $A = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$.



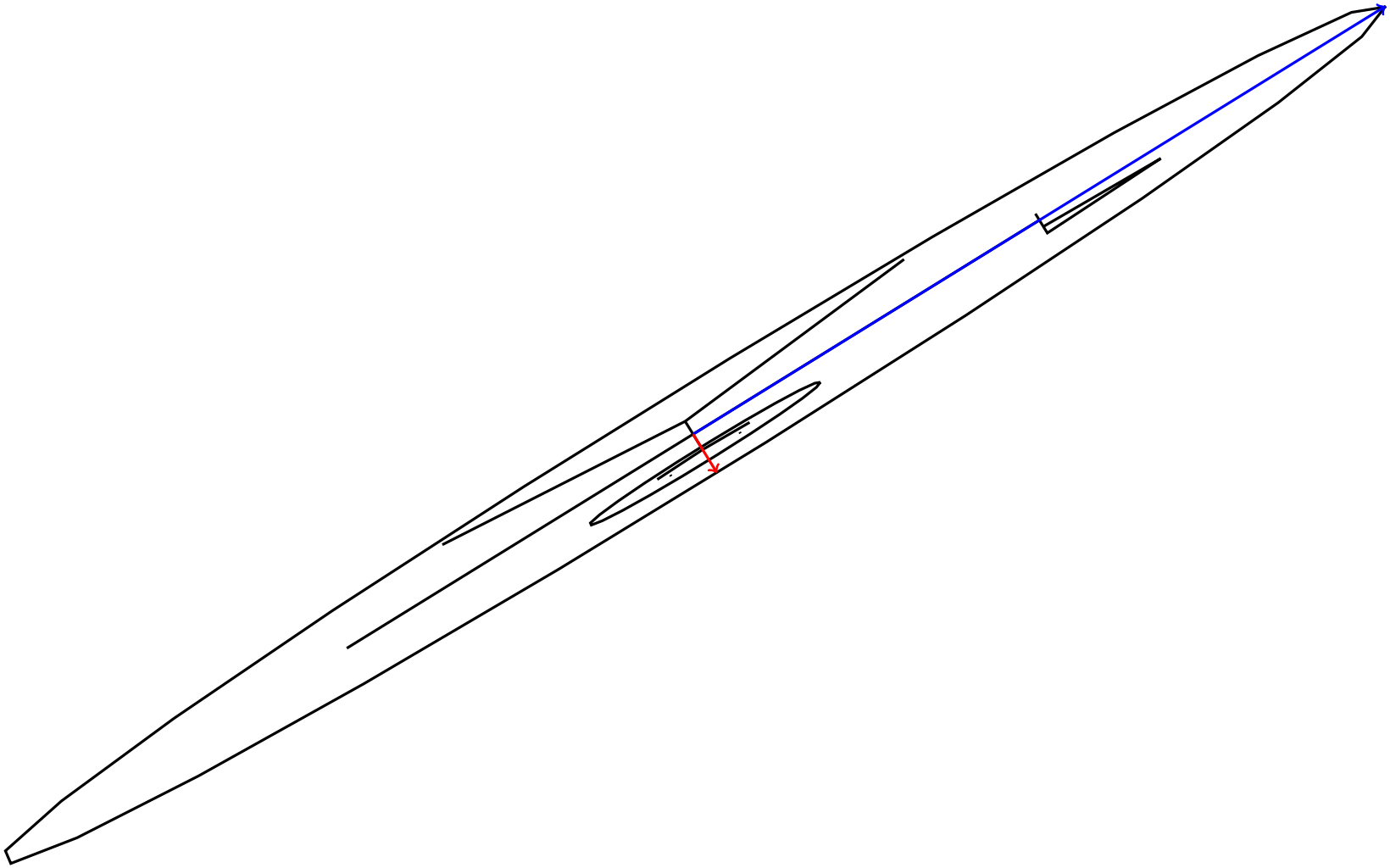
After one transformation.



After two transformations.

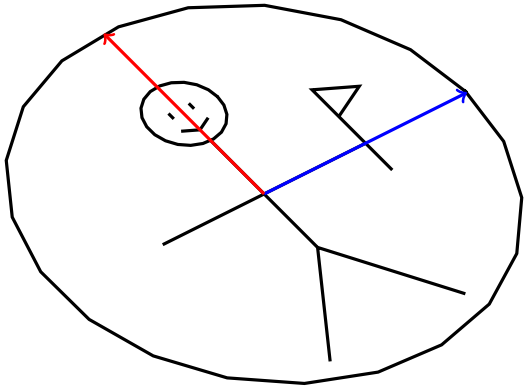


After three transformations.

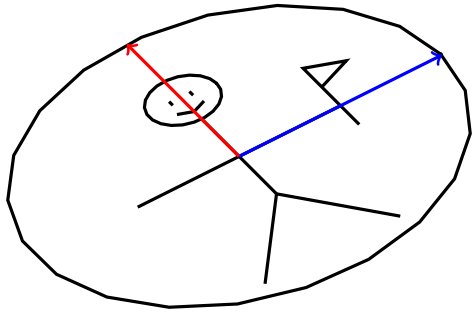


More Examples

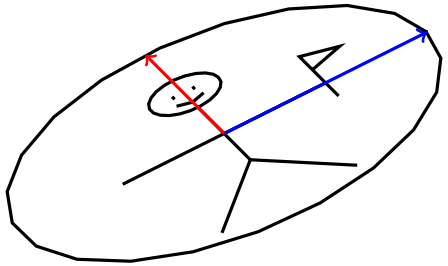
Here $A = \begin{pmatrix} 0.9 & 0.2 \\ 0.1 & 0.8 \end{pmatrix}$. Eigenvalue Guy has aligned his body with the two eigenvectors of A.



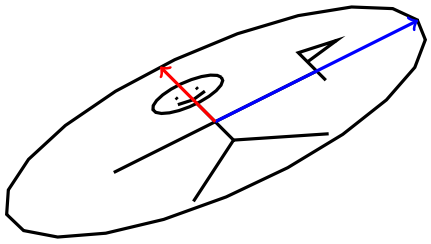
Here has been multiplied by one copy of $A = \begin{pmatrix} 0.9 & 0.2 \\ 0.1 & 0.8 \end{pmatrix}$.



Multiplied by another copy of $A = \begin{pmatrix} 0.9 & 0.2 \\ 0.1 & 0.8 \end{pmatrix}$.

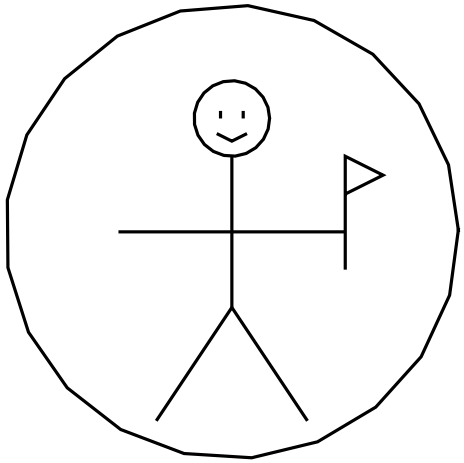


Here he has been multiplied by A^3.

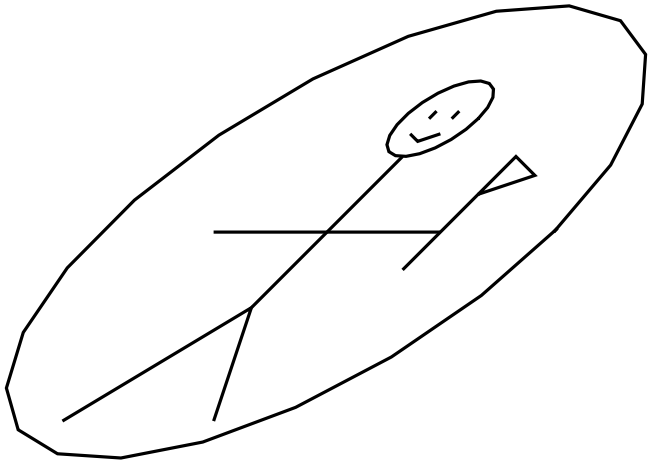


Eigenvalue Guy Gets Sheared

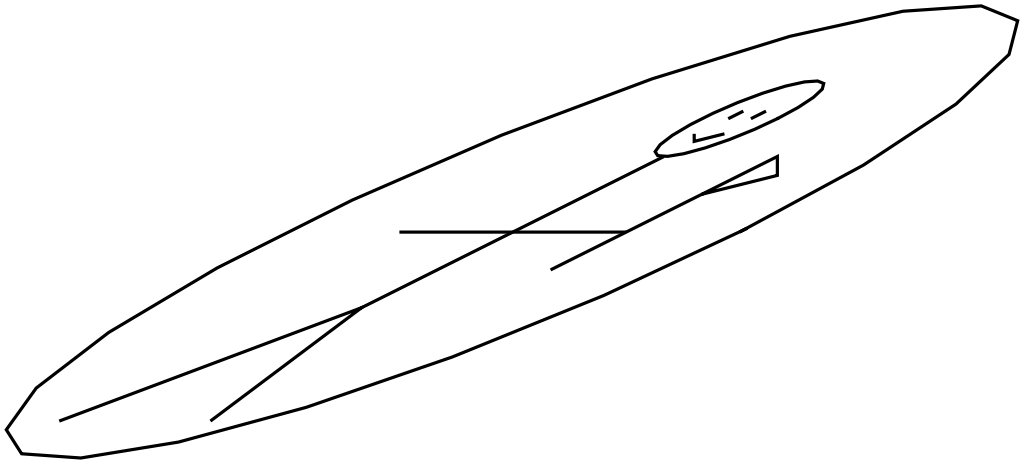
Here the matrix is $A = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$.



Transformed once.

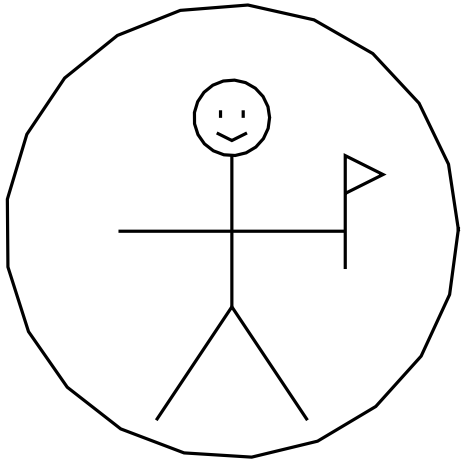


Transformed twice.

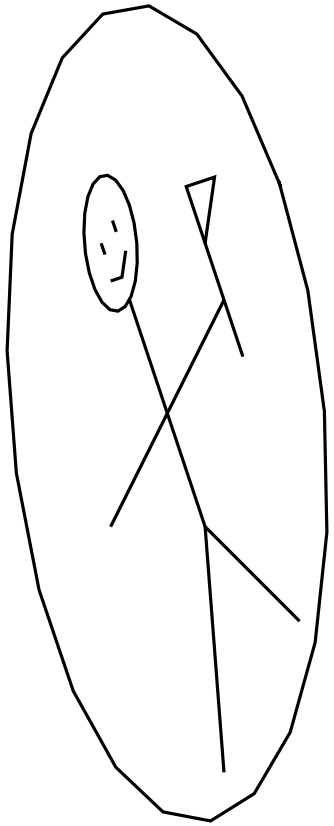


Complex Eigenvalues

Here the matrix is $A = \begin{pmatrix} 0.5 & -0.5 \\ 1 & 1.5 \end{pmatrix}$, which has eigenvalues $\lambda = 1 \pm 0.5i$.



Transformed once.



Transformed twice.