Using matrices to make transformations

6/6 points (100%)

Practice Quiz, 6 questions

Congratulations! You passed!

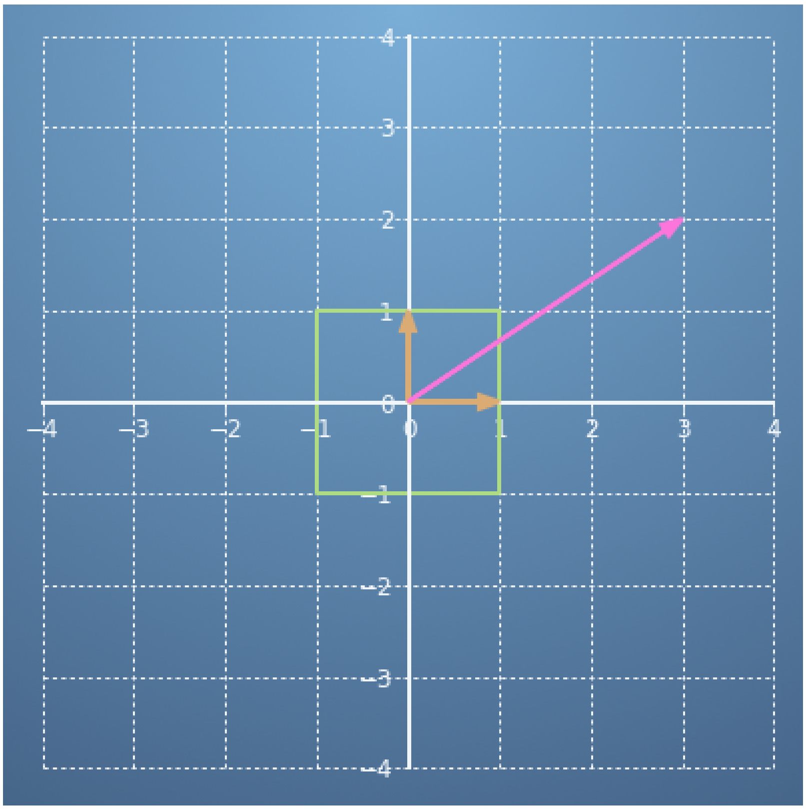
Next Item

1 / 1 points

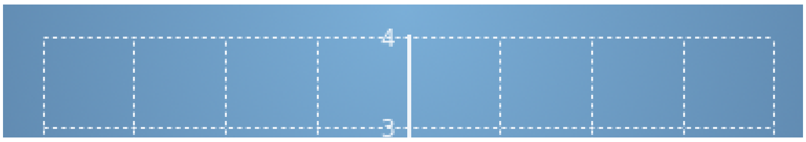
1.

Matrices make transformations on vectors, potentially changing their magnitude and direction.

If we have two unit vectors (in orange) and another vector, $\mathbf{r} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$ (in pink), before any transformations - these look like this:



Take the matrix, $A = \begin{bmatrix} 1/2 & -1 \\ 0 & 3/4 \end{bmatrix}$, see how it transforms the unit vectors and the vector, $\mathbf{r}$,



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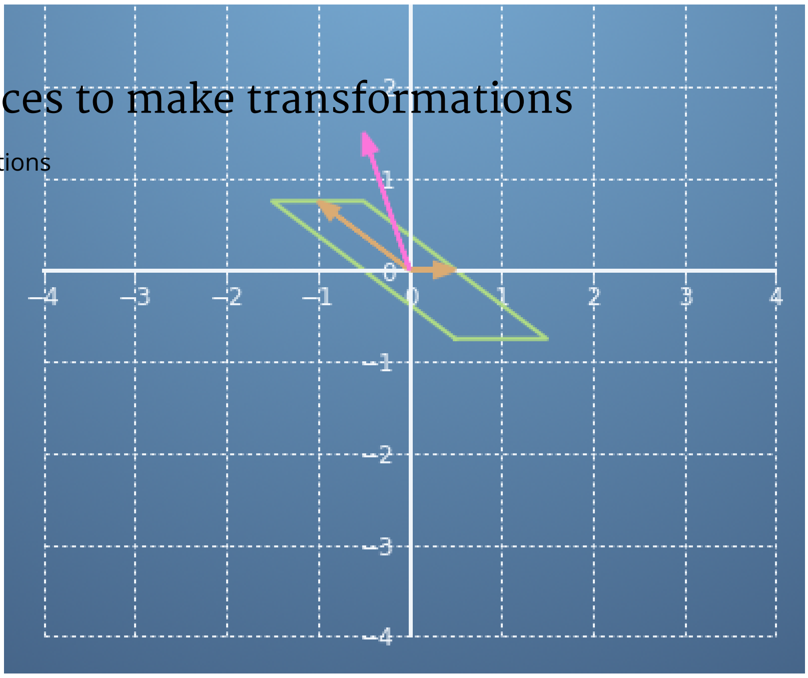

What new vector, $\mathbf{r}'$, does A transform $\mathbf{r}$ to? Specifically, what does the following equal?

$$A\mathbf{r} = \begin{bmatrix} 1/2 & -1 \\ 0 & 3/4 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \end{bmatrix} =$$

- $\begin{bmatrix} -3/2 \\ 3/2 \end{bmatrix}$
- $\begin{bmatrix} 3/2 \\ -3/4 \end{bmatrix}$
- $\begin{bmatrix} -1/2 \\ 3/2 \end{bmatrix}$

Correct
You could either calculate this or read it off the graph.

- $\begin{bmatrix} 3/2 \\ -1/2 \end{bmatrix}$

1 / 1
points

2.

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Let's use the same matrix, $A = \begin{bmatrix} 1/2 & -1 \\ 0 & 3/4 \end{bmatrix}$, from the previous question.

Type an expression for the vector, $\mathbf{s} = A \begin{bmatrix} -2 \\ 4 \end{bmatrix}$.

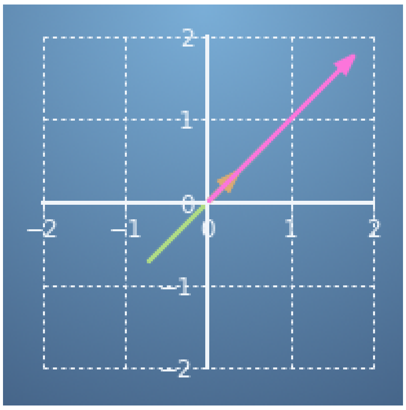
Correct Response

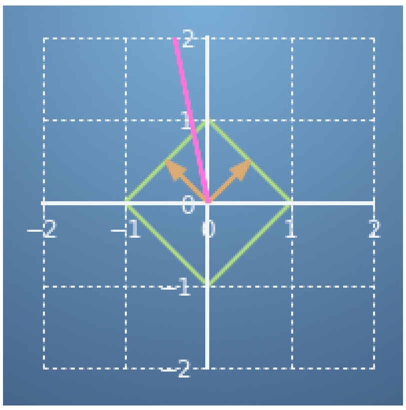
Well done.

1 / 1 points

3.

Select the transformation which best corresponds to the matrix, $M = \begin{bmatrix} -1/2 & 1/2 \\ 1/2 & 1/2 \end{bmatrix}$.





Correct

The axes have been rotated, and also flipped here.

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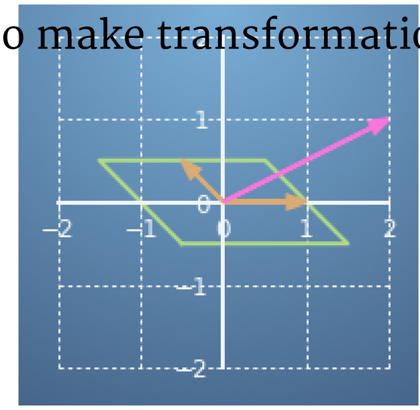

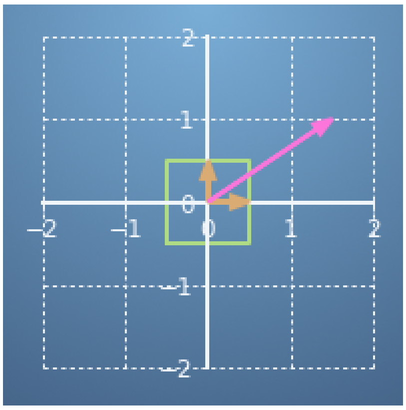

1 / 1 points

4.
A digital image can be stored by putting lots of coloured pixels at their particular coordinates on a grid.

If we apply a matrix transformation to the coordinates of each of the pixels in an image, we transform the image as a whole.

Given a starting image (such as this one of “The Ambassadors” [1533] by Hans Holbein the Younger),

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which is made up of 400×400 pixels, if we apply the same transformation to each of those 160,000 pixels, the transformed image becomes:

Pick a matrix that could correspond to the transformation.

- $\begin{bmatrix} -1/2 & 0 \\ 0 & \sqrt{3/2} \end{bmatrix}$

- $\begin{bmatrix} 1/2 & 0 \\ -\sqrt{3/2} & 1/2 \end{bmatrix}$

- $\begin{bmatrix} \sqrt{3/2} & \sqrt{3/2} \\ 1/2 & 1/2 \end{bmatrix}$

$$\begin{bmatrix} \sqrt{3}/2 & -1/2 \\ 1/2 & \sqrt{3}/2 \end{bmatrix}$$

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Correct

This is a rotation matrix (by 30° anticlockwise).

1 / 1
points

5.

At the bottom of the "The Ambassadors", in the middle of the floor, there is a skull that Holbein has already applied a matrix transformation to!

To undo the transformation, build a matrix which is firstly a shear in the y direction followed by a scaling in y direction. I.e., multiply the matrices,

$$M = \begin{bmatrix} 1 & 0 \\ 0 & 8 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -1/2 & 1 \end{bmatrix}$$

Correct Response

Well done.
Use your answer in the next question to transform the skull back.

1 / 1
points

6.

Use your answer from the previous question to transform the skull back to normal. Change the values of the matrix and press *Go!* to score on this question.

You can also use this example to experiment with other matrix transformations. Try some of the ones in this quiz. Have a play!

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