Using matrices to make transformations | Coursera

Using matrices to make transformations

Practice Quiz • 30 min

Congratulations! You passed!

TO PASS 80% or higher

GRADE

100%

Using matrices to make transformations

TOTAL POINTS 6

1.

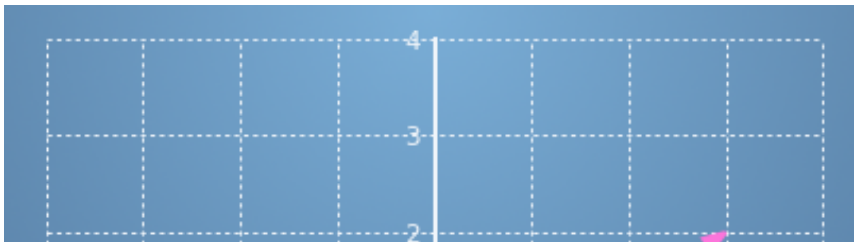
Question 1

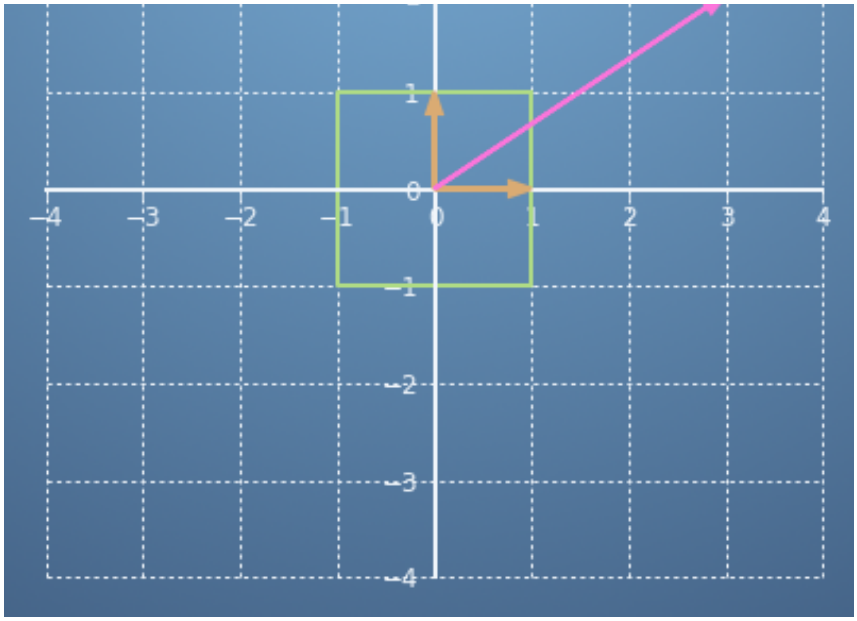
Matrices make transformations on vectors, potentially changing their magnitude and direction.

If we have two unit vectors (in orange) and another vector,

$$\begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

r = [3 2] (in pink), before any transformations - these look like this:



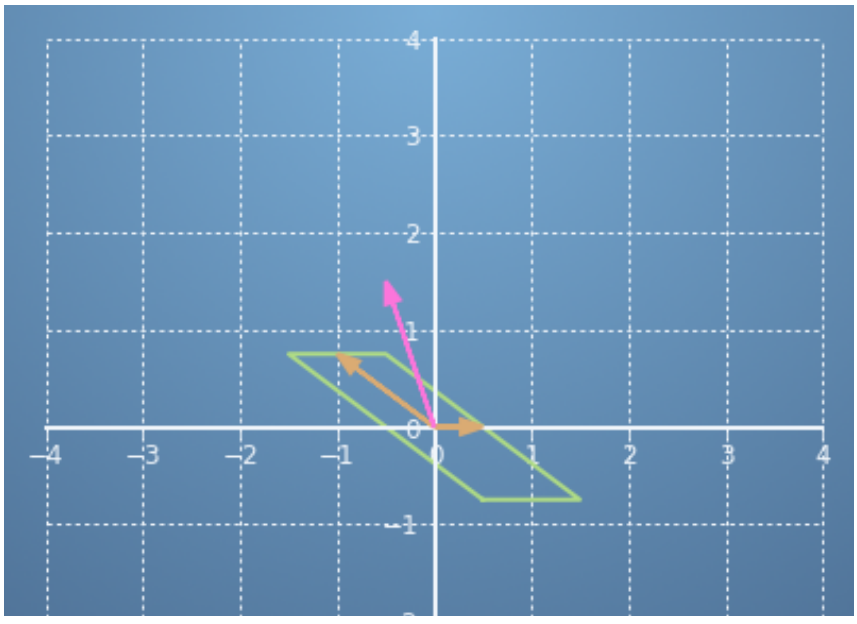


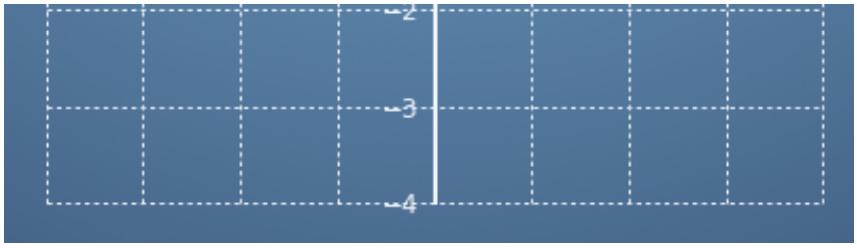
Take the matrix,

$$\begin{bmatrix} 1/2 & -1 \\ 0 & 3/4 \end{bmatrix}$$

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

r,





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

$$\begin{bmatrix} 1/2 & -1 \\ 0 & 3/4 \end{bmatrix}$$

$$\begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

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

1 / 1 point

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

  –1/2
  [3/2]

- ( ) $\begin{bmatrix} -3/2 \\ 3/2 \end{bmatrix}$

  –3/2
  [3/2]

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

3/2
[−3/4]

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

3/2
[−1/2]

Correct

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

2.
Question 2
Let's use the same matrix,

$$\begin{bmatrix} 1/2 & -1 \\ 0 & 3/4 \end{bmatrix}$$

$A = \begin{bmatrix} 1/2 & -1 \\ 0 & 3/4 \end{bmatrix}$, from the previous question.

Type an expression for the vector,

$$\begin{bmatrix} -2 \\ 4 \end{bmatrix}$$

$\mathbf{s} = A \begin{bmatrix} -2 \\ 4 \end{bmatrix}$.

1 / 1 point

Generic File

Generic File

rect values below:

Correct

Well done.

3.

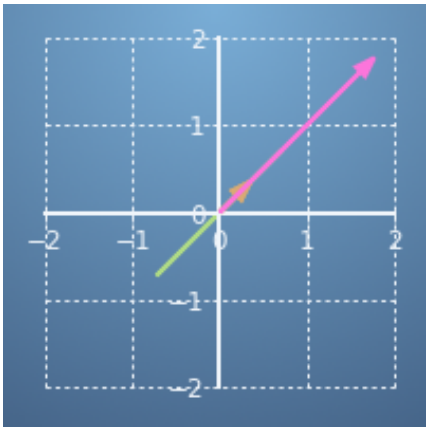
Question 3

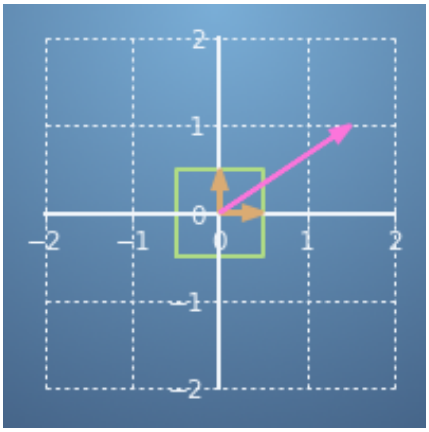
Select the transformation which best corresponds to the matrix,

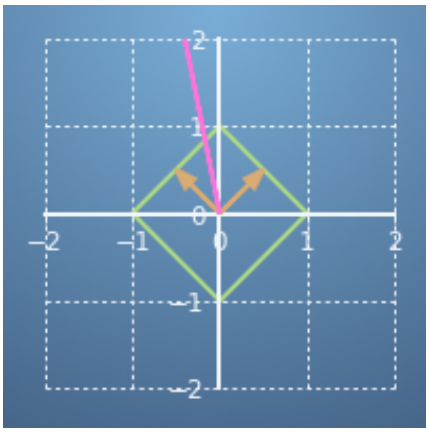
$$\begin{bmatrix} -1/2 & 1/2 \\ 1/2 & 1/2 \end{bmatrix}$$

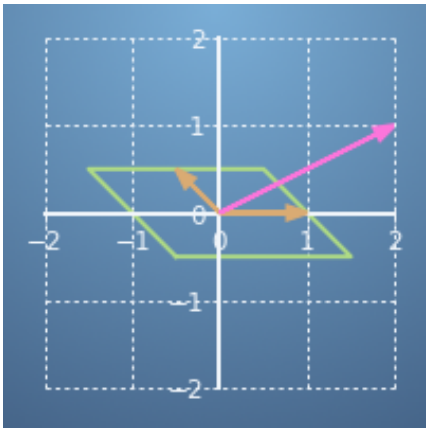
$M = \begin{bmatrix} -1/2 & 1/2 \\ 1/2 & 1/2 \end{bmatrix}$.

1 / 1 point




2
1
0
−2
−1
0
1
2
−1
−2


2
1
0
−2
−1
0
1
2
−1
−2



Correct

The axes have been rotated, and also flipped here.

4.

Question 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),

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.

1 / 1 point

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

  $\sqrt{3}/2 \quad -1/2$
  $[\ 1/2 \quad \sqrt{3}/2\ ]$

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

  $1/2 \quad 0$
  $[-\sqrt{3}/2 \quad 1/2]$

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

  $-1/2 \quad 0$
  $[\ 0 \quad \sqrt{3}/2\ ]$

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

  $\sqrt{3}/2 \quad \sqrt{3}/2$
  $[\ 1/2 \quad 1/2\ ]$

Correct

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

5.

Question 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,

$$\begin{bmatrix} 1 & 0 \\ 0 & 8 \end{bmatrix}$$

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

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

1 / 1 point

Generic File

Generic File

Correct

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

6.

Question 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!

1 / 1 point

Correct

Feel free to use the tool to try out different matrices too.