

Combinations of transformations

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Worked example

A triangle T has vertices $(1, 1)$, $(1, 2)$ and $(2, 2)$.

Find the vertices of the image of T under the transformation given by the matrix $\mathbf{M} = \begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}$.

Your turn

A triangle T has vertices $(1, 1)$, $(1, 2)$ and $(2, 2)$.

Find the vertices of the image of T under the transformation given by the matrix $\mathbf{M} = \begin{pmatrix} 3 & 0 \\ 0 & 2 \end{pmatrix}$
 $(3, 2)$, $(3, 4)$ and $(6, 4)$

Worked example

A, B and C are transformations in the $x - y$ plane.

A: Rotation through 270° anticlockwise about the origin.

B: Reflection in the y -axis

C: Transformation B followed by transformation A.

Use matrix multiplication to show that C is equivalent to a single reflection.

Your turn

A, B and C are transformations in the $x - y$ plane.

A: Rotation through 90° anticlockwise about the origin.

B: Reflection in the x -axis

C: Transformation A followed by transformation B.

Use matrix multiplication to show that C is equivalent to a single reflection.

Shown

$$A = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

$$B = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$\begin{aligned} C = BA &= \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \\ &= \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \end{aligned}$$

This is a reflection in the line $y = -x$

Worked example

Use **matrix multiplication** to show that, in the $x - y$ plane,
a reflection in the line $y = x$,
followed by
a rotation, 90° clockwise about the origin,
followed by
a reflection in the x -axis
is equivalent to a transformation by the identity matrix.

Your turn

Use **matrix multiplication** to show that, in the $x - y$ plane,
a reflection in the line $y = -x$,
followed by
a rotation, 90° anticlockwise about the origin,
followed by
a reflection in the x -axis
is equivalent to a transformation by the identity matrix.

Shown

Correct matrix multiplication of

$$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \text{ to give}$$
$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = I$$