Matrices – www.m4ths.com – Steve Blades

$\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}$ The identity matrix	$\begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}$ Reflection in the x axis	$\begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}$ Reflection in the y axis
$\begin{pmatrix}0 & 1\\1 & 0\end{pmatrix}$ Reflection in the line $y = x$	$\begin{pmatrix}0 & -1\\-1 & 0\end{pmatrix}$ Reflection in the line $y = -x$	$\begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}$ Rotation 90^0 A/C about O
$\begin{pmatrix}-1 & 0\\0 & -1\end{pmatrix}$ Rotation 180^0 about O	$\begin{pmatrix}\cos\theta & -\sin\theta\\\sin\theta & \cos\theta\end{pmatrix}$ Rotation θ^0 A/C about O	$\begin{pmatrix}m & 0\\0 & m\end{pmatrix}$ Enlargement scale factor m centre O

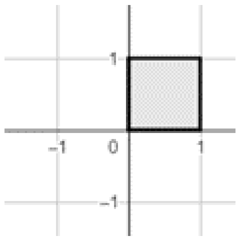
(1) The vertices of rectangle R are $(0,0)$, $(0,4)$, $(3,4)$ and $(3,0)$

(a) Write the coordinates in a 2×4 matrix.

(b) Matrix T represents an enlargement scale factor 3 centre O. Using matrix multiplication, find the vertices of the image of R. (The image is called R')

(c) Matrix M represents a reflection in the line with equation $y = x$. Use matrix multiplication to find the vertices of the R under M.

(2) The unit square is shown below.



(a) Write down the coordinates of the vertices of the square.

(b) Use matrix multiplication to show that a reflection in the y axis **<u>followed</u>** by a reflection in the x axis produces the same transformation as a rotation of 180^o.

(3) The matrix M enlarges a shape by scale factor 4 centre O.

(a) Write down the matrix M.

The point P lies in the x, y plane has coordinates $(2, -3)$

(b) Find the image of point P (P') under the transformation matrix M.

(c) The point P is reflected in the line $y = -x$ **followed** by being reflected in the x axis. Using matrix multiplication show that the coordinates of the point P after the combined transformation are $(3,2)$.

(4) The point Q has coordinates $(4, -4)$

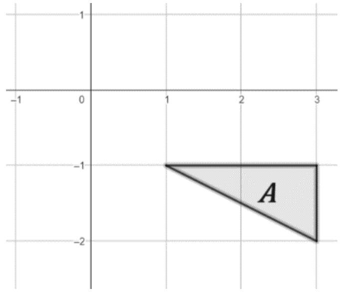
(a) Show that point Q lies on the line with equation $y = -x$

(b) Show that the image of Q also lies on the line $y = -x$ under the transformation matrix $\begin{pmatrix}2 & 0\\0 & 2\end{pmatrix}$.

(c) State fully the transformation that the matrix $\begin{pmatrix}2 & 0\\0 & 2\end{pmatrix}$ produces.

(5) Show that the point with coordinates (r, s) remains invariant under the identity matrix .

(6) The vertices of the triangle A can be written in a 2×3 matrix.



(a) Write down the 2×3 matrix.

(b) Find the matrix which rotates a shape 90^o clockwise about O.

(c) Using matrix multiplication, apply the transformation in part (b) to triangle A and write down the coordinates of the vertices of the image of A.

(7) Find the matrix that reflects in the x axis **followed** by a reflection in the line $y = x$

(8) The matrix $M = \begin{pmatrix}p & 0\\0 & q\end{pmatrix}$ transforms the matrix $\begin{pmatrix}0 & 3 & 5\\1 & -5 & -5\end{pmatrix}$ to the $\begin{pmatrix}0 & -3 & -5\\1 & -5 & -5\end{pmatrix}$

(a) Find the values of p and q.

(b) Hence, describe fully the transformation produced by M.

(c) Explain why all points under the transformation of M^2 remain invariant.

(9) Show that applying the rotation matrix for a 90^o rotation A/C about O twice produces the same matrix for rotating a point by 180^o about O.

(10) Explain what the transformation matrix $\begin{pmatrix}-3 & 0\\0 & -3\end{pmatrix}$ produces.