3.1 The Multipoint Matrix

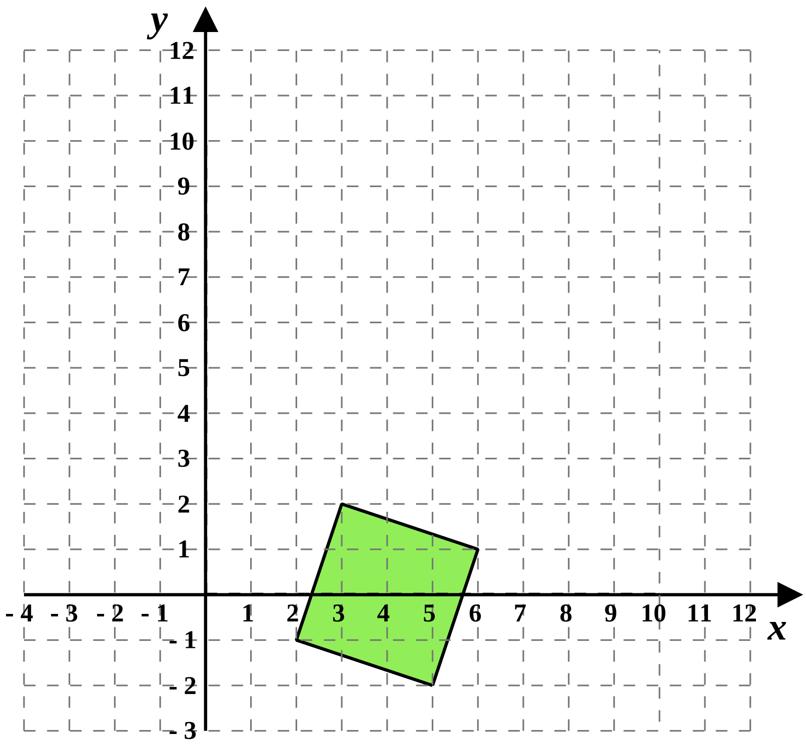
A square has vertices (3, 2), (6, 1), (5, – 2) and (2, – 1)

(i) Write the square's vertices as a multipoint matrix. and transform it with **M**

(ii) Transform the square's vertices using the matrix **M** $= \begin{pmatrix} 1 & 4 \\ 2 & -1 \end{pmatrix}$

(iii) Add a plot of the transformed shape to the graph below.

Teaching Video : http://www.NumberWonder.co.uk/v9090/3.mp4



[1, 4, 1 marks]

Note : The determinant of **M** is a negative number, – 9
The magnitude of *det* **M** is 9 : the Area Scale Factor of the transformation.

3.2 Exercise

Any solution based entirely on graphical
or numerical methods is not acceptable
Marks Available : 30

Question 1

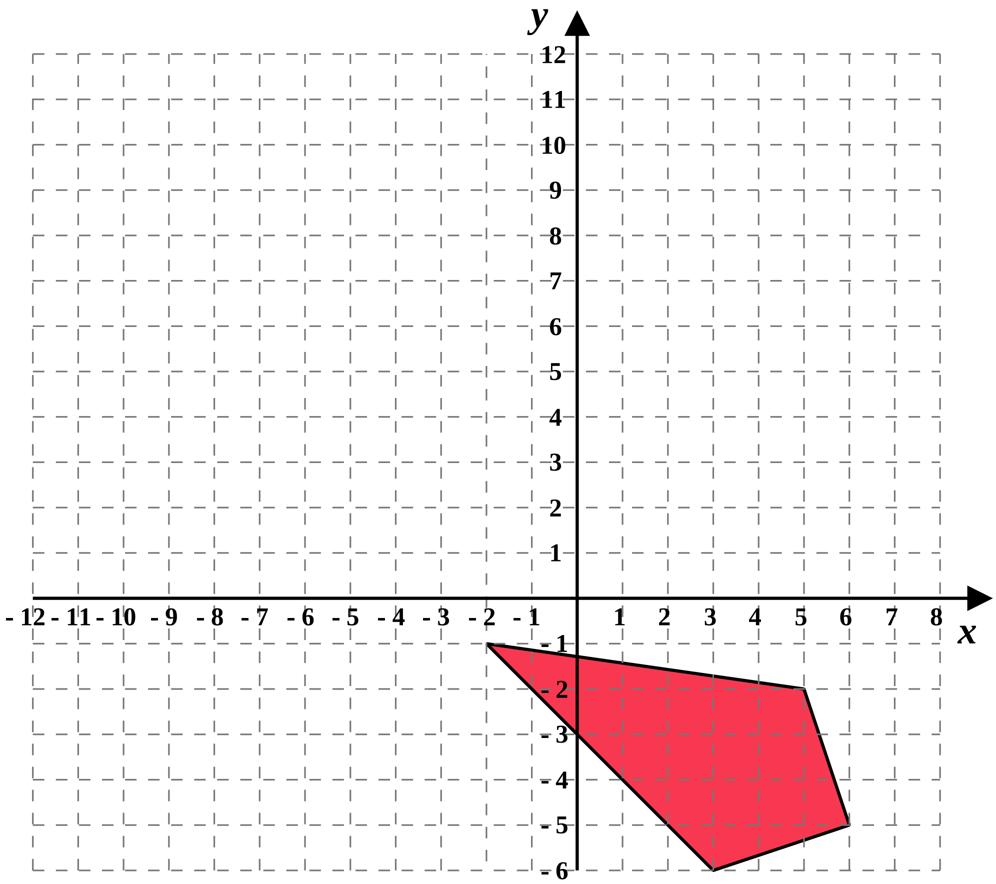
A kite has vertices (5, – 2), (6, – 5), (3, – 6) and (– 2, – 1)

(i) Write the kite's vertices as a multipoint matrix.

(ii) Transform the kite's vertices using the matrix $\mathbf{M} = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

(iii) Add a plot of the transformed shape to the graph below.

(iv) What is the area scale factor of the transformation ?



[1, 4, 1, 1 marks]

Question 2

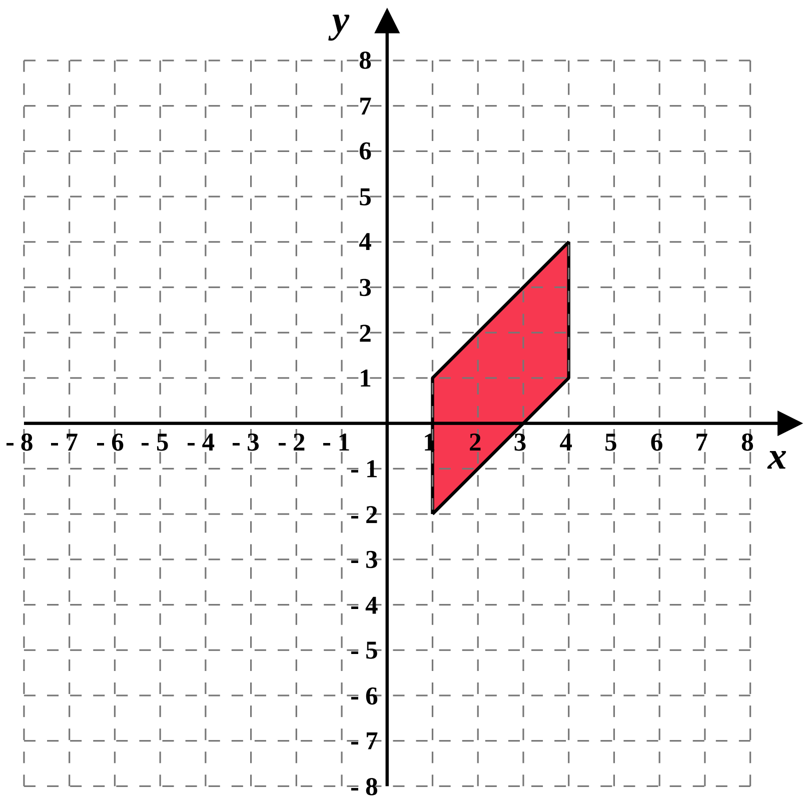
A parallelogram has vertices (1, – 2), (4, 1), (4, 4) and (1, 1)

(i) Write the parallelogram's vertices as a multipoint matrix.

(ii) Transform the parallelogram's vertices using the matrix **M** $= \begin{pmatrix} 1 & -2 \\ -2 & 1 \end{pmatrix}$

(iii) Add a plot of the transformed shape to the graph below.

(iv) Find the magnitude of *det* **M** and explain what it tells you about the transformation.



[1, 4, 1, 1 marks]

Question 3

This question is about working out the following matrix multiplication,

$$\begin{pmatrix} 5 & -1 & 6 \\ 8 & 3 & -4 \end{pmatrix} \times \begin{pmatrix} 2 & 9 & 1 & -6 \\ -3 & 12 & -5 & 7 \\ 4 & -2 & 0 & 11 \end{pmatrix}$$

Here is the multiplication grid already set up,

$$\begin{array}{c|c} & \begin{pmatrix} 2 & 9 & 1 & -6 \\ -3 & 12 & -5 & 7 \\ 4 & -2 & 0 & 11 \end{pmatrix} \\ \hline \begin{pmatrix} 5 & -1 & 6 \\ 8 & 3 & -4 \end{pmatrix} & \begin{pmatrix} & 21 & & \\ & & & -71 \end{pmatrix} \end{array}$$

And here is how the 21 and the (-71) were found:

- In the product matrix, the 21 came from, $5 \times 9 + (-1) \times 12 + 6 \times (-2)$
- In the product matrix, the (-71) came from, $8 \times (-6) + 3 \times 7 + (-4) \times 11$

Complete the matrix multiplication grid.

[5 marks]

Question 4

Further A-Level Examination Question from January 2015, IAL, F1, Q6 (ii) (Edexcel)

$$\mathbf{M} = \begin{pmatrix} 2k + 5 & -4 \\ 1 & k \end{pmatrix} \text{ where } k \text{ is a real number}$$

Show that $det\,\mathbf{M} \neq 0$ for all values of k

[4 marks]

Question 5

Further A-Level Examination Question from January 2014, IAL, F1, Q2 (Edexcel)

(i) $\mathbf{A} = \begin{pmatrix} -4 & 10 \\ -3 & k \end{pmatrix}$ where k is a constant.

The triangle T is transformed to the triangle T' by the transformation represented by **A**

Given that the area of triangle T' is twice the area of triangle T, find the possible values of k

[4 marks]

(ii) Given that,

$$\mathbf{B} = \begin{pmatrix} 1 & -2 & 3 \\ -2 & 5 & 1 \end{pmatrix} \qquad \mathbf{C} = \begin{pmatrix} 2 & 8 \\ 0 & 2 \\ 1 & -2 \end{pmatrix}$$

find **BC**

[3 marks]