**Matrices and matrix transformations test** Name: .............................................................................

Date: ..............................................................................

Write all questions on this paper. Calculator allowed but probably not really necessary.

Time: 35 minutes. TOTAL MARKS = 50

1. Multiply out the following matrices [2 marks]

(i)

(ii) [3 marks]

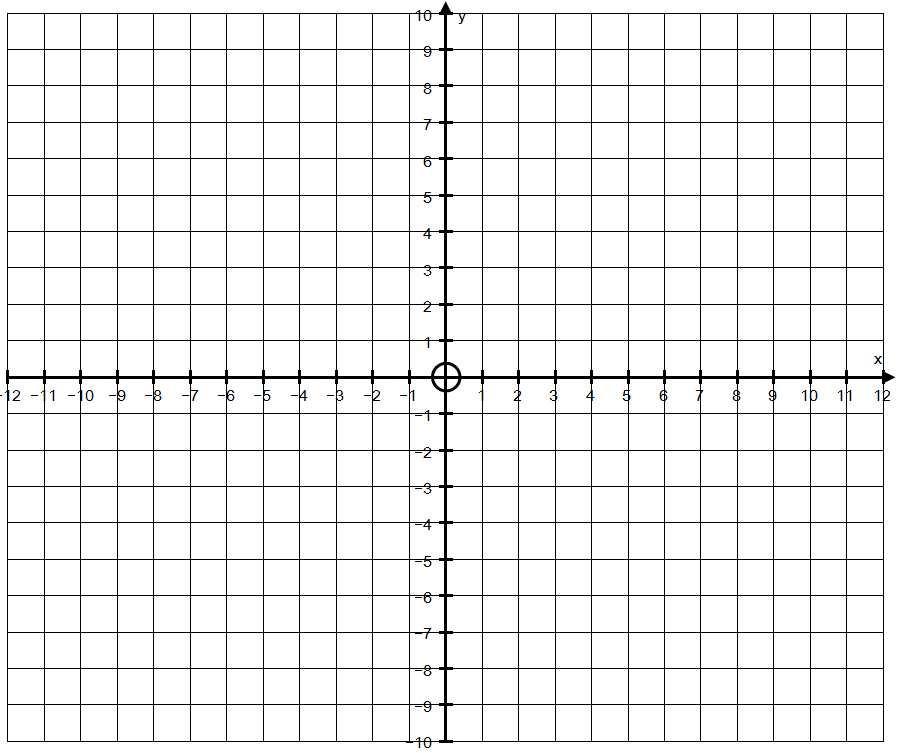
(iii) [3 marks]

(iv) [3 marks]

(v) [2 marks]

2. Vertices A,B,C,D of a shape in (x,y) coordinates are collected together in a 2 x 4 matrix

(a) Plot the shape on the axes below and label all vertices [2 marks]



(b) A matrix transformation has form

(i) Show that . By considering where the basis vectors ("red") (1,0) and ("blue") (0,1) go under this transformation, describe the transformation. You are expected to draw where the "red" and "blue" basis vectors go as part of your answer.

[5 marks]

(ii) Calculate and plot iton the graph above. Does this agree with your answer to part (i) ?

[2 marks]

(iii) Find [3 marks]

(iv) Plot on the plot above and therefore describe this transformation [3 marks]

(v) Without evaluating the matrices, describe the transformations

(i) [2 marks]

(ii) [2 marks]

(iii) [3 marks]

3) Using 'red and blue basis vector diagrams' derive matrices which represent the following transformations

(i) Reflection in the x-axis, then enlargement scale factor -2 about the origin [3 marks]

(ii) Reflection in the y=x, then a stretch of scale factor 2 parallel to the x axis and -0.25 parallel to the y axis. [3 marks]

(iii) A shear parallel to the x axis of angle 30 degrees from the y axis. Bonus mark if the answer is written in surd form. [3 marks]

4. A graphic design company has asked you to write a computer program which will automatically rotate digital photographs and line-art.

For artistic purposes they would like to rotate about *any central point* rather than the origin.

YOUR TASK!

A shape with coordinates stored as column vectors in a matrix needs to be rotated anticlockwise by ninety degreesabout centre (2,3). The rotated shape coordinates are stored in matrix **. (SEE FIGURE 1)**

Use an appropriate method to find out the following matrices to achieve this process via the following equation

The matrices must apply to the following test coordinates

A good start is to find out what matrix rotates coordinates anticlockwise by ninety degrees, *about the origin.* What could we do to effectively change our origin? What other sort of transformation do we need?

Write workings and ideas here: [6 marks]

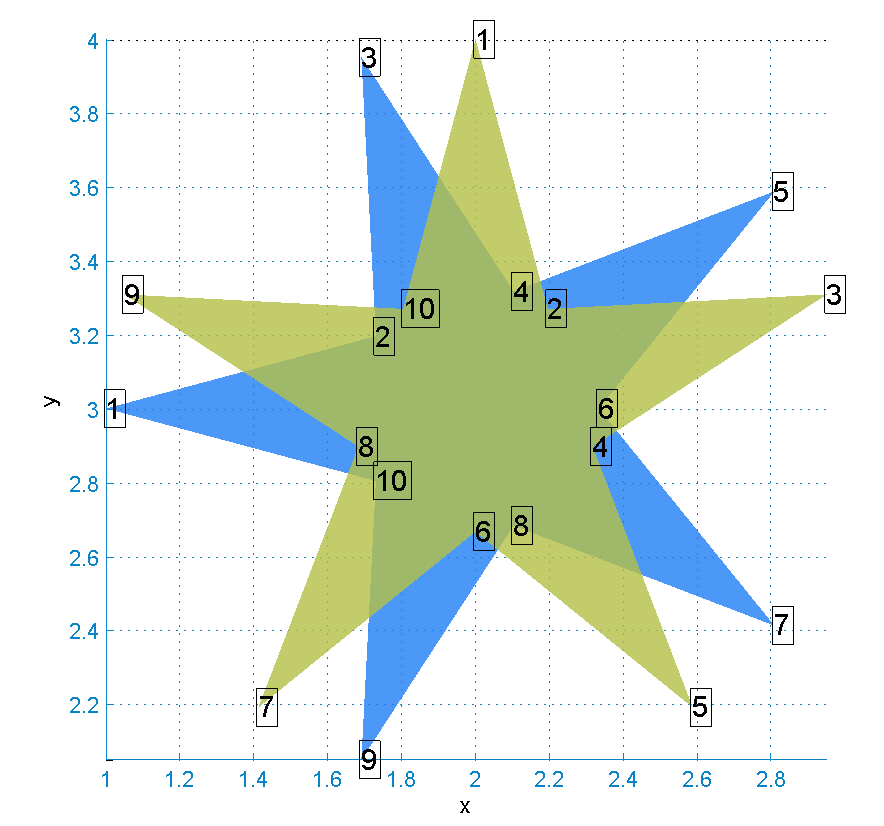


Figure 1: Rotation about (2,3) anticlockwise by 90 degrees

Figure : Original shape (light colour) rotated about (2,3) by 90 degrees anticlockwise.