**7A Introduction to Linear Transformations with Matrices**

Linear Transformations

1. The three transformations **S**, **T** and **U** are defined below. Find the image of the point (2,3) under each of these transformations. State whether each is a *linear* transformation.

Matrices can be used to represent linear transformations:

1. Find matrices to represent these linear transformations:
2. The square S has coordinates (1,1), (3,1), (3,3) and (1,3).

Find the coordinates of the vertices of the image of S after the transformation given by the matrix:

**7B Reflections & Rotations**

**(0,1)**

**(1,0)**

1. Describe fully the geometrical transformation represented by the matrix:
2. Find a matrix to represent the transformation:
3. ‘Reflection in the y-axis’
4. ‘Enlargement, centre (0,0), scale factor 2’
5. ‘Rotation of 45° anticlockwise about (0,0)’

As a general rule, the matrix representing a rotation of angle anticlockwise about the origin is:

Final notes:

Invariant point

Invariant Lines

**7E 3D Transformations**

1. A transformation U, in three dimensions, represents a reflection in the plane .
2. Write down the matrix that represents this transformation.
3. Find the image of the point under this transformation

Reflection in the plane (

Reflection in the plane (

Reflection in the plane (

1. A transformation U, in three dimensions, represents a 90˚ anticlockwise rotation around the x-axis
2. Write down the matrix that represents this transformation.
3. Find the image of the point under this transformation

Rotation anticlockwise around the x-axis

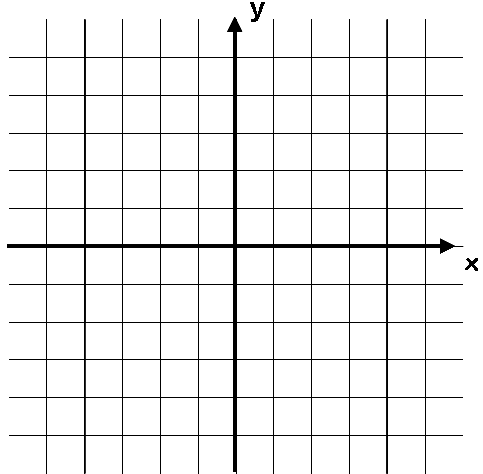
Rotation anticlockwise around the y-axis

Rotation anticlockwise around the z-axis

1. The matrix .
2. Describe the transformation represented by .
3. Find the image of the point with coordinates under the transformation represented by .

**7C Enlargements**

1. The matrix .
2. Find the image of the triangle with vertices (1,1), (1,2) and (2,2) under the transformation represented by .
3. Sketch and on the same set of coordinate axes.



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1. Describe geometrically the transformation represented by .

**Key note:**

The determinant and scale factors:

1. The Matrix .
2. Describe fully the transformation represented by matrix
3. A triangle has vertices at (1,0), (4,0) and (4,2). Find the area of the triangle
4. Triangle is transformed by using matrix . Find the area of the image of .

**7D Multiple Transformations**

1. The points A(1,0), B(0,1) and C(2,0) are the vertices of a triangle T. The triangle T is rotated 90° anticlockwise around (0,0) and then the image T’ is reflected in the line y = x to obtain the triangle T’’.
2. On separate diagrams, draw T, T’ and T’’
3. i) Find the matrix **P** such that **P**(T) = T’

ii) Find the matrix **Q** such that **Q**(T’) = T’’

1. By finding a matrix product, find the single matrix that will perform a 90° anticlockwise rotation followed by a reflection in y = x
2. The following matrices represent three different transformations:

Find the matrix representing the transformation represented by **R**, followed by **Q**, followed by **P** and give a geometrical interpretation of this transformation.

The matrix represents an enlargement with scale factor followed by an anticlockwise rotation through angle about the origin.

1. Find the value of
2. Find the value of

**7F Inverse Matrices & Transformations**

1. The triangle T has vertices at A, B and C. The matrix:

transforms T to the triangle T’ with vertices at (4,3), (4,10) and (-4,-3).

Find the coordinates of the points A, B and C

1. The matrix represents a transformation . Given that maps point with coordinates (x,y) onto the point ’ with coordinates (6,10):
2. Find the coordinates of

The matrix represents a transformation . Given that the transformation followed by the transformation is equivalent to a reflection in the line :

1. Find matrix .