IG- Maths
0580

TRANSFORMATION

SHORT NOTES

IG-Maths 0580

Transformations

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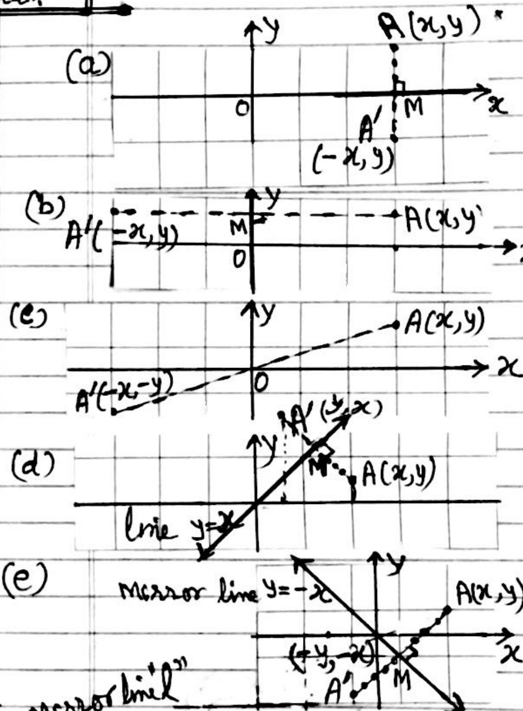
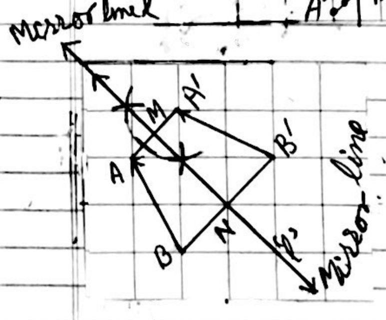
Transformation.	Object Column Matrix →	Image	Matrix representing the transformation.
Reflection			
1. (a) Reflection in x-axis (or Mirror line $y=0$)	$A\begin{pmatrix} x \\ y \end{pmatrix}$	$A'\begin{pmatrix} x \\ -y \end{pmatrix}$	$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
(b) Reflection in y-axis (or Mirror line $x=0$)	$A\begin{pmatrix} x \\ y \end{pmatrix}$	$\begin{pmatrix} -x \\ y \end{pmatrix}A'$	$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$
(c) Reflection in Origin $(0,0)$	$A\begin{pmatrix} x \\ y \end{pmatrix}$	$\begin{pmatrix} -x \\ -y \end{pmatrix}A'$	$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
(d) Reflection in the line $y=x$	$A\begin{pmatrix} x \\ y \end{pmatrix}$	$\begin{pmatrix} y \\ x \end{pmatrix}A'$	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$
(e) Reflection in the line $y=-x$	$A\begin{pmatrix} x \\ y \end{pmatrix}$	$\begin{pmatrix} -y \\ -x \end{pmatrix}A'$	$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$



(f) Given the object and the reflection image. **To find the mirror line.**

Join a pair of corresponding points on the object and the image, say $\longrightarrow AA'$
Draw the perpendicular bisector of AA' is the required Mirror line "l"

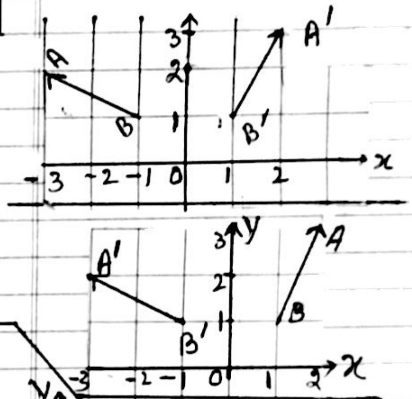
or → Join AA' and BB', let M and N are the mid points of AA' and BB' resp. Then line MN is the required Mirror line.

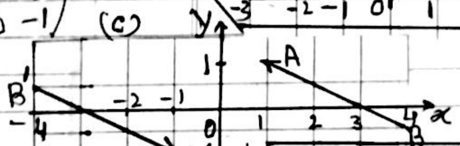


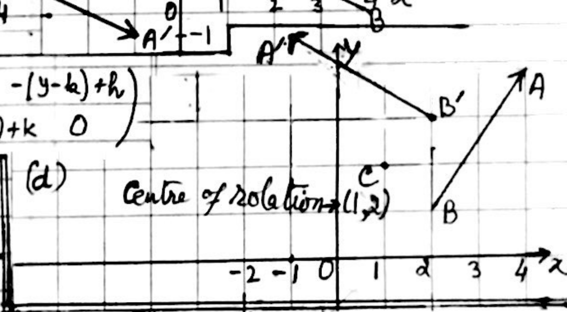
AB is Object
A'B' is image.

Transformations

Transformation	Object Column Matrix	Image	Matrix Representation of the transformation
2. Rotation			
(a) Rotation through 90°, Clockwise, Centre of rotation is Origin (0,0) (or 270° anticlockwise)	$\begin{pmatrix} x \\ y \end{pmatrix} A \rightarrow$	$\begin{pmatrix} y \\ -x \end{pmatrix} A'$	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
(b) Rotation through 90°, anticlockwise Centre of rotation is Origin (0,0). (or 270° clockwise)	$\begin{pmatrix} x \\ y \end{pmatrix} A \rightarrow$	$\begin{pmatrix} -y \\ x \end{pmatrix} A'$	$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$
(c) Rotation through 180°, Centre of rotation origin (0,0), Clockwise or anticlockwise	$\begin{pmatrix} x \\ y \end{pmatrix} A \rightarrow$	$\begin{pmatrix} -x \\ -y \end{pmatrix} A'$	$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
(d) Rotation through 90° in the anticlockwise direction, when centre of rotation a point C (h, k) [other than origin]	$\begin{pmatrix} x \\ y \end{pmatrix} A \rightarrow$	$A' \begin{pmatrix} -(y-k)+h \\ (x-h)+k \end{pmatrix}$	$\begin{pmatrix} 0 & -(y-k)+h \\ (x-h)+k & 0 \end{pmatrix}$
(e) Rotation through 90° in clockwise direction, when centre of Rotation is the point C(h, k) (Not origin)	$\begin{pmatrix} x \\ y \end{pmatrix} A \rightarrow$	$\begin{pmatrix} (y-k)+h \\ -(x-h)+k \end{pmatrix} A'$	



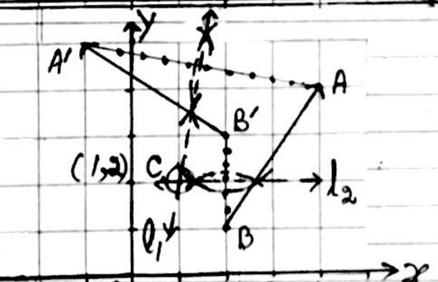




(f) To find the centre of Rotion, given the object and the image under rotation.

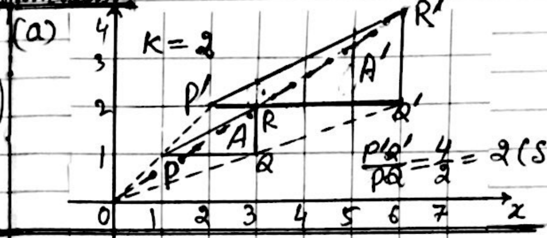
{ AB is Object, A′B′ is image.
Join AA′ and BB′,
the perp. bisectors intersect at C (1,2)

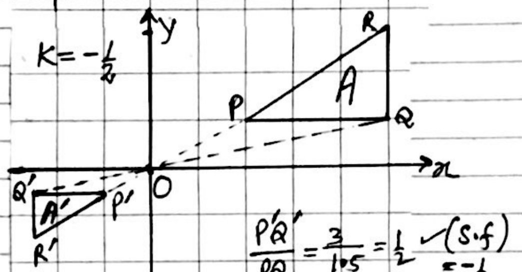
Join two pairs of corresponding points of the object and the image. say AA′ and BB′.
Draw the perp. bisectors l_1 and l_2 respectively of segments AA′ and BB′. If l_1 and l_2 intersect at the point 'C', 'C' is the required point of Rotation.



Transformations

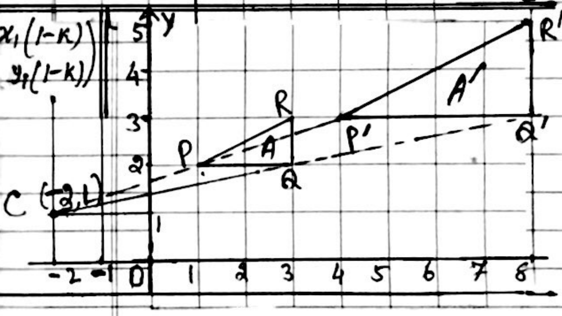
Transformation	Object Column Matrix	Image	Matrix Representing the transformation
(3) **Enlargement.**			
(a) Centre of Enlargement is origin (0,0) and the scale factor $K>0$. Image and the object are on the same side of the centre. To find the image:	$P\begin{pmatrix}x\\y\end{pmatrix}\to$	$\begin{pmatrix}kx\\ky\end{pmatrix}P'$	$\begin{pmatrix}k&0\\0&k\end{pmatrix}$
(b) Centre of Enlargement is origin (0,0) and the scale factor $K<0$. The Object and the image are the opposite side of the Centre of enlargement. To find the image:	$P\begin{pmatrix}x\\y\end{pmatrix}\to$	$\begin{pmatrix}kx\\ky\end{pmatrix}P'$	$\begin{pmatrix}k&0\\0&k\end{pmatrix}$
(C) Centre of enlargement is (x_1, y_1), and scale factor is k.	$P\begin{pmatrix}x\\y\end{pmatrix}\to$	$P'\begin{pmatrix}k(x-x_1)+x_1\\k(y-y_1)+y_1\end{pmatrix}$ or $\begin{pmatrix}kx+x_1(1-k)\\ky+y_1(1-k)\end{pmatrix}$	





Example $C\overset{(x_1,y_1)}{(-2,1)}$, $k=2$: $P\begin{pmatrix}1\\2\end{pmatrix}\to P'\begin{pmatrix}2(1+2)+(-2)\\2(2-1)+1\end{pmatrix}=\begin{pmatrix}4\\3\end{pmatrix}P'$

To find the image:



(d). Given the Object and image after enlargement, To find the centre of enlargement and scale factor.

To find the Centre of enlargement join two pairs of corresponding points on the object and image, find the point of intersection, to give you centre of enlargement) and the ratio of corresponding sides the S.f.

In Example 3(C) above, PP' and Q'Q when produced meet at C(-2,1) is the Centre and $\frac{P'Q'}{PQ}=\frac{4}{2}=2$ is S.f.

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Note: 3×3 Matrix is not in the syllabus

	Transformation	Object Column Matrix	Image	Matrix Representing the transformation.
4.	Translation. (Slide) Translation Vector $\begin{pmatrix} h \\ k \end{pmatrix}$	$P\begin{pmatrix} x \\ y \end{pmatrix}$	$\begin{pmatrix} x+h \\ y+k \end{pmatrix} P'$ Translation: $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$ $P\begin{pmatrix} -2 \\ 2 \end{pmatrix} \rightarrow$	$\begin{pmatrix} 1 & 0 & h \\ 0 & 1 & k \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} x \\ y \\ 1 \end{pmatrix} = \begin{pmatrix} x+h \\ y+k \\ 1 \end{pmatrix} P'$ $\begin{pmatrix} -2+2 \\ 2-1 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} P'$