

Transformation

Exercise 6.1

Q.1 Find the images of the following points under reflection on X-axis followed by another reflection on Y axis.

- (a) (2, 7) (b) (-5, -3) (c) (4, 1) (d) (3, 2) (e) (3, -5)

Q.2 Find the images of the following points under reflection on Y-axis followed by another reflection on X-axis.

- (a) (4, 5) (b) (2, 1) (c) (5, 6) (d) (-2, 6) (e) (3, 4)

Q.3 Find the images of following points under reflection on line $y = x$ followed by another reflection on X-axis.

- (a) (6, 4) (b) (-3, -2) (c) (4, 3) (d) (4, 5) (e) (-4, -5)

Q.4 Find the images of following points under reflection on line $y = -x$ followed by another reflection on Y-axis.

- (a) (4, -1) (b) (0, 0) (c) (-2, -6) (d) (2, -2) (e) (-3, 4)

Q.5 Reflect the following points under the line $x = 6$ followed by X-axis and find the images so obtained.

- (a) (2, 4) (b) (-2, -3) (c) (3, 5) (d) (2, 1) (e) (0, 0)

Q.6 Reflect the following points under Y axis followed by line $y = 4$ and find the image so obtained.

- (a) (0, 0) (b) (3, 3) (c) (3, -4) (d) (4, -4) (e) (0, 3)

Q.7 Reflect the points A(3, 0) and B(4, -3) under the following combined reflection

- (a) X-axis followed by Y-axis
(b) Line $y = x$ followed by line $y = -x$
(c) Line $x = 2$ followed by line $y = 3$

Q.8 If X, Y and W denote the reflection on X-axis, Y-axis and line $y = x$ respectively then find the images of the following points as given below:

- (a) XoY (4, 1) (b) XoW (2, 1) (c) WoX (-1, -2)
(d) WoY (0, -3) (e) YoW (3, 0) (f) YoX (4, 4)

Q.9 If r_1 and r_2 are the reflections on X-axis and on the line $y = 3$ respectively, find the images of the points under the given conditions:

- (a) r_1r_2 (1, 2) (b) r_1r_2 (3, -2) (c) r_2r_1 (2, 3) (d) r_2r_1 (2, -2)
(e) r_1 (2, 3) (f) r_2 (3, 2)

Q.10 If r_1 and r_2 are the reflections on X-axis and line $x = 3$ respectively, find the images of the points under the following conditions:

- (a) r_1r_2 (3, 2) (b) r_2r_1 (3, 2) (c) r_2r_1 (2, 3) (d) r_2r_2 (2, -2)

(e) r_1r_2 (a, b) (f) r_2r_1 (b, a)

Q.11 If r_1 and r_2 denote the reflections about X-axis and line $y = x$ respectively, find the images of point $P(3, -2)$ under the following conditions:

(a) r_1r_2 (b) r_2r_1 (c) r_1^2 (d) r_2^2

Q.12 If r_1 and r_2 denote the reflections about Y-axis and on the line $x = 3$, find the image of point $P(2, 3)$ under r_2r_1 and show that r_2r_1 is a translation.

Q.13 If r_1 and r_2 are the reflections about Y and X axes respectively, find the image of point $P(2, 3)$ under r_2r_1 . What is the single transformation representing these two transformations?

Q.14 If R_1 and R_2 are the reflections on the lines $y = x$ and $y = -x$, find the images of a point $(4, 6)$ under R_1R_2 and R_2R_1 . Write down the single transformation of a point $(4, 6)$ under R_1R_2 and R_2R_1 . Write down the single transformation which represents both of these two transformations.

Q.15 Find the image of a point $(2, 3)$ after translation of -5 units along the direction of X-axis followed by the reflection:

Q.16 If the image of the point P under reflection on X-axis followed by Y-axis is $P''(4, -1)$ find the co-ordinates of the point P .

Q.17 If the reflection of the point A about Y axis followed by another reflection on X-axis is $A''(5, 1)$, find the co-ordinates of point A .

Q.18 If the reflection of the point Q about the line $y=x$ followed by Y-axis is $Q''(3, -2)$, find the co-ordinates of Q .

Q.19 If the co-ordinates of point C under reflection on the line $y = -x$ followed by x-axis is $C''(2, 3)$, find the co-ordinates of C .

Q.20 The point D is reflected on the line $x = 5$ followed by X-axis and the co-ordinates of image is $D''(3, 6)$. Find the co-ordinates of D .

Q.21 The point R is reflected on the line $y = -2$ followed by Y-axis and the co-ordinates of image is $R''(4, 5)$. Find the co-ordinates of R .

Q.22 If r_1 reflect the point $A(3, 4)$ to $A'(3, -4)$ and r_2 reflect $A'(3, -4)$ to $A''(-4, 3)$ what are the reflections represented by r_1 and r_2 ?

Q.23 If r_1 reflect the point $M(3, 4)$ to $M'(-3, 4)$ and r_2 reflect $M'(-3, 4)$ to $M''(-3, -4)$. What are the reflections represented by r_1 and r_2 ?

- Q.24 If r_1 reflect $N(3, 4) \rightarrow N'(4, 3)$ and r_2 reflect $N'(4, 3) \rightarrow N''(4, -3)$, what are the reflections represented by r_1 and r_2 ?
- Q.25 If r_1 reflected $P(3, 4) \rightarrow P'(3, 0)$ and r_2 reflect $P'(3, 0) \rightarrow P''(0, 3)$, what are the reflections represented by r_1 and r_2 ?
- Q.26 Find the image of the point $A(4, 5)$ under the reflection on X-axis followed by the line $x + y = 2$.
- Q.27 If f represents the reflection in X-axis and g the reflection in the line $x - 3 = 0$, find $fog(-1, 4)$.
- Q.28 l_1 and l_2 are two axes of reflections intersecting at the origin O and inclined with each other at an angle of 45° . Find the image of the point $(-4, 3)$ by the reflection about the line l_1 followed by the reflection about the line l_2 .

Long Questions

- Q.1 If the coordinates of the vertices of ΔABC are $A(1, 1)$, $B(3, -1)$ and $C(4, 3)$, find the coordinates of the vertices of the images of the points under the reflection about X-axis followed by Y-axis and present the ΔABC and its image in the graph paper.
- Q.2 If $A(-1, 1)$, $B(4, 2)$ and $C(5, 6)$ are the vertices of ΔABC , find the image points of ΔABC under the reflection about Y-axis followed by X-axis and present in the graph paper.
- Q.3 If $A(3, 1)$, $B(-1, 4)$ and $C(-3, 1)$ are the vertices of ΔABC , find the image points of ΔABC under the reflection about $y = x$ followed by Y-axis and present the ΔABC and its image in the graph paper.
- Q.4 If $A(4, -2)$, $B(8, -2)$ and $C(8, 4)$ are the vertices of ΔABC , find the images of ΔABC under the following axis of reflections and present the ΔABC and its image on the graph paper in each cases:
 (a) X-axis followed by Y-axis
 (b) Line $y = x$ followed by line $y = -x$
 (c) Line $x = 2$ followed by line $y = 3$
- Q.5 $A(-2, -3)$, $B(-1, 1)$, $C(4, 1)$ and $D(3, -3)$ are the vertices of parallelogram, $ABCD$. Find the images of the vertices of parallelogram, $ABCD$ under the reflection on X-axis followed by the line $y = x$.
- Q.6 $P(2, 1)$, $Q(1, -2)$, $R(-3, -2)$ and $S(-5, 1)$ are the vertices of trapezium $PQRS$. Find the coordinates of images of the vertices of trapezium $PQRS$ under the reflection on Y-axis followed by the line $y = -x$.

- Q.7 Find the image of the line AB joining the points A(3, 0) and B(5, 6) under the reflection about X-axis followed by Y-axis and represent the image in the graph paper.
- Q.8 Reflect the ΔABC with vertices A(0, 1), B(1, 2) and C(3, -4) at first on the line $y = x$ and then on X-axis and draw the graph of ΔABC and its image.
- Q.9 If r_1 denotes the reflection on the line $x = 4$ and r_2 on Y-axis, find the image of quadrilateral ABCD under the combined reflection r_2r_1 and draw the graph where the vertices are A(6, 2), B(10, 2), C(11, 4) and D(5, 4).
- Q.10 Find the image of line PQ with coordinates P(2, 5) and Q(6, 1) under the reflection on X-axis followed by the reflection on $y = x$ and draw the graph also. Write the single transformation which represents both of the above two transformations.
- Q.11 Find the image of ΔABC with vertices A(1, 3), B(2, 6) and C(4, 1) under the reflection of Y-axis followed by the reflection on the line $y = x$. draw the graph of this transformation. What is the single transformation which is equivalent to the above combined transformations?
- Q.12 If P(5, 0), Q(-4, -3), R(-2, 0) and S(3, 2) are the vertices of quadrilateral, reflect the quadrilateral PQRS on the line $x = 4$ and then in $x = 0$. Find the image under combined transformation and show on the graph paper.
- Q.13 Reflect the ΔPQR on the line $y = x$ followed by $x = 0$ whose vertices are P(2, 1), Q(4, 0) and R(5, 3), find the vertices of image of ΔPQR under the combined transformation and show the ΔPQR and its image on graph paper. Also prove that above combined transformation is equivalent to the rotation of ΔPQR about the origin through $+90^\circ$.
- Q.14 Reflect the ΔABC with vertices A(-4, 0), B(-6, 2) and C(-4, 3) on line $x = -3$ and then on the line $x = 1$. Draw the graph of ΔABC and its image after combined transformation. Which single transformation is equivalent to the given combined transformation?
- Q.15 Draw the ΔABC with vertices A(5, 4), B(2, 2) and C(5, 2) on graph paper. Find the image of ΔABC under the reflection on X-axis followed by the line $y = x$. also draw the image on the same graph paper.
- Q.16 Reflect the ΔABC with vertices A(2, 3), B(4, 5) and C(3, 1) under Y-axis followed by the line $x + y - 3 = 0$.
- Q.17 Let r_1 represent the reflection on the line $y = x$ and r_2 represent the reflection on the line $x = 1$. Find the single transformation equivalent to the combined transformation r_2r_1 . Use this transformation to find the co-ordinates of the vertices of the image of

$\triangle ABC$ having vertices at $A(2, 2)$, $B(5, 4)$ and $C(6, 1)$. Also draw the graph showing both the figures.

- Q.18 A triangle with vertices $A(1, 2)$, $B(4, -1)$ and $C(2, 5)$ is reflected successively in the lines $x = 5$ and $y = -2$. Find the stating coordinates and graphically represent the images under these transformations. State also the single transformation given by the combinations of these transformations.

Exercise 6.2

- Q.1 Find the coordinates of the images of the following points by the rotation with the centre at origin through 90° positive followed by 90° negative:

(a) $(4, 0)$ (b) $(0, 4)$ (c) $(-3, 0)$ (d) $(0, -3)$ (e) $(-2, 5)$
(f) $(-3, -4)$ (g) $(0, 5)$ (h) $(-b, a)$ (i) $(2, 3)$ (j) $(3, -4)$

- Q.2 Find the coordinates of the images of the following points by the rotation with the centre at origin through positive quarter turn followed by half turn

(a) $A(1, -2)$ (b) $B(5, 7)$ (c) $C(6, -9)$ (d) $D(-3, -5)$ (e) $E(-3, 7)$
(f) $F(7, 11)$ (g) $G(-2, -13)$ (h) $H(7, 14)$

- Q.3 Find the image of point $A(5, 6)$ under rotation about origin through $+90^\circ$ followed by half turn.

- Q.4 Find the image of point $B(6, 9)$ under rotation about origin through -90° followed by half turn.

- Q.5 Find the image of point $C(2, 3)$ under rotation about origin through -180° followed by positive quarter turn.

- Q.6 Find the image of point $D(1, 5)$ under rotation about origin through -180° followed by negative quarter turn.

- Q.7 Find the image of point $E(9, 8)$ under rotation about origin through $+270^\circ$ followed by positive quarter turn.

- Q.8 Find the image of point $F(1, 6)$ under rotation about origin through -270° followed by half turn.

- Q.9 If Q is the rotation through positive quarter turn, H is the rotation through half turn and $P(3, 4)$ is a given point and $Q^2(P)$ is the double rotation through positive quarter turn, then what is the relation between $Q^2(P)$ and $H(P)$?

- Q.10 If Q - is the rotation of negative quarter turn. H is the rotation of half turn, $P(3, 4)$ is a given point and $Q^2(P)$ is the double rotation through negative quarter turn, then is $Q^{-2}(P)$ and $H(P)$?
- Q.11 Find the images of the point $P(5, 7)$ rotation about the origin, through 270° positive followed by 90° negative.
- Q.12 Find the images of the point $P(3, -5)$ rotation about the origin through 270° negative and followed by 90° positive.
- Q.13 Find the coordinates of the image of a point $(2, 3)$ which is at first rotated through 90° positively and then through 180° with the same centre at origin.
- Q.14 Find the image of a point $(2, 3)$ rotated about origin through $+90^\circ$ and then again rotated through -90° about the same origin.
- Q.15 Find the image of a point $(4, -3)$ rotated about centre $(0, 0)$ through 180° and again rotated through -90° about the same centre.
- Q.16 Point A is rotated about the origin as in the followings. Find the angles of rotation and directions:
- Rotation of $A(3, 5) \rightarrow A'(5, -3)$ and $A'(5, -3) \rightarrow A''(3, 5)$
 - Rotation of $A(3, 5) \rightarrow A'(-5, 3)$ and $A'(-5, 3) \rightarrow A''(5, -3)$
 - Rotation of $A(3, 5) \rightarrow A''(-3, -5)$ and $A''(-3, -5) \rightarrow A'(5, -3)$
- Q.17 If r_1 denotes the rotation about origin through positive quarter turn and r_2 denotes the half turn about the same centre, then find the coordinates of A and B as given below:
- Q.18 Find the images of point $A(3, 4)$ under rotation about origin through 60° followed by the rotation of 120° about the same centre.
- Q.19 Find the image of point $A(4, 4)$ under rotation about origin through 60° followed by the rotation about the same centre through 180° .
- Q.20 Find the image of point $B(2, -3)$ under rotation about the centre $(1, 2)$ through 150° followed by another rotation about the same centre through -60° .
- Q.21 A' is the image of A under rotation through 90° and A'' is the image of A' under rotation through 90° about origin. Write down the co-ordinates of A' and A'' . Write the single transformation that maps A onto A'' .

Long Questions

- Q.1 A(3, 2), B(6, 1) and C(3, -2) are the vertices of ΔABC . Find the image of ΔABC by the rotation through positive quarter turn about the origin followed by half turn and draw the graph of ΔABC and its image.
- Q.2 A(3, -1), B(2, 2) and C(6, 3) are the vertices of ΔABC . Find the coordinates of image of ΔABC by the rotation about origin through negative quarter turn followed by half turn and draw graph of ΔABC and its image.
- Q.3 P(3, 5), Q(3, 1) and R(6, 1) are the vertices of ΔABC . Find the coordinates of image through half turn followed by positive quarter turn about the origin and draw the graph of ΔPQR and its image.
- Q.4 A(-1, 2), B(2, 2) and C(2, 6) are the vertices of ΔABC . Find the coordinates of image of ΔABC by the rotation of the following angles and directions about the origin and draw the graph of it:
- Positive quarter turn followed by half turn
 - Negative quarter turn followed by 270° negative turn
- Q.5 A(0, -2), B(2, 1), C(-1, 2) and D(-3, -1) are the vertices of parallelogram ABCD. Find the coordinates of image of parallelogram, ABCD under the rotation through the following angles and directions about the origin and draw the graph also:
- Positive quarter turn followed by half turn
 - Negative quarter turn followed by 270° negative turn
- Q.6 P(1, 3), Q(-1, 0), R(1, -3) and S(2, 0) are the vertices of rectangle PQRS. Find the image of the coordinates of rectangle PQRS about the origin O under the rotation through the following conditions and draw the graph:
- 90° positive turn followed by half turn
 - Negative quarter turn followed by 270° negative
- Q.7 A(2, -2), B(-2, 1), C(-1, -3) and D(-3, -2) are the vertices of rectangle ABCD. Find the images of the coordinates of vertices of rectangle ABCD about the origin O under the rotation through the following conditions and draw the graph also:
- Positive quarter turn followed by negative quarter turn
 - Half turn followed by 270° positive turn
- Q.8 Find the image of ΔPQR with vertices P(2, 3), Q(4, 5) and R(3, 6) under rotation about [(0, 0), 150°] followed by [(0, 0), 30°] and draw the graph.
- Q.9 Find the image of ΔABC with vertices A(3, -1), B(1, 4), C(2, 3) under rotation about centre (1, 1) through $+90^\circ$ followed by half turn about the same centre and show the relation in graph.

Exercise 6.3

- Q.1 If two translation vectors are $T_1 = (2 \ 1)$ and $T_2 = (-1 \ 1)$, find the combined translation vectors T_1T_2 and T_2T_1 . Is $T_1T_2 = T_2T_1$?
- Q.2 If $T_1 = (1 \ 2)$ and $T_2 = (2 \ 3)$ are two translation vectors, find the image of a point $(1, 3)$ under combined translation T_1T_2 and T_2T_1 .
- Q.3 If $T_1 = (1 \ 2)$ and $T_2 = (3 \ 2)$ are two translation vectors, find the images of the point $P(2, 3)$ under combined translation T_1T_2 and T_2T_1 . Is the translation under T_1T_2 and T_2T_1 same?
- Q.4 If $T_1 = (2 \ 4)$ and $T_2 = (1 \ 3)$, find the image of the point $(4, -2)$ under T_2oT_1 and T_1oT_2 .
- Q.5 If $T_1 = (2 \ 4)$ and $T_2 = (2 \ 3)$ are two translation vectors then find the images of the following points under combined translations as given below:
- | | | |
|------------------------|------------------------|-----------------------|
| (a) $T_1oT_2 (-1, 1)$ | (b) $T_2oT_1 (-1, -3)$ | (c) $T_2oT_1 (-5, 7)$ |
| (d) $T_1oT_2 (6, 0)$ | (e) $T_1oT_2 (0, 7)$ | (f) $T_2oT_1 (6, -6)$ |
| (g) $T_1oT_2(8, 8)$ | (h) $T_2oT_1 (5, 9)$ | (i) $T_1oT_2 (2, 11)$ |
| (j) $T_2oT_1 (-3, -3)$ | | |
- Q.6 Find the image of the point $P(3, 2)$ under the following combined translations:
- | |
|--|
| (a) $(3 \ 1)$ followed by $(-2 \ -4)$ |
| (b) $(-2 \ 0)$ followed by $(0 \ -2)$ |
- Q.7 If a translation T_1 shifts the point $(5, 7)$ into the point $(3, 9)$ and another translation T_2 shifts $(3, 9)$ to $(8, 4)$, find the translation components T_1 and T_2 ?
- Q.8 Given the translation components are $T_1 = (2 \ 5)$, $T_2 = (-3 \ 4)$, $T_3 = (5 \ -7)$ and $T_4 = (-3 \ -5)$, find the images under the combined translations as given below:
- | | | | |
|---------------------|----------------------|----------------------|----------------------|
| (a) $T_1T_2 (2, 3)$ | (b) $T_2T_3 (-2, 4)$ | (c) $T_3T_1 (5, -7)$ | (d) $T_3T_2(-3, -8)$ |
|---------------------|----------------------|----------------------|----------------------|
- Q.9 Find the image of point $(-3, -2)$ under translation $(6 \ 2)$ followed by another translation $(-6 \ -2)$.
- Q.10 If the point $A(-2, 3)$ is translated to the point $A'(1, -1)$ and $A'(1, -1)$ to the point $A''(-2, 3)$, find the translation components to each translation.
- Q.11 Find the images of given points by translation equation $x' = x + 3$, $y' = y + 4$ and $x'' = x' + 2$, $y'' = y' - 3$:
- | | | | | |
|----------------|----------------|----------------|---------------|-----------------|
| (a) $A(6, 8)$ | (b) $B(-1, 4)$ | (c) $C(-5, 0)$ | (d) $D(0, 0)$ | (e) $E(-2, -3)$ |
| (f) $F(-1, 0)$ | | | | |
- Q.12 Find the points of given images by translation equations $x' = x + 2$, $y' = y - 3$ and $x'' = x' - 4$, $y'' = y' + 2$:
- | | | |
|------------------|------------------|-------------------|
| (a) $A''(3, 4)$ | (b) $B''(2, -1)$ | (c) $C''(-2, -5)$ |
| (d) $D''(0, -5)$ | (e) $E''(-4, 0)$ | |

- Q.13 If point $P(3, 6) \rightarrow P'(-3, 2) \rightarrow P''(4, 5)$, find the translation components.
- Q.14 If point $A(2, 6)$ shifted $A'(5, 4)$ and $A'(4, 5)$ to $A''(3, 5)$ find the translation vectors.
- Q.15 Find the coordinates of the image of point $A(2, 1)$ under the combined transformation of $T_1 \circ T_2$ where $T_1 = \begin{pmatrix} 1 & 2 \end{pmatrix}$ and $T_2 = \begin{pmatrix} -3 & 1 \end{pmatrix}$.

Long Questions

- Q.1 $A(-2, 2)$, $B(2, 2)$ and $C(2, 6)$ are the vertices of $\triangle ABC$. Find the coordinates of image under the translation vector $\begin{pmatrix} 3 & -2 \end{pmatrix}$ followed by $\begin{pmatrix} -1 & 2 \end{pmatrix}$ and also represent it by graph.
- Q.2 $P(1, 1)$, $Q(6, 3)$ and $R(4, 7)$ are the vertices of $\triangle PQR$. Find the image under translation $\begin{pmatrix} 3 & 5 \end{pmatrix}$ followed by $\begin{pmatrix} -2 & 3 \end{pmatrix}$ and show in graph.
- Q.3 Find the images of the triangle ABC with coordinates of vertices $A(3, 3)$, $B(7, 5)$ and $C(2, 0)$ under the translation vector $\begin{pmatrix} 3 & -2 \end{pmatrix}$ followed by $\begin{pmatrix} -2 & 3 \end{pmatrix}$.
- Q.4 Find the image of triangle ABC where $A(2, 2)$, $B(-1, 2)$ and $C(4, -5)$ under the translation $\begin{pmatrix} -3 & 4 \end{pmatrix}$ followed by $\begin{pmatrix} 3 & 4 \end{pmatrix}$ and show in graph paper.
- Q.5 Find the coordinates of the image $\triangle A'B'C'$ of the $\triangle ABC$ with vertices $A(2, 3)$, $B(-2, 4)$ and $C(5, -7)$ under the following components vectors:
 (a) $T_1 = \begin{pmatrix} 3 & 5 \end{pmatrix}$ followed by $T_2 = \begin{pmatrix} -3 & -5 \end{pmatrix}$
 (b) $T_3 = \begin{pmatrix} 4 & 5 \end{pmatrix}$ followed by $T_2 = \begin{pmatrix} -3 & -5 \end{pmatrix}$
- Q.6 $A(-3, -1)$, $B(-1, -1)$, $C(5, 1)$ and $D(3, 1)$ are the vertices of parallelogram. If AC and BD are the translation vector,
 (a) Find the components for AC and BD
 (b) Find the coordinates of image of parallelogram, under combined translation of vectors AC and BD . Also show in the graph.
- Q.7 $A(-3, 0)$, $B(-2, 2)$, $C(1, 3)$ and $D(3, -1)$ are the vertices of quadrilateral $ABCD$.
 (a) Find the components for the vectors AD and BC
 (b) Find the image quadrilateral under the translation through the magnitudes and directions of AD and BC . Also show in the graph paper.
- Q.8 If $A(1, 2)$, $B(7, 2)$ and $C(4, 6)$ are the vertices of $\triangle ABC$ find the coordinates of image after translation in magnitude and direction of $AB + BC$
- Q.9 The $\triangle ABC$ with vertices $A(-2, 2)$, $B(2, 2)$ and $C(2, 8)$ is translated into $\triangle A'B'C'$ under the translation vector T . If the coordinates of image of A is $A'(4, -2)$ find the coordinates of B' and C' and translate $\triangle A'B'C'$ by $\begin{pmatrix} -2 & 1 \end{pmatrix}$.

- Q.10 If $A(-2, -1)$, $B(2, 3)$, $C(1, -1)$ and $D(2, 5)$ are the vertices of a kite, find the coordinates of the image of the vertices of kite under the translation vector $(-1 \ 3)$ followed by $(-2 \ 2)$.
- Q.11 What type of shape is formed by joining the points $A(-1, 1)$, $B(-1, 2)$, $C(4, 2)$, $D(4, 1)$, $E(2, 1)$, $F(2, -2)$, $G(1, -2)$, $H(1, 1)$ and $A(-1, 1)$? Find the coordinates of the figure under translation $(2 \ -1)$ followed by $(3 \ -1)$ and show in the graph.

Exercise 6.4

- Q.1 Enlarge the point $A(2, 0)$ by $E_1[0, 2]$ followed by $E_2[0, -3]$.
- Q.2 Enlarge the point $B(3, 5)$ by $E_2[0, 1]$ followed by $E_2[0, -3]$.
- Q.3 Enlarge the point $C(4, -7)$ by $E_1[0, 1]$ followed by $E_2[0, 3]$.
- Q.4 Enlarge the point $D(-3, 8)$ by $E_1[0, 1]$ followed by $E_2[0, \frac{1}{2}]$.
- Q.5 Enlarge the point $E(-5, -7)$ by $E_1[0, 1]$ followed by $E_2[0, -1 \frac{1}{2}]$.
- Q.6 Enlarge the point $F(0, -11)$ by $E_1[0, 1]$ followed by $E_2[0, 0.75]$.
- Q.7 Enlarge the point $G(-6, -6)$ by $E_1[0, 1]$ followed by $E_2[0, 3]$.
- Q.8 Enlarge the point $H(2, 3)$ by $E_1[0, -1]$ followed by $E_2[0, 0.75]$.
- Q.9 Enlarge the point $P(2, 0)$ by $E[(2, 3), 2]$ followed by $E_1[(-3, 2), -\frac{1}{2}]$.
- Q.10 Enlarge the point $Q(3, 1)$ by $[(-1, 2), 1 \frac{1}{2}]$ followed by $E_1[(-3, 2), -\frac{1}{2}]$.
- Q.11 Enlarge the point $R(5, 7)$ by $[(-3, 2), 1]$ followed by $E_1[(-3, 2), -2]$.
- Q.12 Find the image of the point $A(2, 0)$ under the enlargement $E_1[(-3, 2), -2]$ followed by another enlargement $E_2[(-2, 0), 1]$.
- Q.13 Find the image of the point $B(2, 4)$ under the enlargement $E_1[(-3, 2), -2]$ followed by another enlargement $E_2[(5, 5), 3]$.
- Q.14 Suppose $E_1 = E[0, 3]$ and $E_2 = E[0, 2]$ represents enlargements about the origin O . Is $E_1E_2 = E_2E_1$? Describe a single transformation, which represents E_1E_2 .

Long Questions

- Q.1 Points A(2, 4), B(-3, 5) and C(-2, -3) are the vertices of ΔABC . Find the image of ΔABC under the following enlargements E and draw the graph also:
- $E[O, -2]$ followed by $E[O, \frac{1}{2}]$
 - $E[O, -\frac{1}{2}]$ followed by $E[O, -1]$
- Q.2 Find the coordinates of image of ΔPQR with vertices P(1, 2), Q(2, -1) and R(4, 1) under the enlargement with scale factor with the centre at origin O followed by centre at (1, 1) scale factor 1 and draw the graph also.
- Q.3 P(1, 3), Q(4, 2) and R(3, 4) are the vertices of ΔPQR . Find the coordinates of the image of ΔPQR under the following enlargement factors and draw the graph:
- Centre of enlargement (2, 1) and scale factor 2 followed by centre of enlargement (3, 0) and scale factor $1\frac{1}{2}$
 - Centre of enlargement (3, 0) and scale factor $\frac{1}{2}$ followed by centre of enlargement (0, 2) and scale factor 3
- Q.4 A(2, 1), B(2, 4) and C(5, 3) are the vertices of ΔABC . Find the image of ΔABC under the enlargement with centre at P(4, 1) and scale factor 2 followed by $E[O, 3]$ and draw the graph of ΔABC and image.
- Q.5 Enlarge the ΔABC having the vertices A(3, 4), B(-2, 6) and C(1, -5) with centre (1, 2) and scale factor -2 followed by $E[0, 2]$. Also present the ΔABC and its image on the graph paper.
- Q.6 Enlarge the parallelogram ABCD with vertices A(-3, -2), B(-1, 2), C(4, 2) and D(2, -2) with the centre of enlargement is at origin and the scale factor -2 followed by $E[0, 3]$. Also draw the graph of parallelogram ABCD and its image.
- Q.7 A(-2, 1), B(-2, 4), C(4, 4) and D(4, -1) are the vertices of rectangle ABCD. Find the coordinates of image of rectangle A'B'C'D' with centre of enlargement at origin and scale factor 2 followed by $E[0, 1]$. Also draw the graph.
- Q.8 A(4, 0), B(4, 2) and C(1, 3) are the vertices of ΔABC . Taking centre of enlargement P(2, 1) and scale factor 2 followed by $E[0, -3]$ Enlarge the ΔABC and draw the graph also.
- Q.9 A(3, 4), B(4, 2), C(-6, 1), D(-1, -4) and E(2, -3) are the vertices of regular pentagon. Taking centre of enlargement at origin and scale factor $1\frac{1}{2}$ followed by $E[0, 2]$, enlarge the pentagon ABCDE to A'B'C'D'E' and draw the graph.
- Q.10 A(2, 2), B(5, 2), C(8, 4) and D(1, 4) are the vertices of trapezium. Find the image of trapezium ABCD under the following conditions:
- Centre at (2, 0) and scale factor 2 followed by centre at (-1, 1) and scale factor 3
 - Centre at (2, 1) and scale factor $-\frac{1}{2}$ followed by centre at (3, -2) and scale factor -2

- Q.11 Find the two enlargement components when a point $A(2, 3)$ is enlarged to $A'(-4, -6)$ and that of $A'(-4, -6)$ to $A''(8, 12)$.
- Q.12 Taking centre of enlargement $(0, 0)$ and scale factor 2, the image of point $P(1, p)$ is $P'(q, 8)$. Find the value of p and q and also enlarge the point p by $E[(1, 1), -2]$.
- Q.13 If the $\triangle ABC$ is enlarged to $\triangle A'B'C'$ with the vertices $A'(0, 5)$, $B'(8, 7)$ and $C'(6, 13)$ by the enlargement with centre of origin and scale factor -2 , find the coordinates of $\triangle ABC$ and enlarge it by $E[0, 10]$.
- Q.14 If the enlargement of $\triangle ABC$ with vertices $A(4, 4)$, $B(13, 13)$ and $C(-4, 4)$ is the $\triangle A'B'C'$ with the vertices $A'(10, 10)$, $B'(37, 37)$ and $C'(-14, 10)$, find the centre of enlargement if scale factor is 3. Again enlarge $\triangle A'B'C'$ with same centre and scale factor.
- Q.15 If the enlargement of $\triangle ABC$ with the vertices $A(4, 3)$, $B(2, 6)$ and $C(-3, -1)$ are $A'(8/3, 2)$, $B'(4/3, 4)$ and $C'(-2, -2/3)$, find the centre of enlargement and the scale factor. Also enlarge $\triangle A'B'C'$ with same centre and scale factor.
- Q.16 On the graph, draw the $\triangle ABC$ whose vertices are $A(3, 2)$, $B(4, 2)$ and $C(3, 4)$. On the same graph paper draw the $\triangle A'B'C'$, the image of $\triangle ABC$ by an enlargement with the vertices $A'(6, -1)$, $B'(4, -1)$ and $C'(6, -5)$. Find its centre of enlargement and the scale factor. Also enlarge $\triangle A'B'C'$ by $E[0, 3]$.
- Q.17 The enlargement of $\triangle ABC$ with vertices $A(4, 0)$, $B(4, 2)$ and $C(1, 3)$ is the $\triangle A'B'C'$ with vertices $A'(6, -1)$, $B'(6, 3)$ and $C'(0, 5)$. Find the centre of enlargement and the scale factor and enlarge $\triangle A'B'C'$ by the same centre and scale factor. Also draw the $\triangle ABC$ and its image on the graph paper.
- Q.18 The enlargement of $\triangle ABC$ with scale factor 2 and centre of enlargement $(4, 1)$ is $\triangle A'B'C'$ with vertices $A'(0, 1)$, $B'(0, 7)$ and $C'(6, 5)$. Find the coordinates of vertices of $\triangle ABC$. Also enlarge it by $E[0, 2]$.

Exercise 6.5

Short Questions

- Q.1 Point $(3, 2)$ is reflected on the line $y = x$. The image obtained in this case is then rotated about the origin $+90^\circ$. Find the coordinates of this image. Write the single transformation which represents both of these two transformations.
- Q.2 Find the coordinates of image of the points $(6, -4)$ when it is first reflected on X-axis and then translated by $(-2, -1)$.

- Q.3 Point $(4, 5)$ is rotated about the origin O through $+90^\circ$ and the image so obtained is reflected on the Y -axis. Find the coordinates of the image.
- Q.4 Find the coordinates of the image of the point $(-4, 6)$ when it is first translated by $(6, -4)$ and then reflected on the X -axis.
- Q.5 Find the coordinates of the image of a point $(-4, 3)$ when it is first rotated about origin through -90° and then translated by $(-5, 6)$.
- Q.6 Find the co-ordinates of the image of the point $(-5, 7)$ when it is first reflected on the line $y = -x$ and then the image so formed is rotated about the origin O through an angle of $+180^\circ$.
- Q.7 Find the coordinates of the image of a point $(4, 5)$ when it is first rotated by $+90^\circ$ about the origin and then reflected on the X -axis. Write down the single transformation which represents both of these two transformations.
- Q.8 Determine the co-ordinates of the image of a point $(3, 7)$ when it is first reflected on the Y -axis and then rotated through an angle of $+90^\circ$ about the origin. Also write down a single transformation which denotes both of these transformations.
- Q.9 Find the co-ordinates of the image of a point $(3, 2)$ when it is first rotated by $+180^\circ$ about the origin O and then reflected on Y -axis.
- Q.10 The image formed by reflecting the point $(3, 4)$ on the Y -axis is rotated about origin $O(0, 0)$ through $+90^\circ$, find the co-ordinates of the image formed.
- Q.11 $T = (-1, -2)$ denotes the translation and F the rotation about the origin O through $+90^\circ$. If the image of the point $A(x, y)$ is $A'(8, 9)$ under the combined transformation ToF , find the values of x and y .
- Q.12 Point $(-2, 3)$ is rotated about the origin through $+90^\circ$ and the image so obtained is reflected on the X -axis. Find the coordinates of the image.
- Q.13 Find the coordinates of the image of the point $(4, 5)$ when it is first translated by $(-2, 3)$ and then reflected on the Y -axis.
- Q.14 Point $(-9, 15)$ is rotated about the origin through -180° and the image so formed is reflected on the line $y = x$. Find the coordinates of the image so obtained.
- Q.15 $T = (2, 3)$ and F denote the translation and reflection on the Y -axis respectively. What point would have the image $(5, 6)$ under the combined transformation FoT .
- Q.16 P' is the image of P after a reflection in X -axis and P'' is the image of P' after a rotation of $+90^\circ$ about origin. Write down the coordinates of P' and P'' .

- Q.17 Find the image of the point (3, 4) which when first reflected on Y-axis and then rotated about origin through $+90^\circ$.
- Q.18 Find the image of the point (3, 4) which when first reflected on Y-axis and then rotated about origin through $+90^\circ$.
- Q.19 Rotate the point (4, 5) at first by $[O, 90^\circ]$ and then reflected the image so obtained on X-axis. Write the single transformation representing these two transformations.
- Q.20 Find the image of point (-4, 6) under translations by (6 -4) followed by reflection on X-axis.
- Q.21 $T = \begin{pmatrix} 2 & 3 \end{pmatrix}$ is a translation and R is a rotation about $[O, 90^\circ]$. If this combined translations ToR translate the point P(a, b) to P'(-6, 5), find the values of a and b.
- Q.22 Find the image of the point P(6, 5) which when reflected on the line $y = -x$ and then rotated about origin through quarter turn.
- Q.23 Find the image of point (5, 4) which at first reflected on the line $x = y$ and then rotated about $[O, -90^\circ]$.
- Q.24 A represents the reflection on Y-axis and $T = \begin{pmatrix} 2 & 3 \end{pmatrix}$ a translation vector. If image of A(a, b) under combined transformation ToR is A'(6, 7), find a and b.
- Q.25 Find the image of the point (4, -5) at first rotates about the origin through -90° and then reflect on (a) Y-axis (b) X-axis.
- Q.26 Find the image of the point P(4, -5) at first rotates about $[O, 90^\circ]$ and then reflect on the line (a) $y = x$ (b) $y = -x$.
- Q.27 Translate the point A(5, 6) by the vector $\begin{pmatrix} 4 & -3 \end{pmatrix}$ at first rotates about $[O, -90^\circ]$ and then reflect on the lines (a) X-axis (b) Y-axis (c) $y = x$.
- Q.28 Translate the point (2, 3) at first by the vector $\begin{pmatrix} 2 & -1 \end{pmatrix}$ and then (a) reflect on X-axis (b) Enlarge by $E[O, -1]$.
- Q.29 Translate the point (2, 3) by $\begin{pmatrix} -5 & 0 \end{pmatrix}$ and then (a) reflect on Y-axis followed by rotation $[O, +90^\circ]$ (b) reflect on line $y = -x$ followed by enlargement $E[O, -1]$.
- Q.30 Translate the point (5, 6) at first by the vector $\begin{pmatrix} 0 & -3 \end{pmatrix}$ and then (a) reflection on X-axis followed by enlargement $E[O, -2]$ (b) reflection on the line $y = x$ followed by $E[O, 3]$.
- Q.31 Determine the coordinates of the image of (4, 2) when it is first reflected on the X-axis and then rotated through $+270^\circ$ about the origin. Also write down the single transformation which denotes both of these transformations.

- Q.32 If a point $(2, -3)$ is reflected on the Y-axis first and then rotated about the origin O through -90° , find the coordinates of this image.
- Q.33 In the given figure, $P(1, 3)$ is a point. P' and P'' are image of P after a reflection in the Y-axis and P'' is the image of P' after a rotation of $+90^\circ$ about the origin respectively. Find the coordinates of the point P' and P'' .
- Q.34 In the given figure, P_1 is the image of P after a reflection on the y-axis and $P_2(6, 2)$ is the image of P_1 after a rotation of -90° about the origin. Write down the coordinates of P and P_1 .
- Q.35 In the figure, $P'(4, 1)$ is the image of P after reflection in the line $x = 1$ and P'' is the image of the point P' after translation by $T = (-2, 3)$. Find the coordinates of P and P'' .
- Q.36 Find the coordinates of the image of point $A(2, 1)$ under the combined transformation of $T_1 \circ T_2$ where $T_1 = (1, 2)$ and $T_2 = (-3, 1)$.
- Q.37 If r_1 the reflector about the Y-axis and r_2 is the rotation through -90° about the origin, find the image of point $P(-5, 8)$ under the combined transformation of $r_1 \circ r_2$.

Long Questions

- Q.1 $A(-2, -4)$, $B(-4, -2)$ and $C(-6, -4)$ are the vertices of $\triangle ABC$. Translate the $\triangle ABC$ by $(2, 3)$ to obtain $\triangle A'B'C'$ and then reflect the $\triangle A'B'C'$. Find the vertices of $\triangle A'B'C'$ and $\triangle A''B''C''$ and draw the graph.
- Q.2 Draw a figure having the vertices $O(0, 0)$, $A(2, 0)$, $B(3, 1)$ and $C(1, 1)$ on the graph paper. It is translated by $(0, 2)$ and plot the figure $O'A'B'C'$ on the same graph paper. Then the figure $O'A'B'C'$ is reflected on the line $x = 3$ to form the figure $O''A''B''C''$ on the same graph. Determine the vertices of O'' , A'' , B'' and C'' .
- Q.3 The vertices of $\triangle ABC$ are $A(2, 1)$, $B(4, 5)$ and $C(-1, 4)$. Enlarge $\triangle ABC$ taking centre at origin and scale factor 2 then reflect in the line $x = y$.
- Q.4 Draw the graph $\triangle ABC$ with vertices $A(2, 0)$, $B(3, 1)$ and $C(1, 1)$. Also draw the image of $\triangle ABC$ under rotation through $[O, 90^\circ]$ followed by reflection on Y-axis and write the coordinates of final image.
- Q.5 $A(1, 2)$, $B(1, 4)$ and $C(2, 3)$ are the vertices of $\triangle ABC$. R represents the reflection about the line $y = x$ and E be the enlargement by $[O, -2]$ then find the final image of $\triangle ABC$ under the combined transformation RE. Also write the vertices of final image.

- Q.6 Rotate the line AB joining the points A(2, 6) and B(-1, 3) under $[O, +45^\circ]$ followed by $[O, 135^\circ]$ and show in the graph paper. What is a single transformation equivalent to these transformations?
- Q.7 P(4, -2), Q(2, 1) and R(5, 2) are the vertices of ΔPQR . Rotate the ΔPQR about the same centre at (1, 1) through 180° followed by the rotation of 90° about the same centre. Draw the graph ΔPQR and its image on the same graph paper.
- Q.8 Find the coordinates of image of square ABCD with vertices A(-6, 6), B(-2, 6), C(-2, 2) and D(-6, 2) at first rotated through $+90^\circ$ about the origin and then reflected on Y-axis. Also draw the graph of square ABCD and its image.
- Q.9 If R_1 denotes the rotation about centre (0, 0) through 180° T_1 denotes the translation through (3 0), T_2 denotes translation through (0 5) and X denotes the reflection on X-axis, then find the image of ΔABC with the vertices A(-4, 5), B(-6, 2) and C(-3, 2) under the following combined transformations and draw the graph in case also.
 (a) XR_1 (b) T_1T_2 (c) R_1T_1 (d) R_1T_2
- Q.10 Translate the ΔABC with vertices A(1, 3), B(1, 6) and C(3, 5) under the following conditions and draw the graph of ΔABC and its image in each case:
 (a) Rotate ΔABC through $+90^\circ$ about the origin and obtain the coordinates of $\Delta A'B'C'$.
 (b) Reflect the $\Delta A'B'C'$ on Y-axis and obtained the coordinates of image $\Delta A''B''C''$.
 (c) What is the single transformation that transforms ΔABC to $\Delta A''B''C''$?
- Q.11 If E represents the enlargement with centre at origin and scale factor 2 i.e. $E[O, 2]$ and R represents reflection about X-axis, find the image of ΔABC with vertices A(2, 2), B(5, 5) and C(6, 3) under the following combined transformation and the graph of ΔABC and its image on the same graph paper:
 (a) ER (b) RE (c) Is $ER = RE$?
- Q.12 Enlarge the ΔABC with vertices A(-4, 6), B(2, 8) and C(6, 2) under enlargement components $E[(2, 3), -2]$ and then reflected the image under line $y = x$. also draw the ΔABC and its image on the same graph paper.
- Q.13 Reflect the ΔABC with vertices A(6, 3), B(-3, 5) and C(4, -2) under the line $x = 3$. Also rotate the image so obtained by $[O, 180^\circ]$ and show in the graph paper.
- Q.14 Find the image of the ΔABC with vertices A(-2, 8), B(8, 6) and C(4, 2) under reflection on the line $x - 2 = 0$ followed by $E[O, 2]$ and draw on the graph paper.
- Q.15 Find the image of ΔABC with vertices A(3, -1), B(1, -3) and C(5, -3) under enlargement with centre at (1, 1) and scale factor 2 followed by the reflection on X-axis. Also show the relation on graph.

- Q.16 Find the image of ΔPQR with vertices $P(3, 4)$, $Q(1, 1)$ and $R(4, 1)$ under enlargement with centre at $(1, -1)$ and scale factor -2 followed by rotation on $[O, 90^\circ]$. Also show the ΔPQR and its image on the graph paper.
- Q.17 $A(2, 1)$, $B(4, 5)$ and $C(-1, 4)$ are the vertices of ΔABC . Find the coordinates of image $\Delta A'B'C'$ under the enlargement with centre at origin and scale factor 2 . also find the coordinates of $\Delta A''B''C''$ under the reflection of $\Delta A'B'C'$ on the line $y = -x$. show ΔABC and its images of $\Delta A'B'C'$ and $\Delta A''B''C''$ on the same graph paper.
- Q.18 $P(1, 2)$, $Q(3, 2)$ and $R(1, 3)$ are the vertices of ΔPQR which are reflected on the line $y = 0$ and then translated by the translation vector $\frac{1}{3} PQ$. Find the coordinates of final images.
- Q.19 $P(2, 7)$, $Q(3, 2)$ and $R(0, -2)$ are the vertices of a triangle PQR . Find the image of PQR after reflection in the line $x = 3$ followed by the translation vector $(3 \ 2)$. Also draw the given triangle and its final image on the same graph.
- Q.20 Draw a triangle ABC having vertices $A(1, -1)$, $B(3, 2)$ and $C(0, 2)$ on a graph paper. Find the image of $\Delta A'B'C'$ after successive reflection in Y -axis followed by a reflection in the line $y = -x$. what is the single transformation that transforms ΔABC to $\Delta A'B'C'$?

Exercise 6.6