

## Exercise 12(A)

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1. Complete the following table:

	Point	Transformation	Image
(a)	(5, -7)	_____	(-5, 7)
(b)	(4, 2)	Reflection in x-axis	_____
(c)	_____	Reflection in y-axis	(0, 6)
(d)	(6, -6)	_____	(-6, 6)
(e)	(4, -8)	_____	(-4, -8)

**Solution:**

	Point	Transformation	Image
(a)	(5, -7)	Reflection in origin	(-5, 7)
(b)	(4, 2)	Reflection in x-axis	(4, -2)
(c)	(0, 6)	Reflection in y-axis	(0, 6)
(d)	(6, -6)	Reflection in origin	(-6, 6)
(e)	(4, -8)	Reflection in y-axis	(-4, -8)

2. A point P is its own image under the reflection in a line l. Describe the position of point the P with respect to the line l.

**Solution:**

As, the image of the point P is the same point under the reflection in the line l we can say, point P is an invariant point.

Thus, the position of point P remains unaltered.

3. State the co-ordinates of the following points under reflection in x-axis:

(i) (3, 2)

(ii) (-5, 4)

(iii) (0, 0)

**Solution:**

(i) (3, 2)

The co-ordinates of the given point under reflection in the x-axis are (3, -2).

(ii) (-5, 4)

The co-ordinates of the given point under reflection in the x-axis are (-5, -4).

(iii) (0, 0)

The co-ordinates of the given point under reflection in the x-axis are (0, 0).

4. State the co-ordinates of the following points under reflection in y-axis:

(i) (6, -3)

(ii) (-1, 0)

(iii) (-8, -2)

**Solution**

(i) (6, -3)

The co-ordinates of the given point under reflection in the y-axis are (-6, -3).

(ii) (-1, 0)

The co-ordinates of the given point under reflection in the y-axis are (1, 0).

(iii) (-8, -2)

The co-ordinates of the given point under reflection in the y-axis are (8, -2).

**5. State the co-ordinates of the following points under reflection in origin:**

(i) (-2, -4)

(ii) (-2, 7)

(iii) (0, 0)

**Solution:**

(i) (-2, -4)

The co-ordinates of the given point under reflection in origin are (2, 4).

(ii) (-2, 7)

The co-ordinates of the given point under reflection in origin are (2, -7).

(iii) (0, 0)

The co-ordinates of the given point under reflection in origin are (0, 0).

**6. State the co-ordinates of the following points under reflection in the line  $x = 0$ :**

(i) (-6, 4)

(ii) (0, 5)

(iii) (3, -4)

**Solution:**

(i) (-6, 4)

The co-ordinates of the given point under reflection in the line  $x = 0$  are (6, 4).

(ii) (0, 5)

The co-ordinates of the given point under reflection in the line  $x = 0$  are (0, 5).

(iii) (3, -4)

The co-ordinates of the given point under reflection in the line  $x = 0$  are (-3, -4).**7. State the co-ordinates of the following points under reflection in the line  $y = 0$ :**

(i) (-3, 0)

(ii) (8, -5)

(iii) (-1, -3)

**Solution:**

(i) (-3, 0)

The co-ordinate of the given point under reflection in the line  $y = 0$  is (-3, 0).

(ii) (8, -5)

The co-ordinate of the given point under reflection in the line  $y = 0$  is (8, 5).

(iii) (-1, -3)

The co-ordinate of the given point under reflection in the line  $y = 0$  is (-1, 3).

**8. A point P is reflected in the x-axis. Co-ordinates of its image are (-4, 5).**

**(i) Find the co-ordinates of P.**

**(ii) Find the co-ordinates of the image of P under reflection in the y-axis.**

**Solution:**

(i) As,  $M_x(-4, -5) = (-4, 5)$

Hence, the co-ordinates of P are (-4, -5).

(ii) Co-ordinates of the image of P under reflection in the y-axis (4, -5).

**9. A point P is reflected in the origin. Co-ordinates of its image are (-2, 7).**

**(i) Find the co-ordinates of P.**

**(ii) Find the co-ordinates of the image of P under reflection in the x-axis.**

**Solution:**

(i) As,  $M_o(2, -7) = (-2, 7)$

Hence, the co-ordinates of P are (2, -7).

(ii) Co-ordinates of the image of P under reflection in the x-axis (2, 7)

Exercise 12(B)

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1. Attempt this question on graph paper.

(a) Plot A (3, 2) and B (5, 4) on graph paper. Take 2 cm = 1 unit on both the axes.

(b) Reflect A and B in the x-axis to A' and B' respectively. Plot these points also on the same graph paper.

(c) Write down:

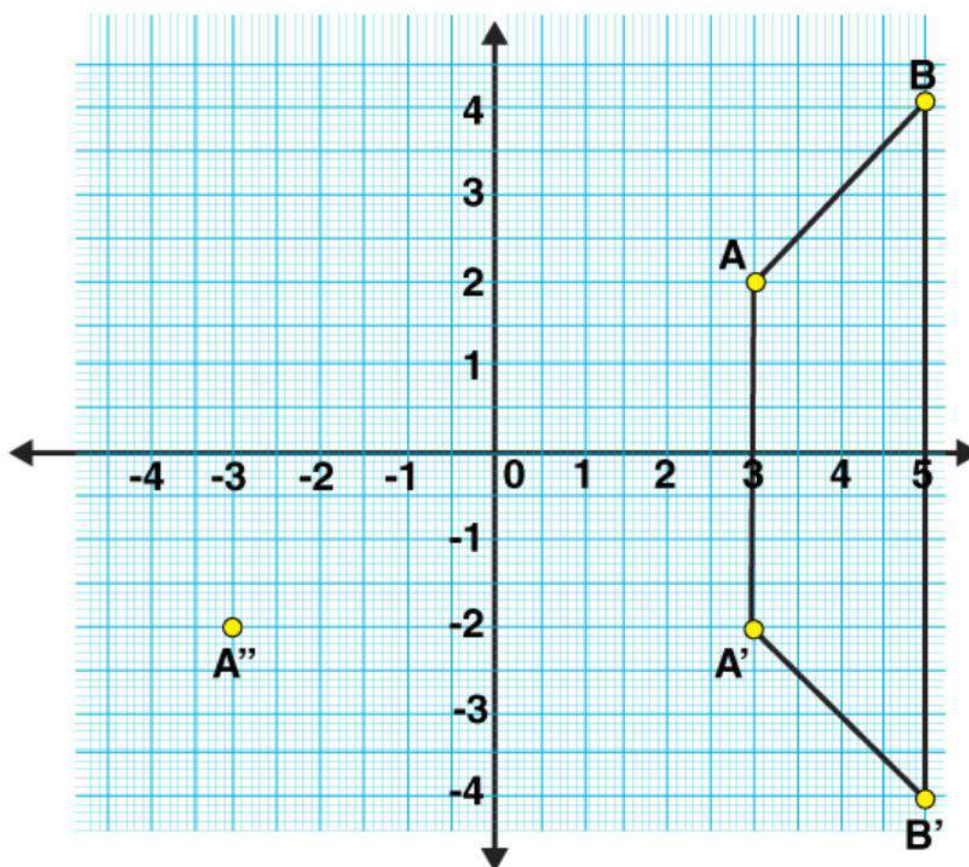
(i) the geometrical name of the figure ABB'A';

(ii) the measure of angle ABB';

(iii) the image of A'' of A, when A is reflected in the origin.

(iv) the single transformation that maps A' to A''.

Solution:



(c)

(i) From the graph, it's clearly seen that ABB'A' is an isosceles trapezium.

(ii) The measure of angle ABB' is 45°.

(iii) A'' = (-3, -2)

(iv) Single transformation that maps A' to A'' is the reflection in y-axis.

2. Points (3, 0) and (-1, 0) are invariant points under reflection in the line L<sub>1</sub>; points (0, -3) and (0, 1) are invariant points on reflection in line L<sub>2</sub>.

(i) Name or write equations for the lines L<sub>1</sub> and L<sub>2</sub>.

(ii) Write down the images of the points P (3, 4) and Q (-5, -2) on reflection in line  $L_1$ . Name the images as  $P'$  and  $Q'$  respectively.

(iii) Write down the images of P and Q on reflection in  $L_2$ . Name the images as  $P''$  and  $Q''$  respectively.

(iv) State or describe a single transformation that maps  $P'$  onto  $P''$ .

**Solution:**

(i) We know that, every point in a line is invariant under the reflection in the same line.

As the points (3, 0) and (-1, 0) lie on the x-axis.

Thus, (3, 0) and (-1, 0) are invariant under reflection in x-axis.

Therefore, the equation of line  $L_1$  is  $y = 0$ .

Similarly, (0, -3) and (0, 1) are also invariant under reflection in y-axis.

Therefore, the equation of line  $L_2$  is  $x = 0$ .

(ii)  $P' =$  Image of P (3, 4) in  $L_1 = (3, -4)$

And,  $Q' =$  Image of Q (-5, -2) in  $L_1 = (-5, 2)$

(iii)  $P'' =$  Image of P (3, 4) in  $L_2 = (-3, 4)$

And,  $Q'' =$  Image of Q (-5, -2) in  $L_2 = (5, -2)$

(iv) Single transformation that maps  $P'$  onto  $P''$  is reflection in origin.

**3. (i) Point P (a, b) is reflected in the x-axis to  $P'$  (5, -2). Write down the values of a and b.**

**(ii)  $P''$  is the image of P when reflected in the y-axis. Write down the co-ordinates of  $P''$ .**

**(iii) Name a single transformation that maps  $P'$  to  $P''$ .**

**Solution:**

(i) As,  $M_x(x, y) = (x, -y)$

$P' (5, -2) =$  reflection of P (a, b) in x-axis.

Hence, the co-ordinates of P are (5, 2).

Thus,  $a = 5$  and  $b = 2$ .

(ii)  $P'' =$  image of P (5, 2) reflected in y-axis = (-5, 2)

(iii) Single transformation that maps  $P'$  to  $P''$  is the reflection in origin.

**4. The point (-2, 0) on reflection in a line is mapped to (2, 0) and the point (5, -6) on reflection in the same line is mapped to (-5, -6).**

**(i) State the name of the mirror line and write its equation.**

**(ii) State the co-ordinates of the image of (-8, -5) in the mirror line.**

**Solution:**

(i) We know that, reflection of a point (x, y) in y-axis is (-x, y).

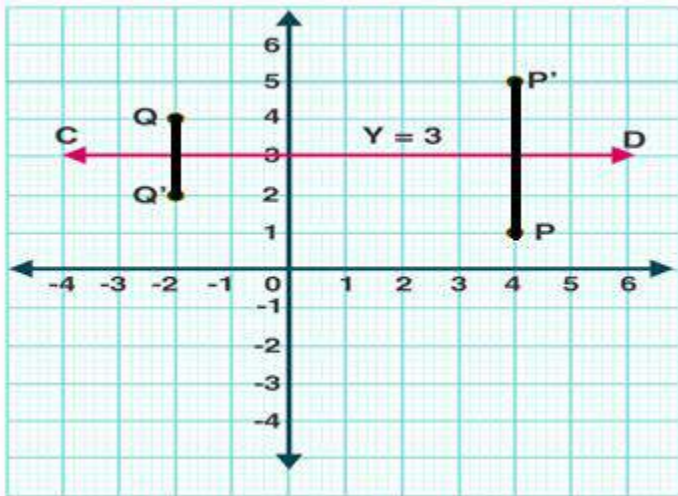
So, the point (-2, 0) when reflected in y-axis is mapped to (2, 0).

Hence, the mirror line is the y-axis and its equation is  $x = 0$ .

(ii) The co-ordinates of the image of  $(-8, -5)$  in the mirror line (i.e., y-axis) are  $(8, -5)$ .

5. The points  $P(4, 1)$  and  $Q(-2, 4)$  are reflected in line  $y = 3$ . Find the co-ordinates of  $P'$ , the image of  $P$  and  $Q'$ , the image of  $Q$ .

Solution:



The line  $y = 3$  is a line parallel to x-axis and at a distance of 3 units from it.

Let's mark the points  $P(4, 1)$  and  $Q(-2, 4)$ .

Now from  $P$ , draw a straight line perpendicular to line  $CD$  and produce. Mark a point  $P'$  on this line which is at the same distance above  $CD$  as  $P$  is below it.

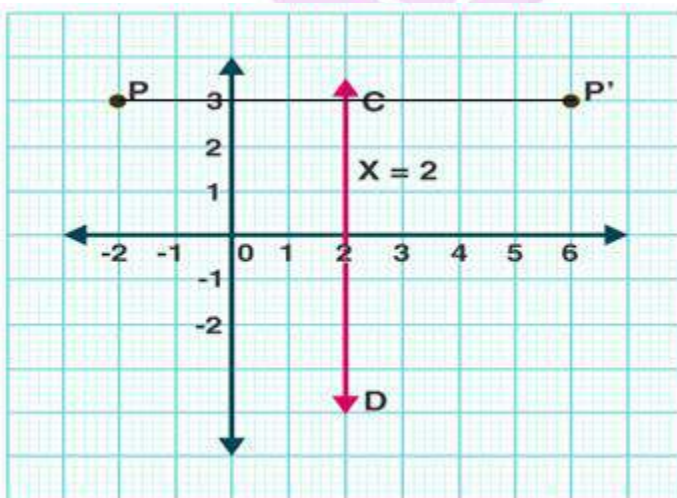
Thus, the co-ordinates of  $P'$  are  $(4, 5)$ .

Similarly, from  $Q$ , draw a line perpendicular to  $CD$  and mark point  $Q'$  which is at the same distance below  $CD$  as  $Q$  is above it.

Hence, the co-ordinates of  $Q'$  are  $(-2, 2)$ .

6. A point  $P(-2, 3)$  is reflected in line  $x = 2$  to point  $P'$ . Find the coordinates of  $P'$ .

Solution:



The line  $x = 2$  is a line parallel to y-axis and at a distance of 2 units from it.

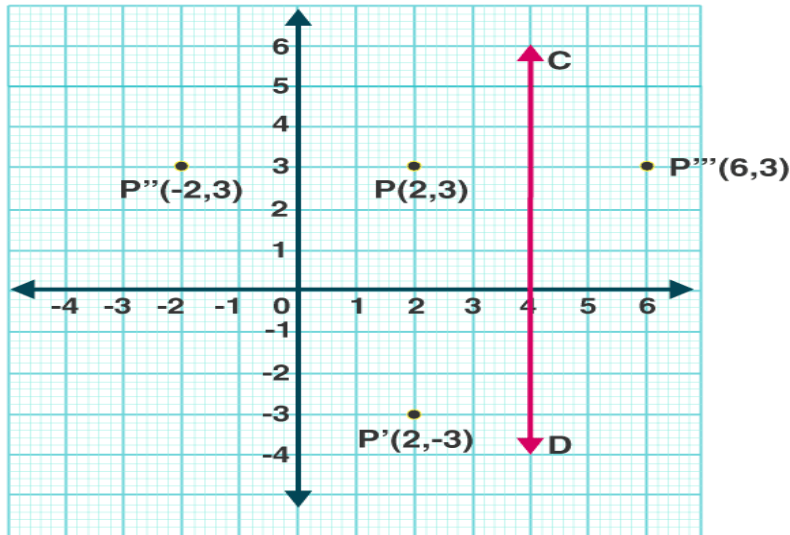
Let's mark the point  $P(-2, 3)$ .

From P, draw a straight line perpendicular to line CD and produce. Mark a point on this line which is at the same distance to the right of CD as P is to the left of it.

Hence, the co-ordinates of P' are (6, 3).

7. A point P (a, b) is reflected in the x-axis to P' (2, -3). Write down the values of a and b. P'' is the image of P, reflected in the y-axis. Write down the co-ordinates of P''. Find the co-ordinates of P''', when P is reflected in the line, parallel to y-axis, such that x = 4.

**Solution:**



A point P (a, b) is reflected in the x-axis to P' (2, -3).

We know that,  $M_x(x, y) = (x, -y)$

Hence, the co-ordinates of P are (2, 3).

And thus, a = 2 and b = 3.

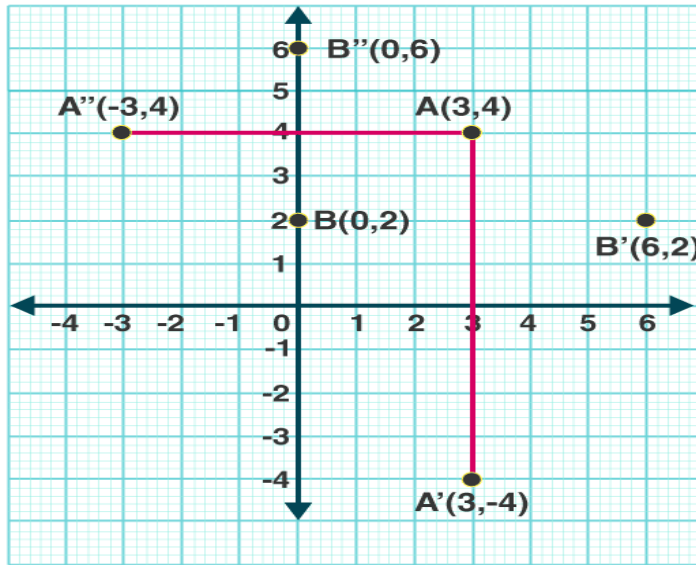
P'' = Image of P reflected in the y-axis = (-2, 3)

P''' = Reflection of P in the line (x = 4, a line parallel to y-axis and at a distance of 4 units from it) = (6, 3)

8. Points A and B have co-ordinates (3, 4) and (0, 2) respectively. Find the image:

- A' of A under reflection in the x-axis.
- B' of B under reflection in the line AA'.
- A'' of A under reflection in the y-axis.
- B'' of B under reflection in the line AA''.

**Solution:**



- (a)  $A'$  = Image of  $A$  under reflection in the  $x$ -axis =  $(3, -4)$
- (b)  $B'$  = Image of  $B$  under reflection in the line  $AA'$  ( $x = 3$ ) =  $(6, 2)$
- (c)  $A''$  = Image of  $A$  under reflection in the  $y$ -axis =  $(-3, 4)$
- (d)  $B''$  = Image of  $B$  under reflection in the line  $AA''$  ( $y = 4$ ) =  $(0, 6)$