Book Name: Selina Concise

EXERCISE 12 (A)

Question 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 1:

Point	Transformation	Image
(5, −7)	Reflection in origin	(− 5, 7)
(4, 2)	Reflection in x-axis	(4, − 2)
(0, 6)	Reflection in y-axis	(0, 6)
(6, − 6)	Reflection in origin	(− 6, 6)
(4, − 8)	Reflection in y-axis	(− 4, −8)

Question 2:

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

Solution 2:

Since, the point P is its own image under the reflection in the line l. So, point P is an invariant point.
Hence, the position of point P remains unaltered.

Question 3:

State the co-ordinates of the following points under reflection in x-axis:
(i) (3, 2) (ii) (− 5, 4) (iii) (0, 0)

Solution 3:

(i) (3, 2)
The co-ordinate of the given point under reflection in the x-axis is (3, -2).
(ii) (− 5, 4)
The co-ordinate of the given point under reflection in the x-axis is (-5, -4).
(iii) (0, 0)
The co-ordinate of the given point under reflection in the x-axis is (0, 0).

Question 4:

State the co-ordinates of the following points under reflection in y-axis:
(i) (6, −3) (ii) (−1 , 0) (iii) (−8, −2)

Solution 4:

(i) (6, −3)
The co-ordinate of the given point under reflection in the y-axis is (-6, -3).
(ii) (−1, 0)
The co-ordinate of the given point under reflection in the y-axis is (1, 0).
(iii) (−8, −2)
The co-ordinate of the given point under reflection in the y-axis is (8, -2).

Question 5:

State the co-ordinates of the following points under reflection in origin:
(i) (−2, −4) (ii) (−2, 7) (iii) (0, 0)

Solution 5:

(i) (− 2, −4)
The co-ordinate of the given point under reflection in origin is (2, 4).
(ii) (−2, 7)
The co-ordinate of the given point under reflection in origin is (2, -7).
(iii) (0, 0)
The co-ordinate of the given point under reflection in origin is (0, 0).

Question 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 6:

(i) (−6, 4)
The co-ordinate of the given point under reflection in the line x = 0 is (6, 4).
(ii) (0, 5)
The co-ordinate of the given point under reflection in the line x = 0 is (0, 5).
(iii) (3, −4)
The co-ordinate of the given point under reflection in the line x = 0 is (-3, -4).

Question 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 7:

(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).

Question 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 8:

(i) Since, M_x (−4, −5) = (−4, 5)
So, the co-ordinates of P are (−4, −5).
(ii) Co-ordinates of the image of P under reflection in the y-axis (4, −5).

Question 9:

A point P is reflected in the origin. Co-ordinates of its image are (−2, 7)
(i) Find the co-ordinate of P.
(ii) Find the co-ordinates of the image of P under reflection in the x-axis

Solution 9:

(i) Since, M_O (2, −7) = (−2, 7)
So, the co-ordinates of P are (2, −7).
(ii) Co-ordinates of the image of P under reflection in the x-axis (2, 7).

Question 10:

The point P (a, b) is first reflected in the origin and then reflected in the y-axis to P. If P has co-ordinates (4, 6); evaluate a and b.

Solution 10:

M_O (a, b) = (−a, −b)
M_y (−a, −b) = (a, −b)
Thus, we get the co-ordinates of the point P' as (a, −b). It is given that the co-ordinates of P' are (4, 6).
On comparing the two points, we get,
a = 4 and b = −6

Question 11:

The point P (x, y) is first reflected in the x-axis and then reflected in the origin to P. If P has co-ordinates (−8, 5); evaluate x and y.

Solution 11:

M_x (x, y) = (x, −y)
M_O (x, −y) = (−x, y)
Thus, we get the co-ordinates of the point P' as (−x, y). It is given that the co-ordinates of P' are (−8, 5).
On comparing the two points, we get,
x = 8 and y = 5

Question 12:

The point A(−3, 2) is reflected in the x-axis to the point A'. Point A' is then reflected in the origin to point A".
(i) Write down the co-ordinates of A".
(ii) Write down a single transformation that maps A onto A".

Solution 12:

(i) The reflection in x-axis is given by M_x (x, y) = (x, −y).
A' = reflection of A (−3, 2) in the x− axis = (−3, −2).
The reflection in origin is given by M_O (x, y) = (−x, -y).
A" = reflection of A' (-3, -2) in the origin = (3, 2)

(ii) The reflection in y-axis is given by M_y (x, y) = (−x, y).
The reflection of A (−3, 2) in y-axis is (3, 2).
Thus, the required single transformation is the reflection of A in the y-axis to the point A".

Question 13:

The point A (4, 6) is first reflected in the origin to point A' Point A' is then reflected in the y – axis to point A".
(i) Write down the co-ordinates of A".
(ii) Write down a single transformation that maps A onto A".

Solution 13:

(i) The reflection in origin is given by M_O (x, y) = (−x, −y).
A' = reflection of A (4, 6) in the origin = (−4, −6)
The reflection in y-axis is given by M_y (x, y) = (−x, y).
A" = reflection of A' (−4, −6) in the y-axis = (4, −6)
(ii) The reflection in x-axis is given by M_x (x, y) = (x, −y).
The reflection of A (4, 6) in x-axis is (4, −6).
Thus, the required single transformation is the reflection of A in the x-axis to the point A".

Question 14:

The triangle ABC, where A is (2, 6), B is (−3, 5) and C is (4, 7), is reflected in the y-axis to triangle A'B'C. Triangle A'B'C is then reflected in the origin to triangle A"B"C".
(i) write down the co-ordinates of A",B" and C".
(ii) write down a single transformation that maps triangle ABC onto triangle A"B"C".

Solution 14:

(i) Reflection in y-axis is given by M_y (x, y) = (−x, y)
∴ A' = Reflection of A (2, 6) in y-axis = (−2, 6)
Similarly, B' = (3, 5) and C' = (−4, 7)
Reflection in origin is given by M_O (x, y) = (−x, −y)
∴ A" = Reflection of A' (-2, 6) in origin = (2, −6)
Similarly, B" = (−3, −5) and C" = (4, −7)

(ii) A single transformation which maps triangle ABC to triangle A"B"C" is reflection in x-axis.

Question 15:

P and Q have co-ordinates (−2, 3) and (5, 4) respectively. Reflect P in the x-axis to P' and Q in the y-axis to Q. State the co-ordinates of P' and Q'.

Solution 15:

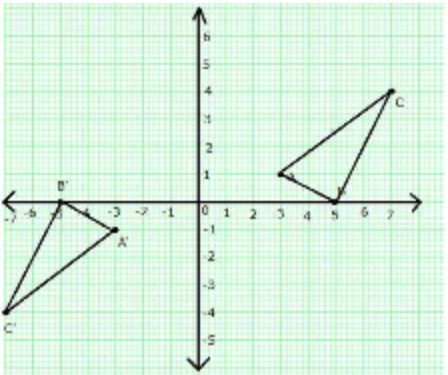
Reflection in x-axis is given by M_x (x, y) = (x, -y)
P' = Reflection of P(-2, 3) in x-axis = (-2, -3)
Reflection in y-axis is given by M_y (x, y) = (-x, y)
Q' = Reflection of Q(5, 4) in y-axis = (-5, 4)
Thus, the co-ordinates of points P' and Q' are (-2, -3) and (-5, 4) respectively.

Question 16:

On a graph paper, plot the triangle ABC, whose vertices are at the points A (3, 1), B (5, 0) and C (7, 4).
On the same diagram, draw the image of the triangle ABC under reflection in the origin O (0, 0)

Solution 16:

The graph shows triangle ABC and triangle A'B'C' which is obtained when ABC is reflected in the origin.



Question 17:

Find the image of point (4, −6) under the following operations:
(i) $M_x . M_y$ (ii) $M_y . M_x$
(iii) $M_O . M_x$ (iv) $M_x . M_O$
(v) $M_O . M_y$ (vi) $M_y . M_O$
Write down a single transformation equivalent to each operation given above. State whether:
(a) $M_O . M_x = M_x . M_O$
(b) $M_y . M_O = M_O . M_y$

Solution 17:

(i) $M_x . M_y (4, -6) = M_y (-4, -6) = (-4, 6)$
Single transformation equivalent to $M_x . M_y$ is M_O.

(ii) $M_y . M_x (4, -6) = M_y (4, 6) = (-4, 6)$
Single transformation equivalent to $M_y . M_x$ is M_O.

(iii) $M_O . M_x (4, -6) = M_O (4, 6) = (-4, -6)$
Single transformation equivalent to $M_O . M_x$ is M_y.

(iv) $M_x . M_O (4, -6) = M_x (-4, 6) = (-4, -6)$
Single transformation equivalent to $M_x . M_O$ is M_y.

(v) $M_O . M_y (4, -6) = M_O (-4, -6) = (4, 6)$
Single transformation equivalent to $M_O . M_y$ is M_x.

(vi) $M_y . M_O (4, -6) = M_y (-4, 6) = (4, 6)$

Single transformation equivalent to M_x . M_O is M_x.

From (iii) and (iv), it is clear that M_O. M_x = M_x. M_O.
From (v) and (vi), it is clear that M_y. M_O = M_O. M_y.

Question 18:

Point A (4, − 1) is reflected as A' in the y – axis. Point B on reflection in the x-axis is mapped as B' (−2, 5). Write the co-ordinates of A' and B.

Solution 18:

Reflection in y-axis is given by M_y (x, y) = (−x, y)
A' = Reflection of A(4, −1) in y-axis = (−4, −1)
Reflection in x-axis is given by M_x (x, y) = (x, −y)
B' = Reflection of B in x-axis = (−2, 5)
Thus, B = (−2, −5)

Question 19:

The point (−5, 0) on reflection in a line is mapped as (5, 0) and the point (−2, −6) on reflection in the same line is mapped as (2, −6).
(a) Name the line of reflection.
(b) write the co-ordinates of the image of 5, −8) in the line obtained in (a).

Solution 19:

(a) We know that reflection in the line x = 0 is the reflection in the y-axis.
It is given that:
Point (-5, 0) on reflection in a line is mapped as (5, 0).
Point (-2, -6) on reflection in the same line is mapped as (2, -6).
Hence, the line of reflection is x = 0.
(b) It is known that M_y (x, y) = (-x, y)
Co-ordinates of the image of (5, -8) in the line x = 0 are (-5, -8).

EXERCISE 12 (B)

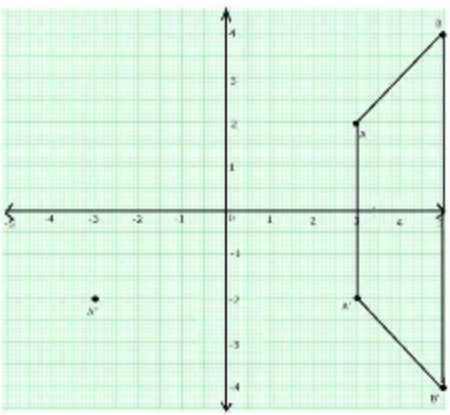
Question:

Attempts this question on graph paper.
(a) Plot A(3, 2) and B (5, 4) on graph paper.
Take 2 cm = 1unit 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 A" of A, when A is reflected in the origin.
(iv) the single transformation that maps A' to A".

Solution:

(a) (b)



(c)
(i) From graph, it is clear 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.

Question 2:

Points (3, 0) and (−1, 0) are invariant points under reflection in the line L_1 ; points (0, −3) and (0, 1) are invariant points on reflection in line L_2.
(i) Name or write equations for the lines L_1 and L_2.
(ii) write down the images of points P (3, 4) and Q (−5, −2) on reflection in 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 2:

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

Since points (3, 0) and (-1, 0) lie on the x-axis.
So, (3, 0) and (-1, 0) are invariant under reflection in x-axis.
Hence, the equation of line L_1 is y = 0.
Similarly, (0, -3) and (0, 1) are invariant under reflection in y-axis.
Hence, the equation of line L_2 is x = 0.

(ii) P' = Image of P (3, 4) in L_1 = (3, -4)
Q' = Image of Q (-5, -2) in L_1 = (-5, 2)

(iii) P'' = Image of P (3, 4) in L_2 = (-3, 4)
Q'' = Image of Q (-5, -2) in L_2 = (5, -2)

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

Question 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 3:

(i) We know M_x (x, y) = (x, -y)
P' (5, -2) = reflection of P (a, b) in x-axis.
Thus, the co-ordinates of P are (5, 2).
Hence, 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.

Question 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-originates of the image of (−8, −5) in the mirror line.

Solution 4:

(i) We know reflection of a point (x, y) in y-axis is (-x, y).
Hence, the point (-2, 0) when reflected in y-axis is mapped to (2, 0).
Thus, the mirror line is the y-axis and its equation is x = 0.

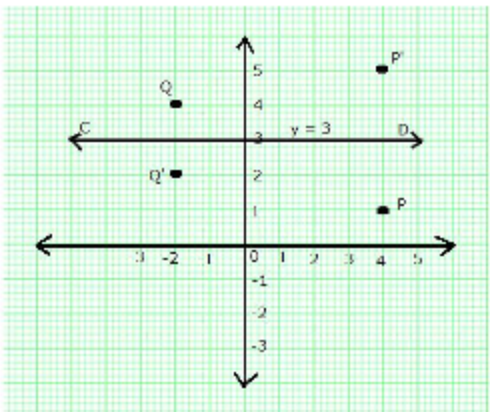
(ii) Co-ordinates of the image of (-8, -5) in the mirror line (i.e., y-axis) are (8, -5).

Question 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 5:

The line y = 3 is a line parallel to x-axis and at a distance of 3 units from it.
Mark points P (4, 1) and Q (-2, 4).
From P, draw a straight line perpendicular to line CD and produce. On this line mark a point P′ which is at the same distance above CD as P is below it.
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.
The co-ordinates of Q′ are (-2, 2).



Question 6:

A point P (−2, 3) is reflected in line x =2 to point P'. Find the co-ordinates of P'.

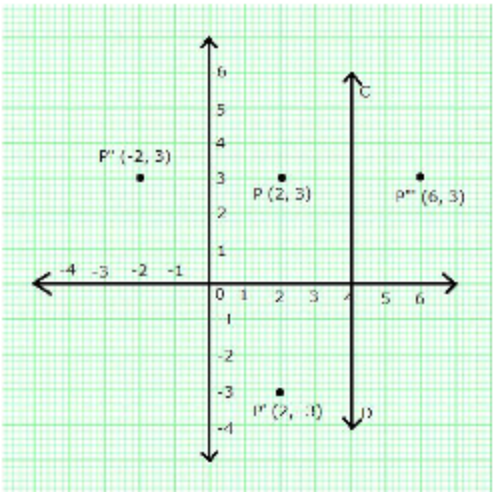
Solution 6:

The line x = 2 is a line parallel to y-axis and at a distance of 2 units from it.
Mark point P (-2, 3).
From P, draw a straight line perpendicular to line CD and produce. On this line mark a point P′ which is at the same distance to the right of CD as P is to the left of it.
The co-ordinates of P′ are (6, 3).

Question 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 7:

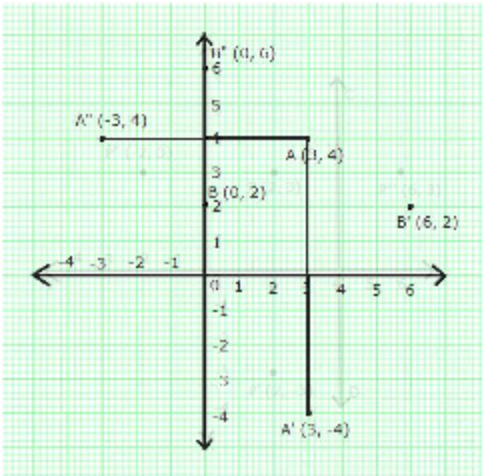


A point P (a, b) is reflected in the x-axis to P' (2, −3).
We know M_x (x, y) = (x, −y)
Thus, co-ordinates of P are (2, 3). Hence, a = 2 and b = 3.
P'' = Image of P reflected in the y-axis = (−2, 3)
P''' = Reflection of P in the line (x = 4) = (6, 3)

Question 8:

Points A and B have co-ordinates (3, 4) and (0, 2) respectively. Find the image:
(a) A' and A under reflection in the x-axis
(b) B' of B under reflection in the line AA'.
(c) A'' of A under reflection in the y-axis
(d) B'' of B under reflection in the line AA''.

Solution 8:

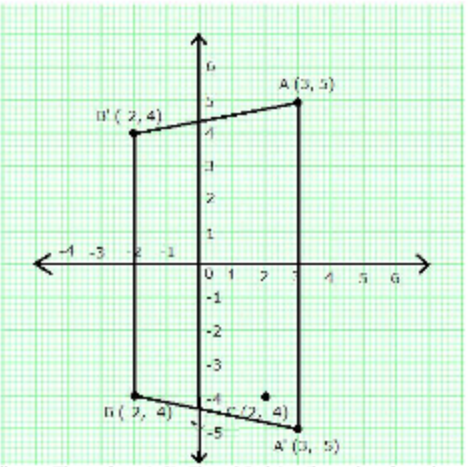


(a) A' = Image of A under reflection in the x-axis = (3, −4)
(b) B' = Image of B under reflection in the line AA' = (6, 2)
(c) A" = Image of A under reflection in the y-axis = (−3, 4)
(d) B" = Image of B under reflection in the line AA" = (0, 6)

Question 9:

(i) Plot the points A (3, 5) and B (−2, −4) Use 1 cm = 1 unit on both the axes.
(ii) A' is the image of A when reflected in the x – axis. Write down the co-ordinates of A' and plot it on the graph paper.
(iii) B' is the image of B when reflected in the y-axis followed by reflection in the origin. Write down the co-ordinates of B' and plot it on the graph paper.
(iv) Write down the geometrical name of the figure AA'BB'.
(v) Name two invariant points under reflection in the x-axis.

Solution 9:

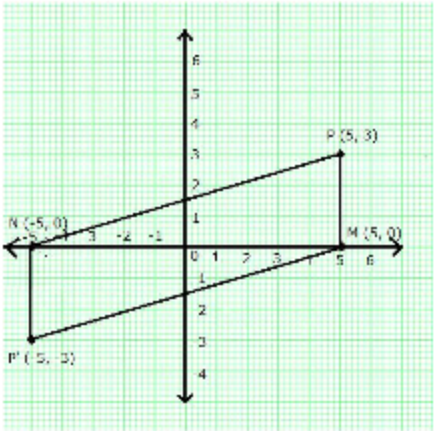


(i) The points A (3, 5) and B (-2, -4) can be plotted on a graph as shown.
(ii) A' = Image of A when reflected in the x-axis = (3, -5)
(iii) C = Image of B when reflected in the y-axis = (2, -4)
B' = Image when C is reflected in the origin = (-2, 4)
(iv) Isosceles trapezium
(v) Any point that remains unaltered under a given transformation is called an invariant.
(vi) Thus, the required two points are (3, 0) and (-2, 0).

Question 10:

The point P (5, 3) was reflected in the origin to get the image P'.
(a) write down the co-ordinates of P'.
(b) If M is the foot of the perpendicular from P to the x-axis, find the co-ordinates of M.
(c) If N is the foot of the perpendicular from P' to the x – axis, find the co-ordinates of N.
(d) Name the figure PMP'N.
(e) Find the area of the figure PMP'N.

Solution 10:

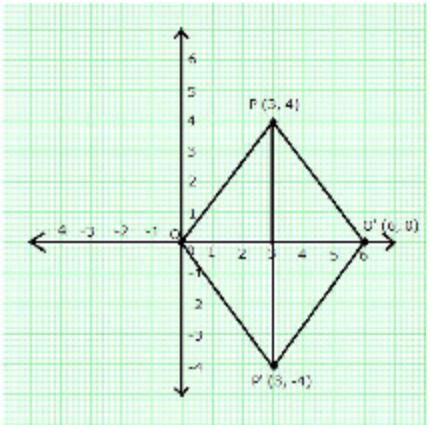


(a) Co-ordinates of P' = (-5, -3)
(b) Co-ordinates of M = (5, 0)
(c) Co-ordinates of N = (-5, 0)
(d) PMP'N is a parallelogram.
(e) Are of PMP'N = 2 (Area of D PMN)
$= 2 \times \frac{1}{2} \times 10 \times 3$
= 30 sq units

Question 11:

The point P(3, 4) is reflected to P' in the x-axis and O' is the image of O (the origin) when reflected in the line PP' write:
(i) the co-ordinates of P' and O'.
(ii) the length of the segments PP' and OO'.
(iii) the perimeter of the quadrilateral POP'O'.
(iv) the geometrical name of the figure POP'O'.

Solution 11:

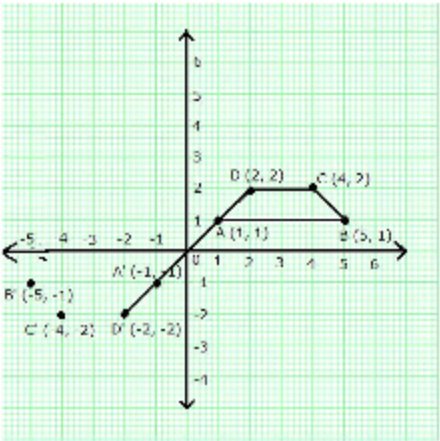


(i) Co-ordinates of P' and O' are (3, -4) and (6, 0) respectively.
(ii) PP' = 8 units and OO' = 6 units.
(iii) From the graph it is clear that all sides of the quadrilateral POP'O' are equal.
In right Δ PO'Q,
PO' = $\sqrt{(4)^2 + (3)^2}$ = 5 units
So, perimeter of quadrilateral POP'O' = 4 PO' = 4 × 5 units = 20 units
(iv) Quadrilateral POP'O' is a rhombus.

Question 12:

A (1, 1), B (5, 1), C (4, 2) and d (2, 2) are vertices of a quadrilateral. Name the quadrilateral ABCD.A, B, C and D are reflected in the origin on to A', B', C', and D', on the graph sheet and write their co-ordinates. Are D, A, A' and D' collinear?

Solution 12:



Quadrilateral ABCD is an isosceles trapezium.
Co-ordinates of A', B', C' and D' are A'(-1, -1), B'(-5, -1), C'(-4, -2) and D'(-2, -2) respectively.
It is clear from the graph that D, A, A' and D' are collinear.

Question 13:

P and Q have co-ordinates $(0, 5)$ and $(-2, 4)$.
(a) P is invariant when reflected in an axis Name the axis.
(b) Find the images of Q on reflected in the axis found in (i).
(c) (0, K) on reflection in the origin is invariant. Write the value of k.
(d) Write the co- originates of the image of Q, obtained by reflecting it in the origin followed by reflection in x-axis.

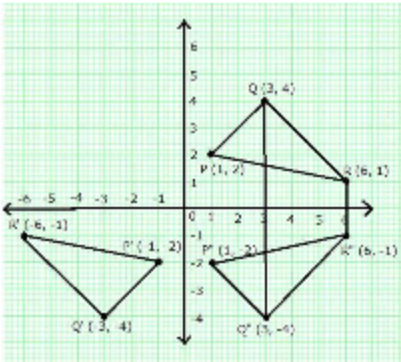
Solution 13:

(a) Any point that remains unaltered under a given transformation is called an invariant.
It is given that P (0, 5) is invariant when reflected in an axis. Clearly, when P is reflected in the y-axis then it will remain invariant. Thus, the required axis is the y-axis.
(b) The co-ordinates of the image of Q (-2, 4) when reflected in y-axis is (2, 4).
(c) (0, k) on reflection in the origin is invariant. We know the reflection of origin in origin is invariant. Thus, k = 0.
(d) Co-ordinates of image of Q (-2, 4) when reflected in origin = (2, -4)
Co-ordinates of image of (2, -4) when reflected in x-axis = (2, 4)
Thus, the co-ordinates of the point are (2, 4).

Question 14:

The points P (1, 2), Q(3, 4) and R(6, 1) are the verticals of Δ PQR.
(a) Write down the co-ordinates of P', Q' and R, if Δ P'Q'R' is the image of Δ pqr, when reflected in the origin.
(b) Write down the co-ordinates of P", Q" and R", IF Δ P"Q"R" is the image of ΔPQR, when reflected in the x-axis
(c) mention the special name of the quadrilateral QR R"Q" and find its area.

Solution 14:



(a) The co-ordinates of P', Q' and R' are (-1, -2), (-3, -4) and (-6, -1) respectively.
(b) The co-ordinates of P", Q" and R" are (1, -2), (3, -4) and (6, -1) respectively.
(c) The quadrilateral QRR"Q" is an isosceles trapezium.

Area of QRR"Q" = $\frac{1}{2}$ (RR"+ QQ") × Height

= $\frac{1}{2}$ (2 + 8) x 3 = 15 sq units

Question 15:

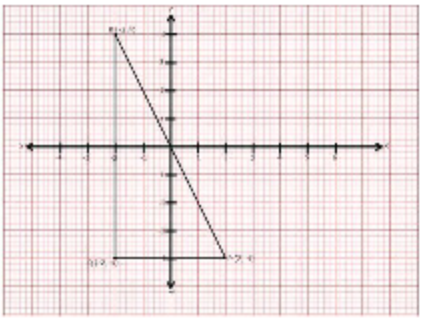
(a) The point P(2, 4) is reflected about the line x = 0 to get the image Q. Find the co-ordinates of Q.
(b) The point Q is reflected about the line y = 0 to get the image R. Find the co-ordinates of R.
(c) Name the figure PQR.
(d) Find the area of figure PQR.

Solution 15:

(i) P (2, −4) is reflected in (x = 0) y-axis to get Q.

P(2, −4) $\xrightarrow{My}$ Q (−2, −4)

(ii) Q (−2, −4) is reflected in (y = 0) x-axis to get R.
Q (−2, −4) $\xrightarrow{Mx}$ R (-2, 4)
(iii) The figure PQR is right angled triangle.

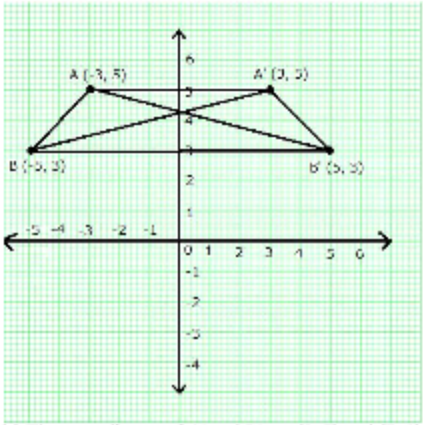


(iv) Area of $\Delta PQR = \frac{1}{2} \times PQ \times QR = \frac{1}{2} \times 4 \times 8$ =16 Sq. units

Question 16:

A and B' are images of A(−3, 5) and B (−5, 3) respectively on reflection in y-axis.
Find:
(a) the co-ordinates of A' and B'
(b) Assign special name of quadrilateral AA'B'B.
(c) Are AB' and BA' equal in length?

Solution 16:



(a) The co-ordinates of A' and B' are (3, 5) and (5, 3).
(b) Quadrilateral AA'B'B is an isosceles trapezium.
(c) Yes, AB' and BA' are equal in length.