CHAPTER THIRTEEN

Transformation

(Q1) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular lines Ox and Oy on a graph sheet.

(i) On this graph sheet, mark the x-axis from -5 to5 and the y-axis from - 6 to 6.

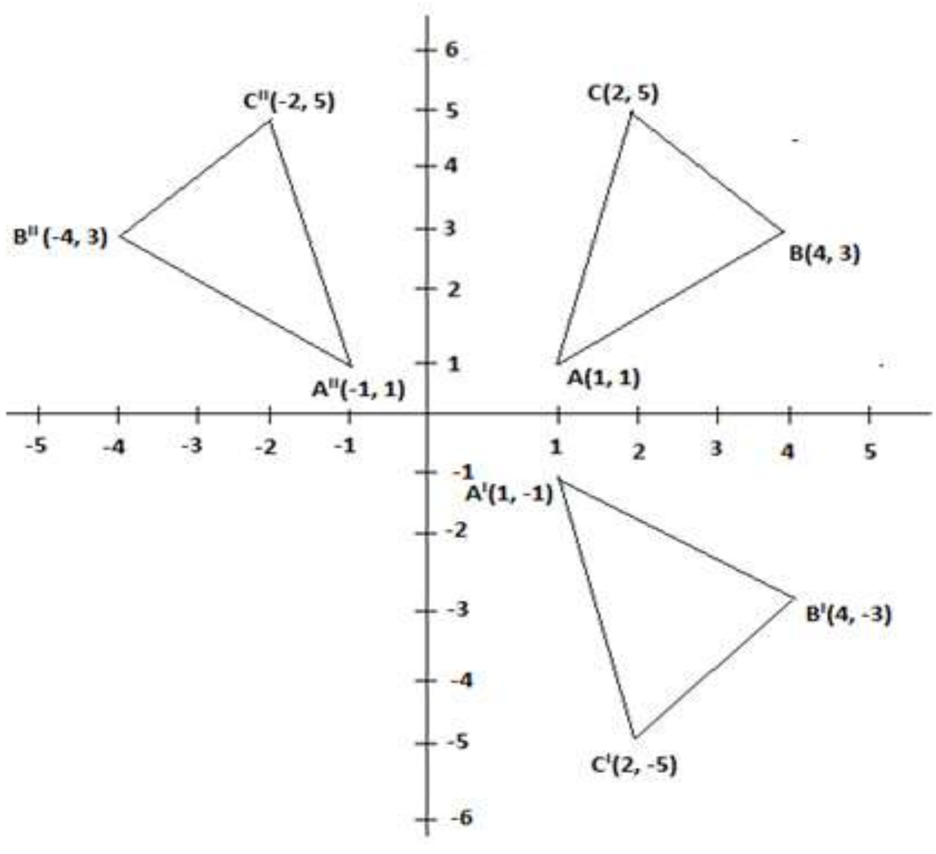
(ii) Plot on the same graph sheet the points A(1, 1), B(4, 3) and C(2, 5). Join the points A, B and C to form a triangle.

(iii) Using the x-axis as mirror line, draw the image of triangle ABC such that

$A \rightarrow A^1$, $B \rightarrow B^1$ and $C \rightarrow C^1$. Write down the coordinates of A^1, B^1 and C^1.

(iv) Using the y-axis as the mirror line, draw the image of triangle ABC such that

$A \rightarrow A^{II}$, $B \rightarrow B^{II}$ and $C \rightarrow C^{II}$.



(i) Using the x-axis as the mirror line, then the mapping is $(x, y) \rightarrow (x, -y)$.

Since $A \rightarrow A^{I}$, then $A(1, 1) \rightarrow A^{I}(1, -1)$.

Since $B \rightarrow B^{I}$, then $B(4, 3) \rightarrow B^{I}(4, -3)$.

Since $C \rightarrow C^{I}$, then $C(2, 5) \rightarrow C^{I}(2, -5)$.

Using the coordinates of points A^{I}, B^{I} and C^{I}, we draw triangle $A^{I}B^{I}C^{I}$.

(i) If the y-axis now serves as the mirror line, then the mapping is $(x, y) \rightarrow (-x, y)$.

Since $A \rightarrow A^{II}$, then $A(1, 1) \rightarrow A^{II}(-1, 1)$.

Since $B \rightarrow B^{II}$ then $B(4, 3) \rightarrow B^{II}(- 4, 3)$.

Since $C \rightarrow C^{II}$, then $C(2, 5) \rightarrow C^{II}(-2, 5)$.

Lastly, using the coordinates of A^{II}, B^{II} and C^{II}, we draw triangle $A^{II}B^{II}C^{II}$.

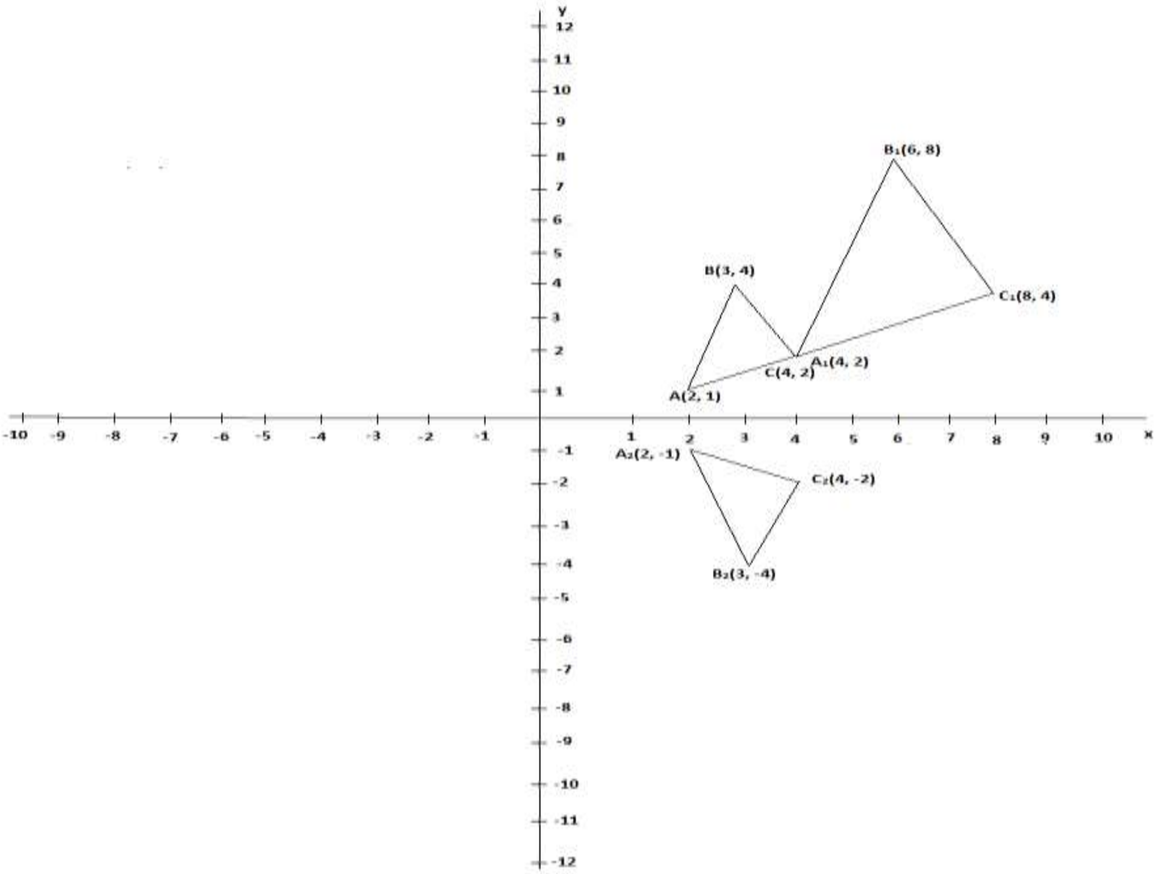
(Q2)(a) Using a scale of 2cm to 2units on both axes, draw two perpendicular axes Ox and Oy on a graph paper.

(b) On this graph sheet mark the x-axis from -10 to 10 and the y-axis from -12 to 12.

(c) Plot on the same graph sheet, the points A(2, 1), B(3, 4) and C(4, 2). Join the points to form triangle ABC.

(d) Draw the enlargement $A_{I}B_{I}C_{I}$ of triangle ABC under a scale factor 2 from the origin (0, 0) such that $A \rightarrow A_{I}$, $B \rightarrow B_{I}$ and $C \rightarrow C_{I}$. Indicate the coordinates of triangle $A_{I}B_{I}C_{I}$. Show all the lines of transformation.

(e) Using the x-axis as the mirror line, draw the image $A_2B_2C_2$ of triangle ABC, where A → A_2, B → B_2 and C → C_2. Indicate the coordinates of triangle $A_2B_2C_2$.



(d) For an enlargement with scale factor 2, (x, y) → (2x, 2y).

Since A → A_1, then A(2, 1) → A_1{2(2), 2(1)},

=> A(2, 1) → A_1(4, 2).

Since B → B_1, then B(3, 4) → B_1{2(3), 2(4)}.

=> B(3, 4) → B_1(6,8).

Since C → C_1, then C(4, 2) → C_1{2(4), 2(2)}

=> C(4, 2) → C_1(8, 4).

Using the coordinates of A_1, B_1 and C_1, we draw triangle $A_1B_1C_1$.

(e) Using the x-axis as the mirror line, the mapping to be used is (x, y) → (x, - y).

Since A → A_2, then A(2, 1) → A_2(2, -1).

Since B → B_2, then B(3, 4) → B_2(3, - 4).

Lastly, since C→ C_2, then C(4, 2) → C_2(4, -2).

Using these coordinates of A_2, B_2 and C_2, we draw triangle $A_2B_2C_2$.

(Q3)(a) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular axes Ox and Oy on a graph sheet.

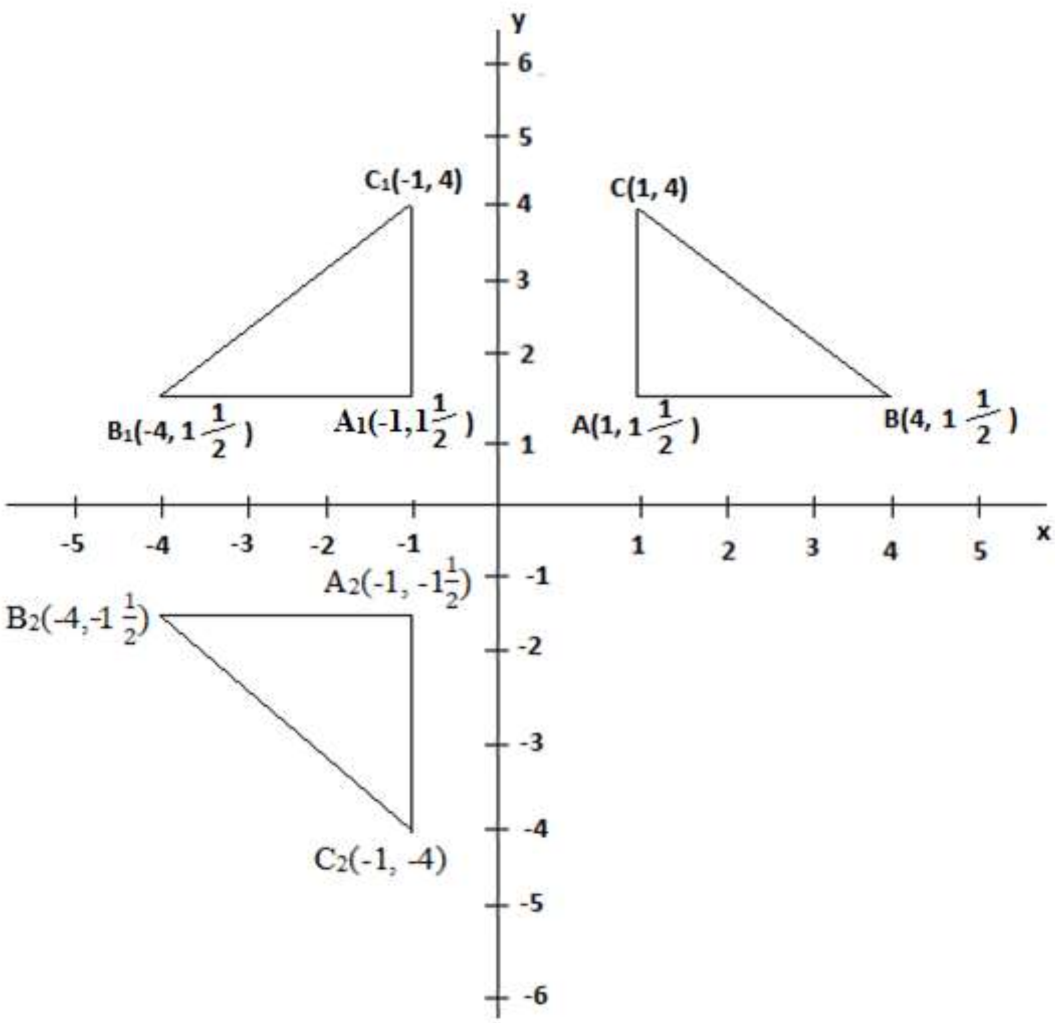
(b) On the same graph sheet, mark the x-axis from -5 to 5 and the y-axis from -6 to 6.

(c) Plot on the same graph sheet, the points A(1, $1\frac{1}{2}$), $B\left(4, 1\frac{1}{2}\right)$ and $C(1, 4)$, and join these points to form a triangle and name the type of triangle drawn.

(d) Draw the image $A_1B_1C_1$ of ABC under a reflection in the y-axis where A → A_1, B → B_1 and C → C_1. Label the vertices and coordinates clearly.

(e) Draw the image $A_2B_2C_2$ of ABC under an enlargement with scale factor -1, with the centre of the enlargement as the origin (0, 0) where A → A_2, B → B_2 and C→ C_2. Show the lines of enlargement and label the vertices and coordinates clearly.

Soln:



(d) For a reflection in the y-axis, $(x, y) \rightarrow (-x, y)$.

Since $A \rightarrow A_1$, then $A(1, 1\frac{1}{2}) \rightarrow A_1(-1, 1\frac{1}{2})$.

Since $B \rightarrow B_1$, then $B(4, 1\frac{1}{2}) \rightarrow B_1(-4, 1\frac{1}{2})$.

Since $C \rightarrow C_1$, then $C(1, 4) \rightarrow C_1(-1, 4)$.

Using these coordinates of A_1, B_1 and C_1, we draw triangle $A_1B_1C_1$.

(e) Under an enlargement with scale factor -1,

$(x, y) \rightarrow (-1x, -1y)$, => $(x, y) \rightarrow (-x, -y)$.

Since A → A_2, then A(1, $1\frac{1}{2}$) → A_2(-1, -$1\frac{1}{2}$).

Since B → B_2, then B(4, $1\frac{1}{2}$) →B_2(- 4, - $1\frac{1}{2}$).

Lastly, since C → C_2, then C(1, 4) → C_2(-1, - 4).

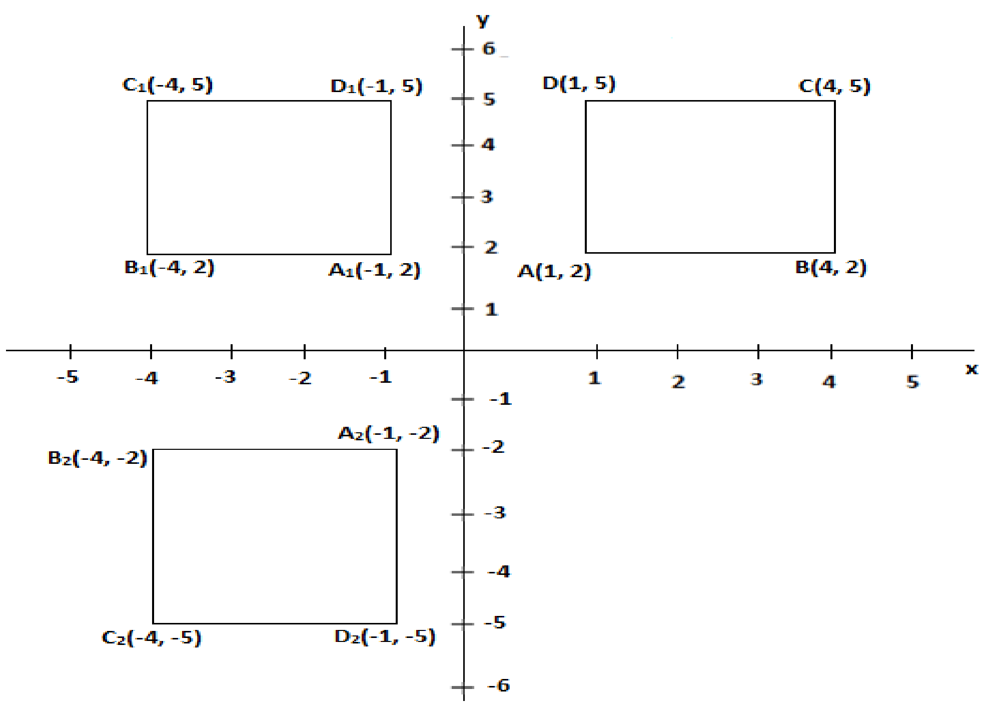
(Q4) Using a scale of 2cm to I unit on both axes, draw two perpendicular lines Ox and Oy on a graph sheet. Mark the x-axis from -5 to 5 and the y-axis from -6 to 6. Mark the origin O.

(i) Draw on the same graph sheet indicating in each case the coordinates of all the vertices the square ABCD where A(1, 2), B(4, 2), C(4, 5) and D(1, 5) are the respective points.

(ii) Using the y-axis as the mirror line, draw the image $A_1B_1C_1D_1$ of square ABCD, where A → A_1, B → B_1, C → C_1 and D → D_1.

(iii) Draw the enlargement $A_2B_2C_2D_2$ of square ABCD with scale factor -1 from O, such that A → A_2, B → B_2, C → C_2 and D → D_2.

(iv) What single transformation maps $A_2B_2C_2D_2$ to $A_1B_1C_1D_1$?



(v) From the diagrams drawn, it can be seen that $A_2B_2C_2D_2$, a reflection of $A_1B_1C_1D_1$ in the x-axis, => the single transformation that maps $A_2B_2C_2D_2$ to $A_1B_1C_1D_1$ is the reflection in the x-axis or the line y = o.