Symmetry

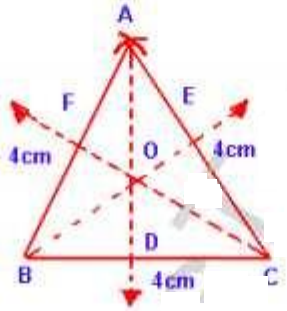
EXERCISE – 13.1

Q1. Construct an equilateral triangle each of whose side is 4cm. Draw all its lines of symmetry.

Sol. Steps of construction:

(i) Take a line segment BC = 4cm.

(ii) From B and C, draw two arcs each equal to 4cm, intersecting eachother at A.



(iii) Join AB and AC.

(iv) Now take midpoints D, E and F of BC, CA and AB respectively.

(v) Join AD, BE and CF.

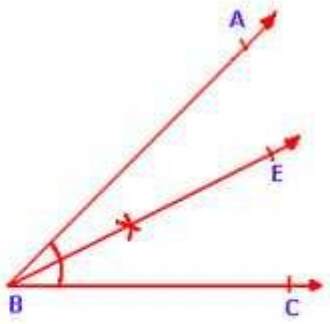
AD, BE and CF are its lines of symmetry.

Q2. Construct an angle of 60° and draw its axis of symmetry.

Sol. Steps of construction:

(i) Draw an angle $\angle ABC$ equal to 60°.

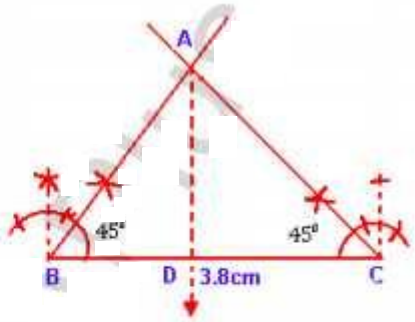
(ii) Draw bisector BE of $\angle ABC$.



∴ BE is the line of symmetry.

Q3. Construct an isosceles triangle with base = 3.8cm and one base angle = 45°. Draw its line of symmetry.

Sol. Steps of Construction:



(i) Draw a line segment BC = 3.8cm.

(ii) At B and C, draw angles of 45° each intersecting eachother at A.

ΔABC is the required isosceles Δ^le.

(iii) Take a midpoint D of BC.

(iv) Join AD.

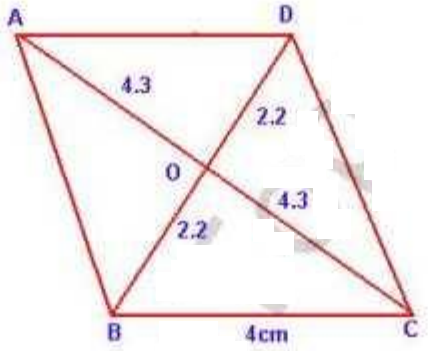
∴ AD is the line of symmetry.

Q4. Using ruler and compasses only, construct a parallelogram ABCD such that BC = 4cm, the diagonal AC = 8.6cm. and diagonal BD = 4.4cm. Measure the side AB. Mark the point of symmetry of the parallelogram as O.

Sol. Steps of construction:

(i) Take a line segment BC = 4cm.

(ii) At B and C, draw arcs equal to $\frac{8.6}{2} = 4.3$cm and $\frac{4.4}{2} = 2.2$cm intersecting eachother at O.



(iii) join BO and CO and produce them so that AC = 8.6cm and BD = 4.4cm.

(iv) join AB, DC and AD.

∴ ABCD is a parallelogram. It has no line of symmetry but O is the point of symmetry.

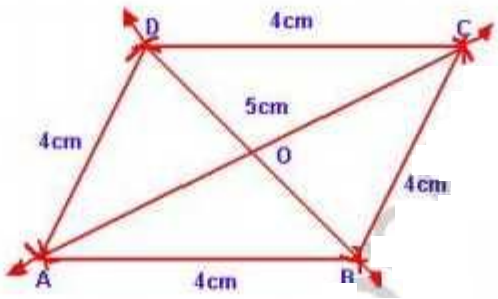
Q5. Without using the set square or protractor, construct a rhombus ABCD with sides of length 4cm and one diagonal AC of length 5cm. Draw its lines of symmetry. Also mark its point of symmetry.

Sol. Steps of construction:

(i) Take a line segment $AB = 4cm$.

(ii) With centre A and B, draw two arcs 5cm and 4cm respectively intersecting each other at C.

(iii) join AC and BC.



(iv) Again with centers A and C, draw two arcs each equal to 4cm intersecting each other at D.

(v) join AD and CD. ABCD is the required rhombus.

(vi) join BD.

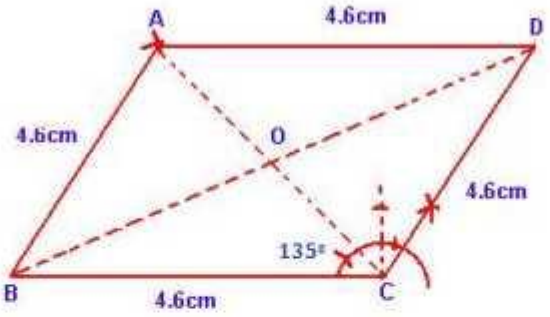
AC and BD are the lines of symmetry.

Q6. Construct a rhombus ABCD of side 4.6cm and $\angle BCD = 135°$, by using ruler and compasses only. Indicate the point of symmetry with the letter O.

Sol. Steps of construction:

(i) Draw a line segment $BC = 4.6cm$.

(ii) At C, draw a line making an angle of $135°$ and cutoff $CD = 4.6cm$.



(iii) with centre D and B, draw two arcs each equal to 4.6cm intersecting eachother at A.

(iv) join AD and AB. ABCD is a rhombus.

(v) join AC and BD intersecting eachother at O is the point of symmetry.

Q7. (i) construct a rectangle ABCD in which AD = 2.5cm and BD = 5.5cm. Measure CD.

(ii) Draw all lines of symmetry of the rectangle ABCD.

Sol. Steps of construction:

(i) Draw a line segment AD = 2.5cm.

(ii) At A, draw a ⊥ line and from D, cutoff DB = 5.5cm.

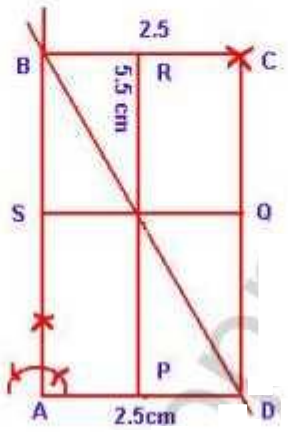
(iii) with centers B and D, draw two arcs equal to 2.5cm and equal to AB intersecting each other at C.

(iv) join DC and BC.

ABCD is a rectangle.

on measuring CD, it is equal to 4.9 cm.

(v) Take midpoints P, Q, R and S of sides AD, DC, CB and BA respectively and join them. These are the lines of symmetry.



Q8. Use a ruler and compass only in this question.

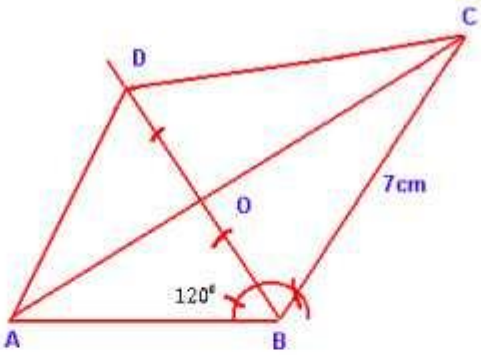
(i) Construct the quadrilateral ABCD in which AB = 5cm, BC = 7cm and $\angle ABC = 120^\circ$, given that AC is its only line of symmetry.

(ii) write down the geometrical name of the quadrilateral.

(iii) Measure and record the length of BD in cm.

Sol. Steps of construction:

(i) Take a line segment 5cm and at B, draw a ray making angle of 120°.



(ii) Cutoff BC = 7cm and join AC.

(iii) From B, draw a perpendicular to AC intersecting AC at O and produce it to D such that BO = OD.

(iv) join CD and AD.

∴ AC is the line of symmetry.

DC = BC = 7cm and AD = AB = 5cm.

(v) Hence the quadrilateral ABCD is a kite shaped.

(vi) on measuring the length of BD, it is 7.8cm.

Q9. Using ruler and compasses only, construct a regular hexagon of side 3cm. Draw all its lines of symmetry.

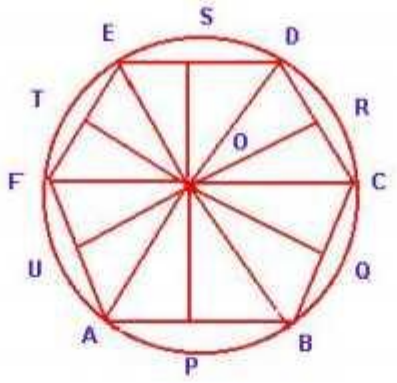
Sol. Steps of Construction:

(i) Draw a circle with radius 3cm and centre O.

(ii) Cutoff arcs from the circle each of 3cm at A, B, C, D, E and F.

(iii) join AB, BC, CD, DE, EF and FA.

ABCDEF is a regular hexagon.



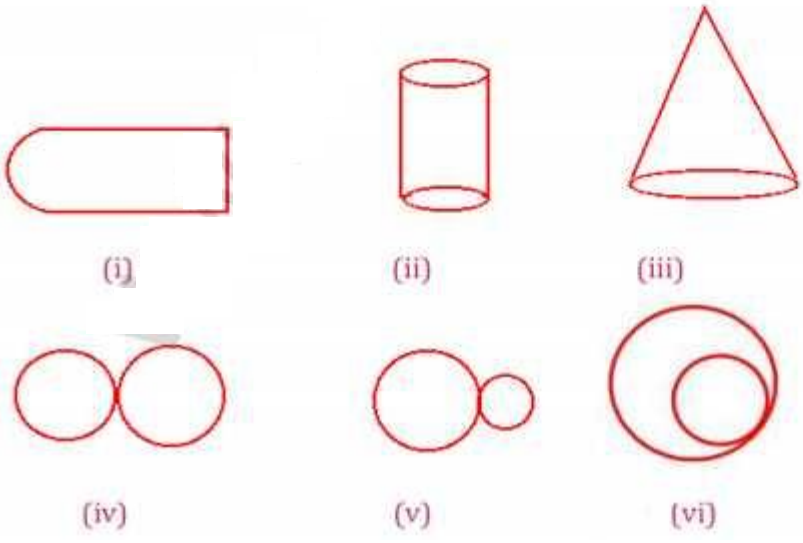
(iv) join AD, BE, CF.

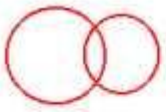
(v) Take the mid-points P, Q, R, S, T and U of the sides AB, BC, CD, DE, EF and FA respectively.

(vi) join PS, QT and RU.

So it has 6 lines of Symmetry.

Q10 How many lines of symmetry for the following figures have? copy these figures and in each case, draw line (or lines) of symmetry. which of these figures have the point of symmetry?

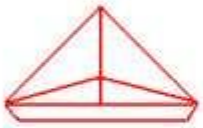




(vii)

(viii)

(ix)



(x)

(xi)

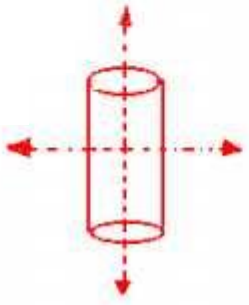
(xii)

Sol. (i) line of Symmetry = 1

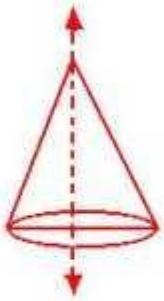
point of Symmetry = NO.

(ii) line of Symmetry = 2.

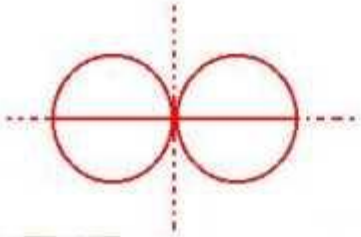
point of Symmetry = Yes.



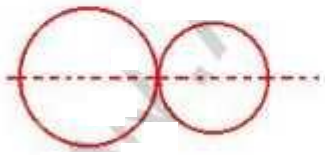
(iii) line of symmetry = 1
point of symmetry = NO.



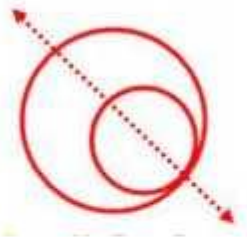
(iv) line of symmetry = 2.
point of symmetry = Yes.



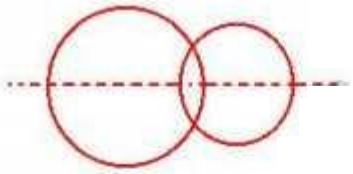
(v) line of symmetry = 0
point of symmetry = NO.



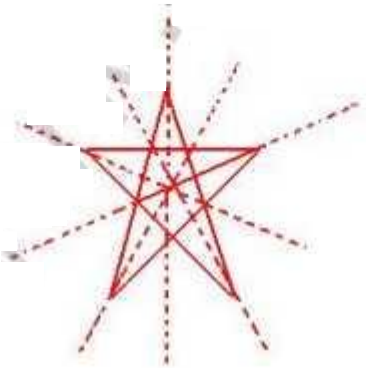
(Vi) line of Symmetry = 0
point of Symmetry = NO.



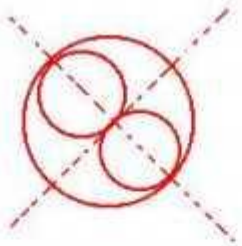
(Vii) line of Symmetry = 1
point of Symmetry = NO.



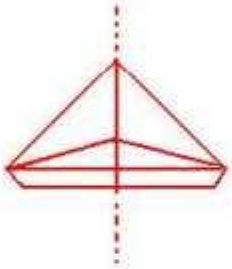
(Viii) line of Symmetry = 5
point of Symmetry = NO.



(ix) Line of symmetry = 2
point of symmetry = yes.

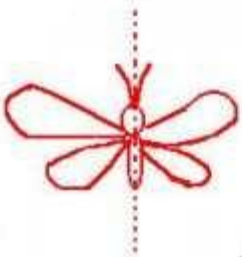


(x) Line of symmetry = 1
point of symmetry = NO.



(xi) Line of symmetry = 1
point of symmetry = NO.

(xii) Line of symmetry = 1
point of symmetry = NO.



Q11. Draw neat diagrams showing the line (or lines) of symmetry and give the specific name of the quadrilateral.

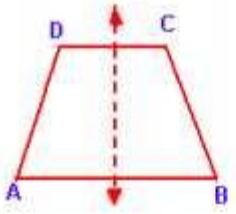
(i) Quadrilateral having only one line of symmetry. How many such quadrilaterals are there?

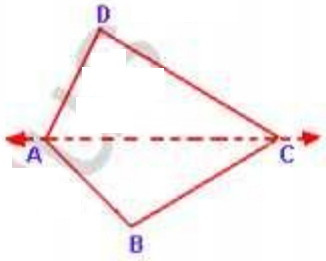
(ii) Quadrilateral having its diagonals as the only lines of symmetry.

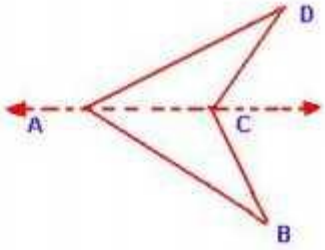
(iii) Quadrilaterals having two lines of symmetry other than diagonals.

(iv) Quadrilaterals having more than two lines of symmetry.

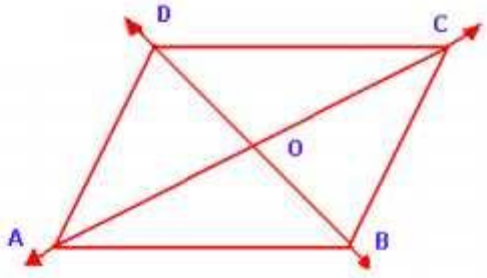
Sol. (i) An isosceles trapezium, a kite and an arrow have one line of symmetry as shown below:



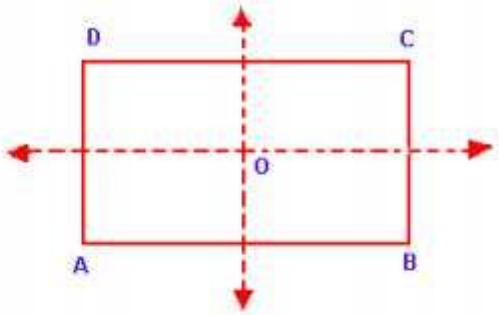




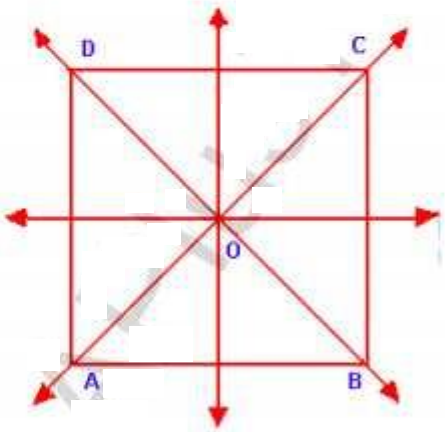
(ii) A rhombus has two diagonals as the lines of symmetry.



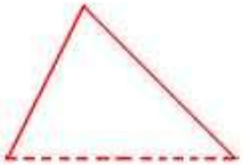
(iii) A rectangle has two lines of symmetry which are other than its diagonals.



(iv) A square has four lines of symmetry.



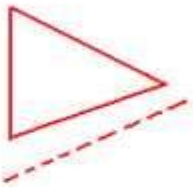
Q12. each ~~of~~ of the following figures shows half of a symmetrical figure about a line of symmetry indicated as a dotted line. Copy these figures in your note book and complete them:



(i)

(ii)

(iii)

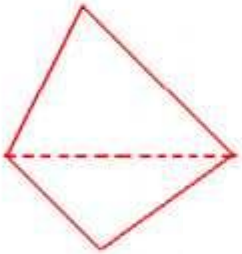


(iv)

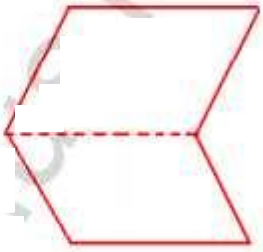
(v)

(vi)

Sol.

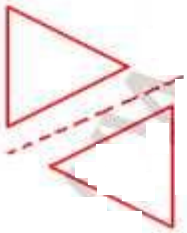


(i)

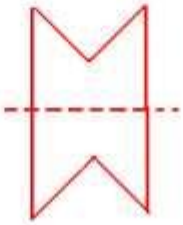


(ii)

(iii)



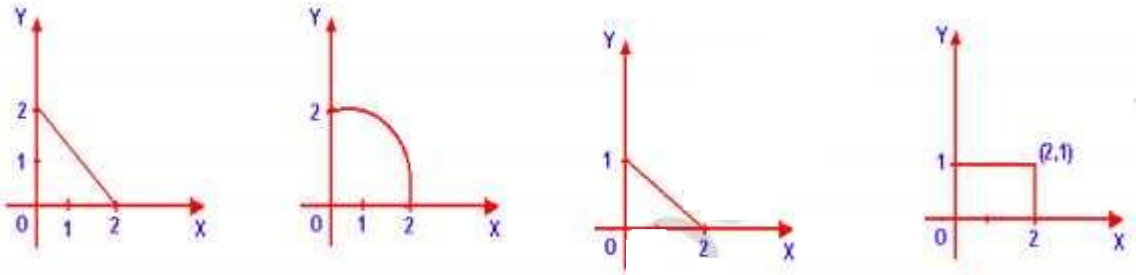
(iv)



(v)

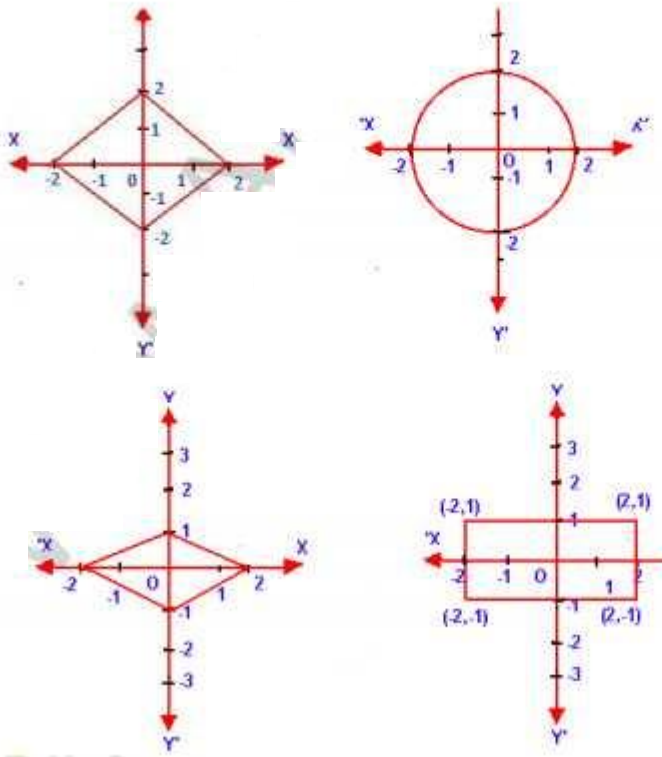
(vi)

Q13. part of a geometrical figure is given in each of the diagram below. complete the figure so that both x-axis and y-axis are lines of symmetry of the completed fig.

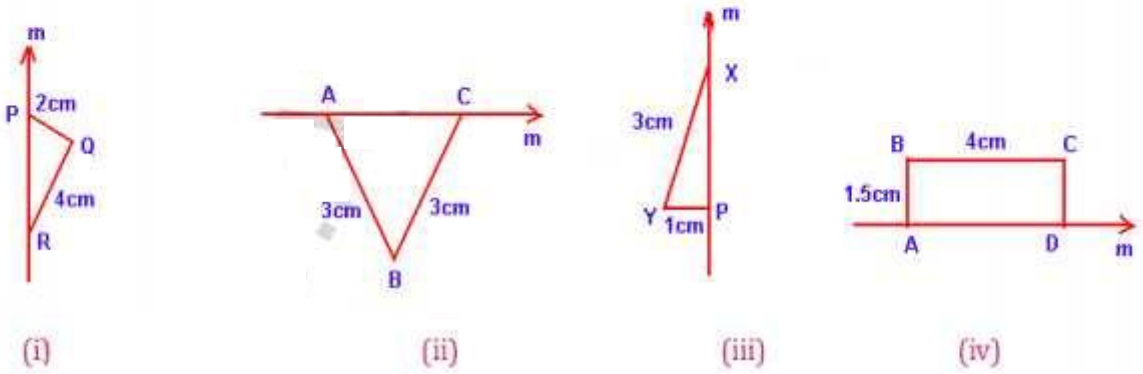


Give the geometrical name of the completed figure.

Sol.

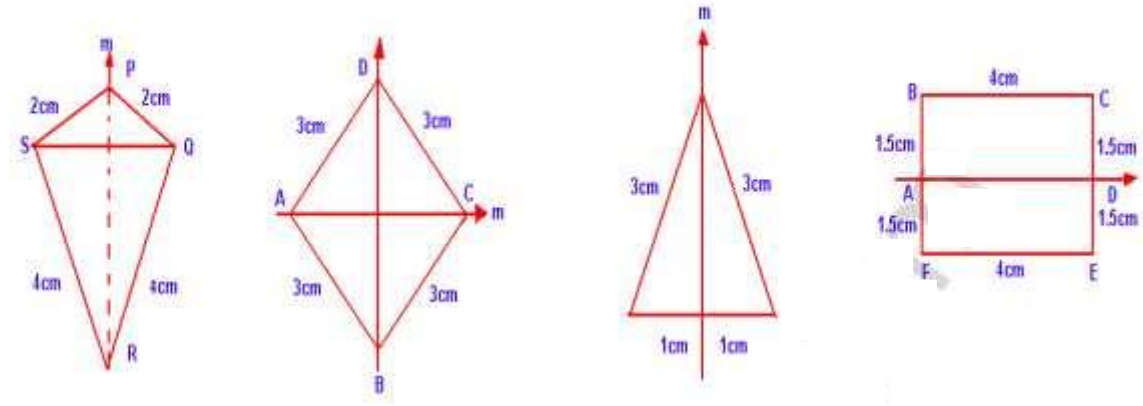


Q14. part of geometrical fig. is given in each of the diagrams below. complete the figures. Recognizable freehand sketches would be awarded full marks. Give the geometrical name of the completed fig.



(i) (ii) (iii) (iv)

Sol.



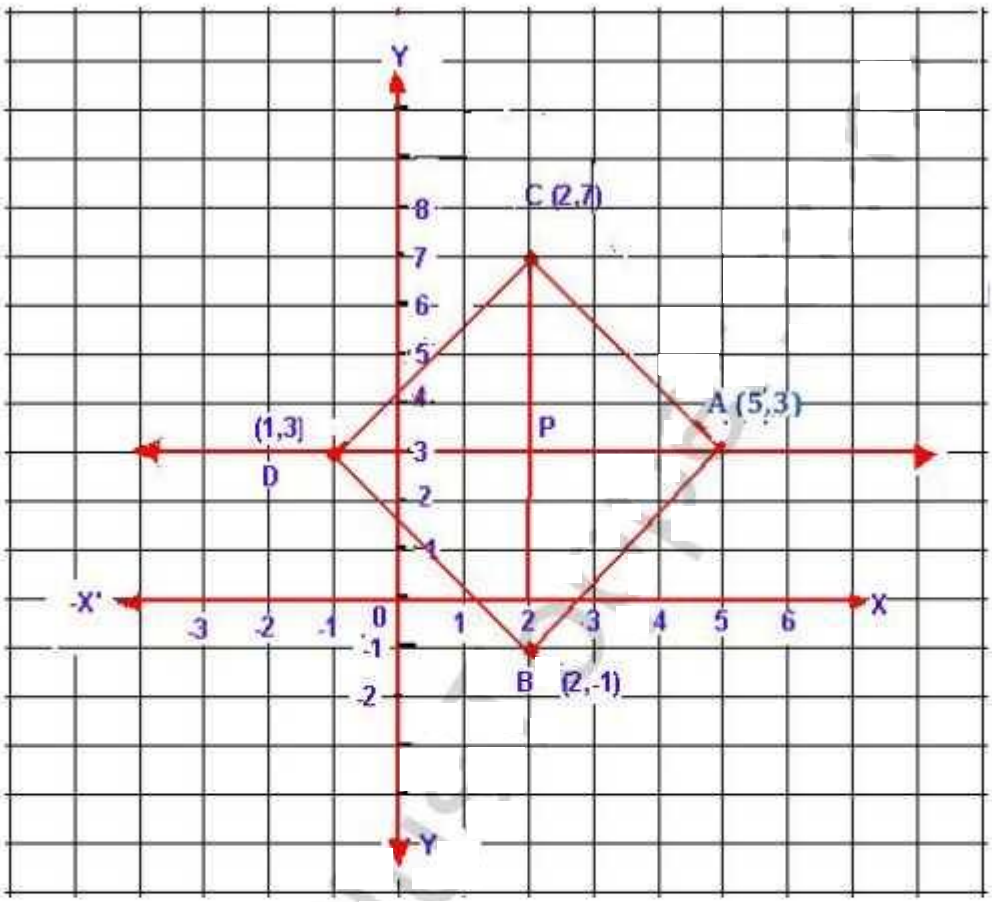
Q15. Use graph paper for this question. Use 1cm = 1unit on both axes. Plot the points A(5,3), B(2,-1) and C(2,7).

(i) Draw the line of symmetry of ΔABC.

(ii) Mark the point D if the line (l) and line BC are both lines of symmetry of the quadrilateral ABCD. Writes the co-ordinates of the point D.

(iii) Assign the special name to the quadrilateral ABCD.

Sol.

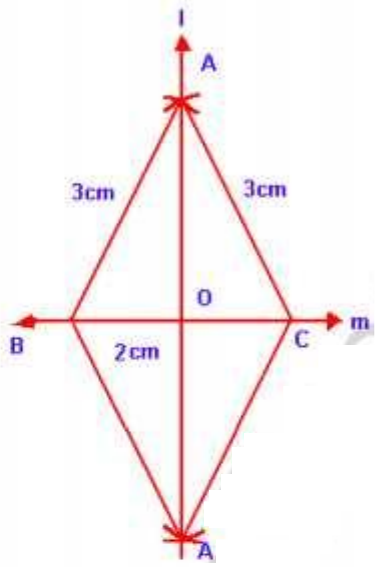


plot the points A(5,3), B(2,-1) and C(2,7) on the graph and join them which form an isosceles $\triangle ABC$. P is the midpoint of BC. join AP and produce it. It is the line of symmetry.

Taking AD and BC as the lines of symmetry, we have point D(-1,3) and join BD and CD.

Now fig. ABCD is a rhombus.

Q16 Construct a ΔABC, in which $AB = AC = 3cm$ and $BC = 2cm$. Using a ruler and compasses only, draw the reflection $A'BC$ of ΔABC in BC. Draw line of symmetry of the figure $ABA'C$.



Sol. Steps of construction:

(i) Take a line segment $BC = 2cm$.

(ii) At B and C, draw two arcs each of 3cm as radius intersecting each other at A.

(iii) join AB and AC.

(iv) Take a point A' such that $AO = OA'$

(v) join $A'B$ and $A'C$ then $\Delta A'BC$ is reflection of ΔABC.

(vi) join AA'.

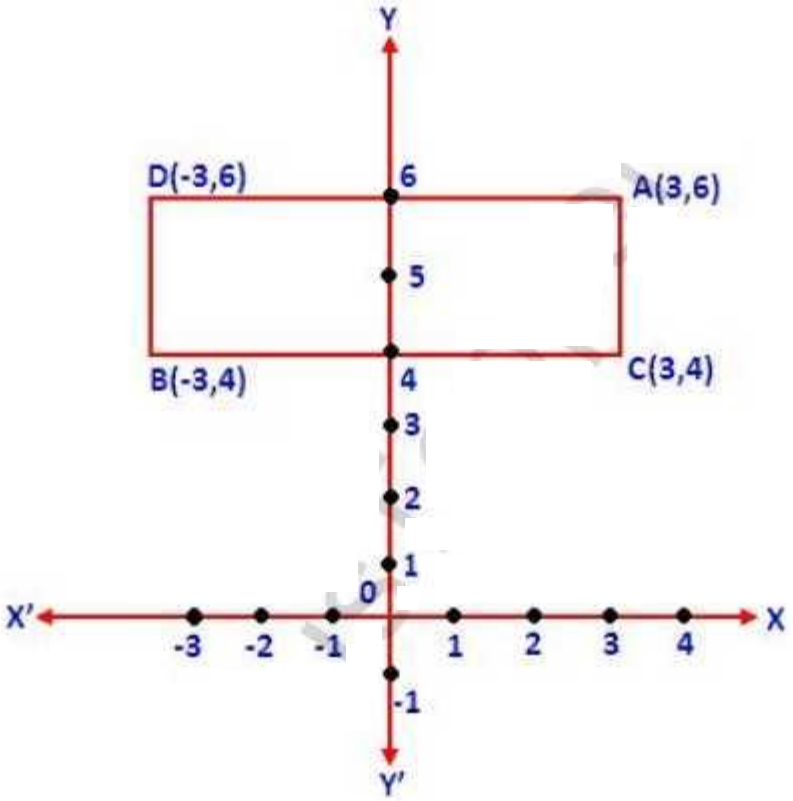
Now $AA'(l)$ and $BC(m)$ are the lines of symmetry as shown in the fig.

Q17. The Y-axis is a line of symmetry for the fig. ABCD where A, B have co-ordinates (3,6), (-3,4) respectively.

(i) Find the co-ordinates of C and D.

(ii) Name the figure ACBD and find its area.

Sol.



(i) plot points A(3,6) and B(-3,4) on the graph. Taking Y-axis a line of symmetry, plot the points D(-3,6) and C(3,4) and join AD, DB, BC and CA.

(ii) ABCD is a rectangle and its area is 12 square units.

Q18. Use graph paper for this question. Take 1cm = 1 unit on both axes.

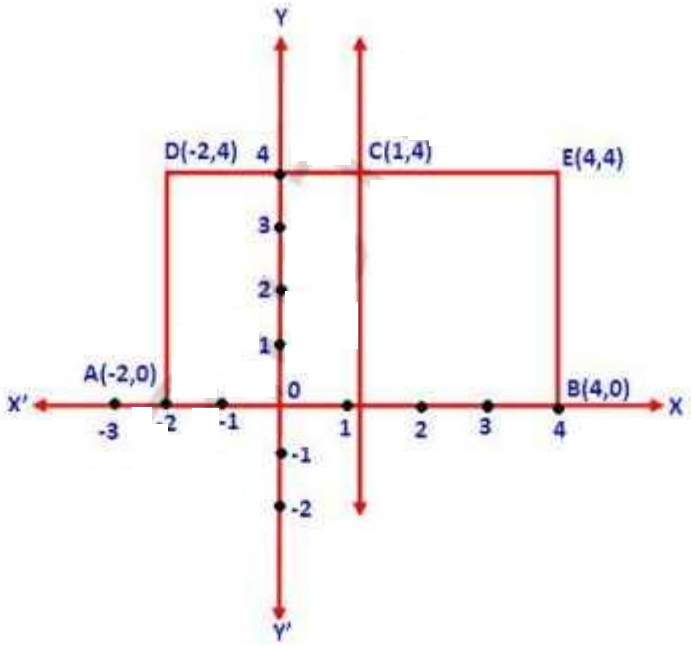
(i) plot the points A(-2,0), B(4,0) and C(1,4) on the graph.

(ii) plot D(-2,4) and E(4,4). give specific name of quadrilateral ABED.

(iii) Draw lines of symmetry of the quadrilateral ABED.

(iv) Does the ΔABC and quadrilateral ABED have a common line of symmetry?

Sol.



(i) plot the points A(-2,0), B(4,0), C(1,4).

(ii) plot the points D(-2,4), E(4,4).

(iii) The quad. ABED is a rectangle.

(iv) join AC and BC.

Yes, ΔABC and rectangle ABED has the same symmetry which is 'l'.

Q19. State whether the following statements are true or ~~the~~ false :

(i) A right-angled Δ^{le} can have at the most one line of symmetry.

(ii) An isosceles triangle with morethan one line of symmetry must be an equilateral triangle.

(iii) A pentagon with one line of symmetry can be drawn.

(iv) A pentagon with morethan one lines of symmetry must be regular.

(v) A hexagon with one line of symmetry can be drawn.

(vi) A hexagon with two lines of symmetry can be drawn.

(vii) A hexagon with more than two lines of symmetry must be regular.

Sol.

(i) True

(ii) True

(iii) True

(iv) True

(v) True

(vi) True

(vii) True.