

COORDINATE GEOMETRY

In this unit the students will be able to:

- Use conventions for coordinates in the Cartesian plane for the derivation of distance formula.
- Represent and identify collinear and non collinear points.
- Find distance between two points in the plane.
- Derive mid-point formula and calculate mid-point of a line segment.
- Apply distance and mid-point formulas to solve real life situations.

Coordinate geometry plays a vital role in our daily life. The adjoining figure shows a lamp post which is equidistant from two homes, so that both the homes may get light from it equally. To erect the lamp post at this point, an idea from coordinate geometry is taken. Coordinate geometry helps us in analyzing characteristics and properties of two-dimensional geometrical shapes and develop mathematical arguments about geometrical relationships.





Distance Between Points on a Coordinate Line

We use the concept of absolute value to define the distance between given points on a coordinate line.

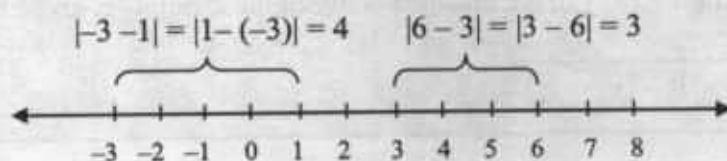


Fig. (i)

We note that the distance between the points with coordinates 3 and 6, shown in above fig.(i) equals 3 units. This distance is the difference obtained by subtracting the smaller (left most) coordinate from the larger (right most) coordinate ($6 - 3 = 3$).

If we use absolute values, (since $|6 - 3| = |3 - 6| = 3$), then order of subtraction does not matter.

Let a and b be the coordinates of two points A and B respectively, on a coordinate line. The distance between A and B, denoted by $d(A, B)$ is defined by

$$d(A, B) = AB = |b - a|$$

The number $d(A, B)$ is the length of the line AB,

and

$$d(A, B) = d(B, A)$$

$$|b - a| = |a - b|$$

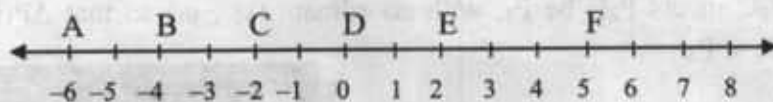
So, we have

$$AB = d(A, B) = d(B, A) = BA$$

Hence, the formula $d(A, B) = |b - a|$ is true regardless the sign of a and b .

Example 1:

A, B, C, D, E and F have coordinates $-6, -4, -2, 0, 2$ and 5 respectively on a coordinate line as shown below.



- Find (a) $d(A, B)$ (b) $d(A, C)$ (c) $d(B, E)$
 (d) $d(D, F)$ (e) $d(A, F)$

Solution: By definition we know that

- (a) $d(A, B) = |b - a|$, a and b are the co-ordinates of points A and B respectively.

$$a = -6, b = -4$$

$$d(A, B) = AB = |-4 - (-6)| = |-4 + 6| = 2$$

Similarly,

- (b) $d(A, C) = AC = |-2 - (-6)| = |-2 + 6| = 4$
 (c) $d(B, E) = BE = |2 - (-4)| = |2 + 4| = 6$
 (d) $d(D, F) = DF = |5 - 0| = |5| = 5$
 (e) $d(A, F) = AF = |5 - (-6)| = |6 + 5| = 11$

Check Point

Can the distance be negative between any two points?

The Distance Formula

Given the two points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$, the distance between these points is given by the formula:

$$d(P_1, P_2) = P_1P_2 = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Proof: If $x_1 \neq x_2$ and $y_1 \neq y_2$, then plot two points P_1 and P_2 with coordinates (x_1, y_1) and (x_2, y_2) respectively as illustrated in figure (ii).

Key Fact

$$P_1P_2 = d(P_1, P_2)$$

$$P_1P_2^2 = (P_1P_2)^2$$

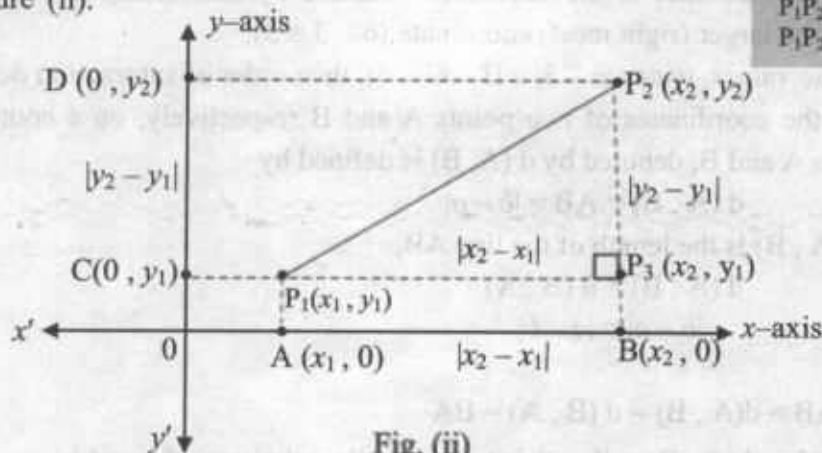


Fig. (ii)

In the above figure P_1A and P_2B are perpendiculars drawn from two points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ on x -axis, and P_1C and P_2D are perpendiculars on y -axis.

The coordinates of the points A, B, C and D are also shown in figure accordingly.

Let the point where P_1C meets P_2B be P_3 , with coordinate (x_2, y_1) so that $\Delta P_1P_2P_3$ is a right triangle with right angle at P_3 .

From figure, we have

$$d(A, B) = AB = P_1P_3 = |x_2 - x_1|$$

$$\text{and } d(C, D) = CD = d(P_2, P_3) = P_2P_3 = |y_2 - y_1|$$

We next use the Pythagoras Theorem in right triangle $P_1P_2P_3$

$$[d(P_1, P_2)]^2 = [d(P_1, P_3)]^2 + [d(P_2, P_3)]^2$$

or

$$P_1P_2^2 = P_1P_3^2 + P_2P_3^2$$

$$P_1P_2^2 = |x_2 - x_1|^2 + |y_2 - y_1|^2$$

$$P_1P_2 = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\text{So } d(P_1P_2) = P_1P_2 = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Key Fact

- In general $(x, y) \neq (y, x)$ because (x, y) is an ordered pair and order of the elements in an ordered pair cannot be changed.
- $(x, y) = (y, x)$ if and only if $x = y$.
- If $(x, y) = (2, 3)$, it means $x = 2$ and $y = 3$ and $(2, 3) \neq (3, 2)$.

Example 2:

Find the distance between the two points A (-1, 3) and B (4, 15).

Solution:

By distance formula distance between two points with coordinates (x_1, y_1) and (x_2, y_2) is :

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Let (-1, 3) be denoted by (x_1, y_1) i.e. $x_1 = -1$, $y_1 = 3$ and (4, 15) be denoted by (x_2, y_2)
i.e. $x_2 = 4$, $y_2 = 15$

Now put them into the distance formula

$$AB = d = \sqrt{(4 - (-1))^2 + (15 - 3)^2}$$

$$d = \sqrt{(4 + 1)^2 + (12)^2}$$

$$d = \sqrt{5^2 + 12^2}$$

$$d = \sqrt{25 + 144}$$

$$d = \sqrt{169}$$

$$d = 13$$

Check Point

Find the distance between A $(\frac{1}{2}, -\frac{3}{2})$ and $(\frac{9}{2}, -\frac{8}{2})$

History & Mystery

Descartes was creative in many fields. But he is best known for his contribution to Mathematics. He had a habit of lying in bed for extended periods. One day, while watching a fly crawling on the ceiling, he set about trying to describe the path of the fly in mathematical language. Thus, the study of lines and curves was born.

Collinear and Non-Collinear Point

A set of points that lie on a same straight line are said to be collinear.

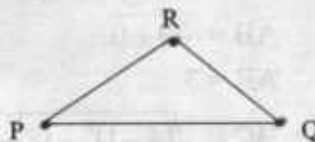
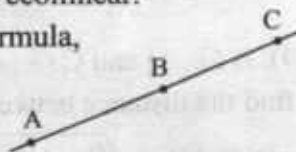
If three points A, B and C are collinear then, by distance formula, we have:

$$d(A, C) = d(A, B) + d(B, C)$$

or $AC = AB + BC$

When three or more points do not lie on the same straight line, they are said to be non-collinear points.

In the figure, points P, Q and R are non-collinear



Application of Distance Formula

Example 3:

Prove that A (3, 2), B (4, 4) and C (5, 6) are collinear points.

Solution:

In first step we find the distance between them.

Memory Play

Try to find the coordinates of
a) Islamabad
b) Pakistan
c) your native village

By **Distance Formula**, distance between two points (x_1, y_1) and (x_2, y_2) is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d(A, B) = AB = \sqrt{(4-3)^2 + (4-2)^2}$$

$$AB = \sqrt{1^2 + 2^2} = \sqrt{1+4}$$

$$AB = \sqrt{5} \dots\dots\dots (i)$$

$$d(B, C) = BC = \sqrt{(5-4)^2 + (6-4)^2}$$

$$BC = \sqrt{1^2 + 2^2} = \sqrt{1+4}$$

$$BC = \sqrt{5} \dots\dots\dots (ii)$$

$$d(A, C) = AC = \sqrt{(5-3)^2 + (6-2)^2}$$

$$AC = \sqrt{2^2 + 4^2}$$

$$= \sqrt{4+16} = \sqrt{20}$$

$$= 2\sqrt{5} \dots\dots\dots (iii)$$

From (i), (ii) and (iii), we find that

$$AC = AB + BC$$

$$2\sqrt{5} = \sqrt{5} + \sqrt{5}$$

$$2\sqrt{5} = 2\sqrt{5}$$

Hence, the given points are collinear.

Example 4:

Prove that the points $(3, 4)$, $(3, 1)$ and $(8, 4)$ are the vertices of a right triangle.

Solution:

Suppose $A(3, 4)$, $B(3, 1)$ and $C(8, 4)$ are the vertices of a triangle.

In first step we find the distance between them.

$$d(A, B) = AB = \sqrt{(1-4)^2 + (3-3)^2}$$

$$= \sqrt{(-3)^2 + 0^2}$$

$$AB = \sqrt{9+0}$$

$$AB = 3$$

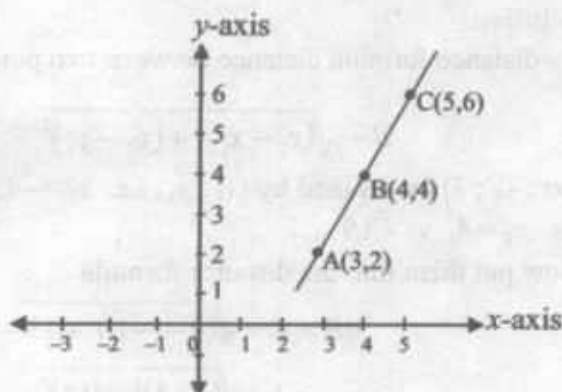
$$d(B, C) = BC = \sqrt{(4-1)^2 + (8-3)^2}$$

$$= \sqrt{3^2 + 5^2}$$

$$= \sqrt{9+25}$$

$$BC = \sqrt{34}$$

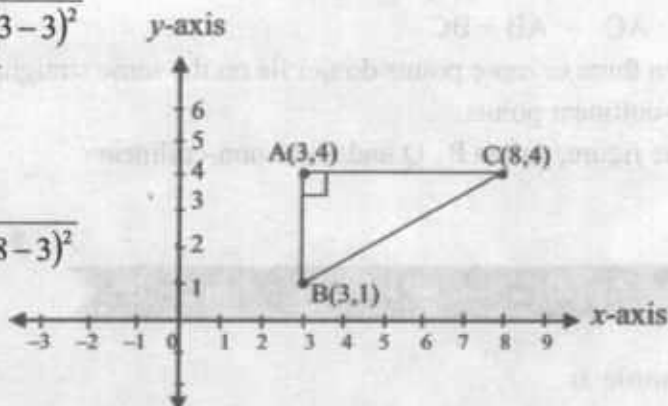
$$d(A, C) = AC = \sqrt{(8-3)^2 + (4-4)^2}$$



Key Fact



- (i) Line segment AB is denoted by $\overline{AB}$
- (ii) Length of $\overline{AB}$ is denoted by AB or $m\overline{AB}$ or $|\overline{AB}|$.
- (iii) Distance between points A and B is denoted by AB or $d(A, B)$ or $m\overline{AB}$ or $|\overline{AB}|$.



$$AC = \sqrt{25+0} = 5$$

In right triangle we know that the greatest length is always the hypotenuse. So, BC is the hypotenuse. By Pythagoras Theorem,

$$BC^2 = AB^2 + AC^2$$

$$(\sqrt{34})^2 = 5^2 + 3^2$$

$$34 = 25 + 9$$

$$34 = 34$$

Hence; A, B and C form a right triangle.

Check Point

Prove by distance formula that the points $(-2, 0)$, $(4, 0)$, $(4, 2)$ and $(-2, 2)$ are the vertices of a rectangle.

EXERCISE 7.1

- Find the distance between each pair of points.

(i) $(-2, 1)$ and $(1, 5)$	(ii) $(1, 1)$ and $(7, 9)$
(iii) $(0, -5)$ and $(-2, 1)$	(iv) $(0, -5)$ and $(10, 5)$
(v) $(4, -1)$ and $(2, 0)$	(vi) $(-3, 1)$ and $(-2, -3)$
(vii) $\left(\frac{1}{2}, 2\right)$ and $(-2, 1)$	(viii) $\left(\frac{7}{2}, 11\right)$ and $\left(13, \frac{17}{2}\right)$
(ix) $\left(-\frac{9}{4}, -\frac{7}{3}\right)$ and $\left(-\frac{3}{2}, -\frac{5}{4}\right)$	(x) $\left(2\frac{1}{2}, 5\frac{1}{4}\right)$ and $(5, -1)$
- Check by distance formula whether these points are collinear or not.

(i) $(0, 1)$, $(2, 3)$ and $(3, 4)$
(ii) $(-5, -4)$, $(1, 0)$ and $(6, 7)$
(iii) $(0, -5)$, $(3, 7)$ and $(5, 15)$
(iv) $(6, 3)$, $(14, 7)$ and $(-6, -3)$
(v) $(0, 15)$, $(2, 9)$, and $(7, -6)$
(vi) $(1, -2)$, $(7, 8)$ and $(-2, -7)$
- Check whether the following points are the vertices of

(a) an equilateral triangle,	(b) an isosceles triangle,
(c) a right triangle,	(d) a scalene triangle.

(i) $(2, 3)$, $(5, 3)$ and $(2, 1)$	(ii) $(0, 0)$, $(1, \sqrt{3})$ and $(2, 0)$
(iii) $(0, 1)$, $(8, 4)$ and $(0, 8)$	(iv) $(-3, -5)$, $(3, -3)$ and $(0, 6)$
(v) $(-1, -1)$, $(-1, 5)$ and $(4, 2)$	(vi) $(1, 2)$, $(7, 2)$ and $(7, 8)$

Also find the perimeter of triangle in each case.

4. Show that A $(-4, 2)$, B $(1, 4)$, C $(3, -1)$ and D $(-2, -3)$ are the vertices of a square.
5. Show that A $(-4, -1)$, B $(0, -2)$, C $(6, 1)$ and D $(2, 2)$ are the vertices of a parallelogram.
6. Show that A $(1, 2)$, B $(7, 2)$, C $(7, 8)$ and D $(1, 8)$ are the vertices of a rectangle. Prove that its diagonals are also equal in length.
7. Show that A $(4, 2)$, B $(7, 2)$, C $(7, 5)$ and D $(4, 5)$ are the vertices of a square. Also show that the length of its diagonals is same.
8. Are A $(-6, 2)$, B $(1, 2)$, C $(1, 5)$ and D $(-6, 5)$ the vertices of a rectangle? Also plot them.
9. Prove that the points A $(-3, 0)$, B $(3, 0)$, C $(6, 4)$ and D $(0, 4)$ are the vertices of a parallelogram.
10. Show that A $(2, -1)$, B $(8, -1)$, C $(8, 3)$ and D $(2, 3)$ are the vertices of a rectangle and prove that $\triangle ABC$ and $\triangle ABD$ form right triangles.

Mid-Point of Two given Points in a Coordinate Plane

Suppose, we have two points $(2, 4)$ and $(6, 10)$ and we want to find the distance between them. First, we plot the points on the graph and join them. Then we can draw the lines that form a right triangle by using these points as two of the corners.

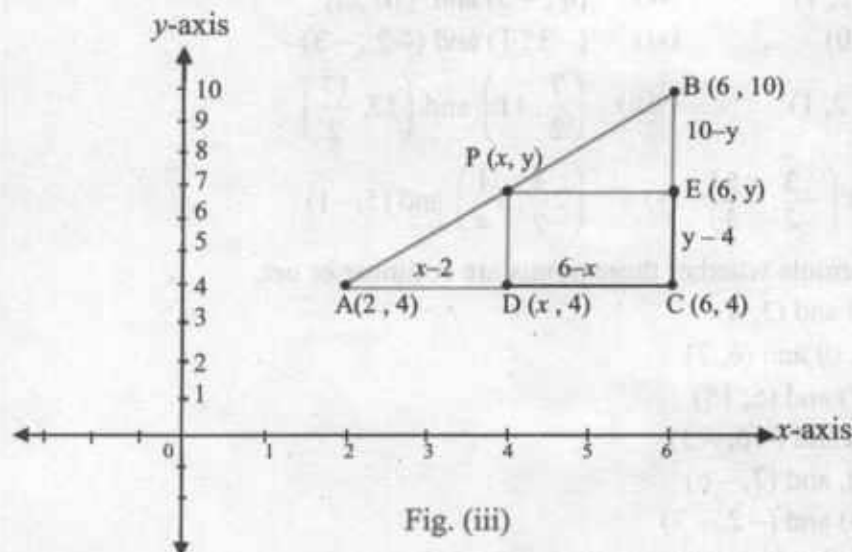


Fig. (iii)

In the diagram, $\triangle ABC$ is drawn by drawing AC parallel to the x -axis and BC parallel to the y -axis. The coordinates of C are $(6, 4)$, where two lines AC and BC intersect.

Let $P(x, y)$ be the mid point of AB. Draw PD parallel to the y -axis and PE parallel to the x -axis. Then the coordinate of D and E are $(x, 4)$ and $(6, y)$ and, $\triangle APD$ and $\triangle PBE$ are congruent by (ASA).

$$\begin{aligned}
 \text{We have } AD = PE & \quad , \quad PD = BE \\
 x - 2 = 6 - x & \quad , \quad y - 4 = 10 - y \\
 2x = 8 & \quad , \quad 2y = 14 \\
 x = 4 & \quad , \quad y = 7
 \end{aligned}$$

The mid point of AB is P (4, 7).

We can also find the mid point of A (2, 4) and B (6, 10) in this way

$$\begin{aligned}
 P \left(\frac{2+6}{2}, \frac{4+10}{2} \right) \\
 = P (4, 7)
 \end{aligned}$$

Mid-Point Formula

In the above figure (iii) if we take A (x_1 , y_1) instead of A (2, 4) and B (x_2 , y_2) instead of B (6, 10), then we have:

$$\begin{aligned}
 x - 2 = x - x_1 \text{ and } 6 - x = x_2 - x \\
 \text{Similarly, } y - 4 = y - y_1 \text{ and } 10 - y = y_2 - y
 \end{aligned}$$

We have already proved that

$$\begin{aligned}
 AD = PE & \quad , \quad PD = BE \\
 x - x_1 = x_2 - x & \quad , \quad y - y_1 = y_2 - y \\
 2x = x_1 + x_2 & \quad , \quad 2y = y_1 + y_2 \\
 x = \frac{x_1 + x_2}{2} & \quad , \quad y = \frac{y_1 + y_2}{2}
 \end{aligned}$$

To apply the mid point formula **remember** that:

the x -coordinate of the midpoint = the average of the x -coordinates
and the y -coordinate of the midpoint = the average of the y -coordinates.

The mid-point P of the line segment from $P_1 (x_1, y_1)$ to $P_2 (x_2, y_2)$ is

$$P \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Example 5:

By using mid point formula, prove that the diagonals of a parallelogram with vertices (1, 1), (2, 4), (6, 1) and (7, 4) bisect each other.

Solution:

First we plot these vertices on a Cartesian plane as shown in the fig.(iv). In parallelogram ABCD, AC and BD are its diagonals.

Let both the diagonals intersect each other at point E(x , y).
By mid point formula, mid point of AC has the coordinates as

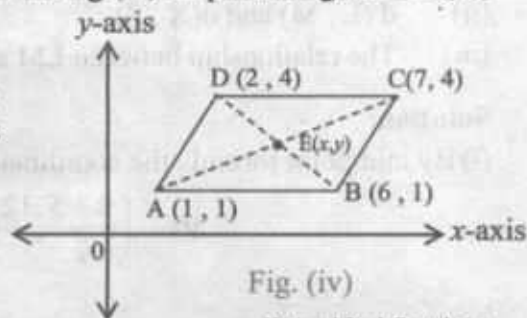


Fig. (iv)

$$\left(\frac{7+1}{2}, \frac{4+1}{2} \right)$$

$$= (4, 2.5) \dots\dots (i)$$

and the coordinates of the mid point of diagonal BD is $\left(\frac{2+6}{2}, \frac{4+1}{2} \right)$

$$= (4, 2.5) \dots\dots (ii)$$

From (i) and (ii) both the diagonals have the same mid point, so they bisect each other at point E(4, 2.5).

Example 6:

If (1, 4) is the midpoint of the line segment joining (6, b) and (a, 2). Find a and b.

Solution:

By mid point formula, mid point of the line segment with end points (x_1, y_1) and (x_2, y_2) is

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right).$$

So, mid point of the line segment joining the end points (6, b) and (a, 2) is

$$\left(\frac{6+a}{2}, \frac{b+2}{2} \right).$$

By using the given condition, we have

$$\left(\frac{6+a}{2}, \frac{b+2}{2} \right) = (1, 4)$$

By the definition of equal ordered pairs,

$$\frac{6+a}{2} = 1 \quad \text{and} \quad \frac{b+2}{2} = 4$$

$$6+a = 2 \quad \text{and} \quad b+2 = 8$$

$$a = 2 - 6 \quad \text{and} \quad b = 8 - 2$$

$$a = -4 \quad \text{and} \quad b = 6$$

$$\text{Hence,} \quad a = -4 \quad \text{and} \quad b = 6$$

Example 7:

Use $\triangle XYZ$ in the adjoining figure to find the following.

(i) Midpoint L and M of XY and YZ respectively

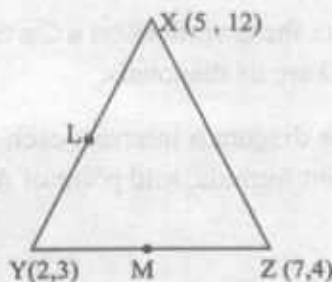
(ii) d(L, M) and d(X, Z)

(iii) The relationship between LM and XZ.

Solution:

(i) By mid point formula the coordinates of L

$$\text{are} \quad \left(\frac{2+5}{2}, \frac{12+3}{2} \right) = \left(\frac{7}{2}, \frac{15}{2} \right)$$



Coordinates of M are $\left(\frac{2+7}{2}, \frac{3+4}{2}\right) = \left(\frac{9}{2}, \frac{7}{2}\right)$

$$\begin{aligned} \text{(ii) } d(L, M) &= \sqrt{\left(\frac{7}{2} - \frac{9}{2}\right)^2 + \left(\frac{15}{2} - \frac{7}{2}\right)^2} \\ &= \sqrt{\left(\frac{-2}{2}\right)^2 + \left(\frac{8}{2}\right)^2} = \sqrt{1+16} = \sqrt{17} \end{aligned}$$

$$\begin{aligned} \text{Now, } d(X, Z) &= \sqrt{(12-4)^2 + (5-7)^2} \\ &= \sqrt{8^2 + (-2)^2} \\ &= \sqrt{64+4} = \sqrt{68} = 2\sqrt{17} \end{aligned}$$

(iii) From part (ii), we observe that

$$d(X, Z) = 2 \text{ times } d(L, M)$$

$$\text{Or } XZ = 2 LM$$

$$\text{Or } LM = \frac{XZ}{2}$$

Hence,

Length of the line which is obtained by joining the mid points of any two sides of a triangle is half of the length of third side.

EXERCISE 7.2

1. Find the mid point of the line segment joining the given points.

(i) $(2, 5), (6, 9)$

(ii) $(-1, 0), (2, 2)$

(iii) $(1.4, -1.5), (2.6, 3.5)$

2. Look at the quadrilateral ABCD in the adjoining figure

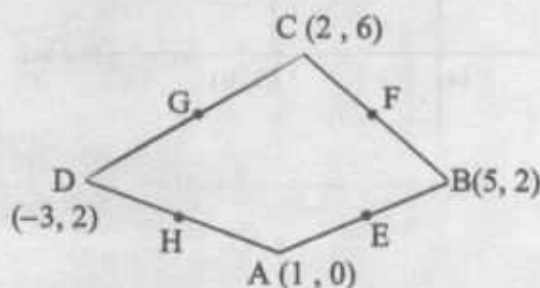
If E, F, G and H are the mid points of its sides as shown in the figure, then

(i) Find the coordinates of E, F, G and H

(ii) Draw line segments EF, FG, GH and HE by joining the mid points of its sides.

(iii) Find the distance of EF, FG, GH and HE

(iv) Guess the type of quadrilateral EFGH.



3. Check by using the mid point formula whether the diagonals of trapezium PQRS with vertices at $P(1, 0)$, $Q(6, 0)$, $R(7, 4)$, $S(-1, 4)$ bisect each other or not.

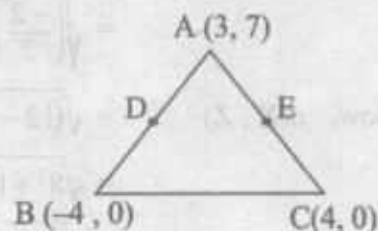
4. If vertices of a rhombus are $A(-3, -1)$, $B(0, 0)$, $C(1, 3)$ and $D(-2, 2)$

Show that its diagonals bisect each other.

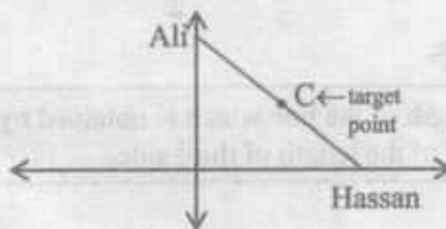
Also find the length of each diagonal.

5. Look at the $\triangle ABC$ in the adjoining figure.

- Find the coordinates of the mid points D and E of AB and AC respectively.
- Find $d(D, E)$ and $d(B, C)$.
- Find half of $d(B, C)$.
- Compare the length of DE and BC and draw conclusion.



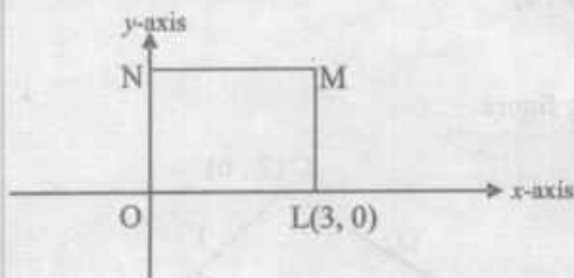
6. Hassan and Ali participated in a race competition. They both have to start running from different points on coordinate axes at a distance of 6 units from origin but they must reach at the same target point C, after covering an equal distance. If Hassan starting point is on x-axis and Ali's starting point is on y-axis as shown in the figure, then find the coordinates of the:



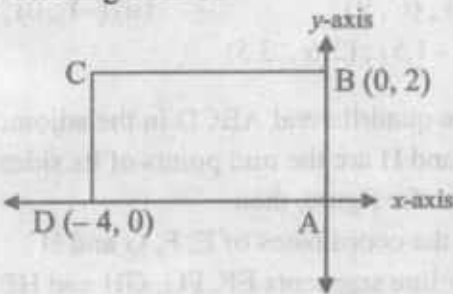
- starting points of Hassan and Ali
- target point C

7. Label the missing coordinates of the vertices of the following figures.

- (i) Square OLMN



- (ii) Rectangle ABCD



KEY POINTS

- The distance between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is given by
$$d(A, B) = AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
- Distance formula is used for finding the
 - (a) distance between any two points on a line,
 - (b) length of the sides of geometrical figures obtained by joining three or more non-collinear points. e.g. triangles and quadrilaterals (square, rectangle, parallelogram, rhombus, trapezium, kite etc.).
- All those points, which lie on a same straight line, are called collinear points.
- The points which do not lie on a same straight line are called non-collinear points. e.g. vertices of a triangle and of a quadrilateral are non-collinear points.
- The mid-point of a line segment with ends $A(x_1, y_1)$ and $B(x_2, y_2)$ is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$
- The mid point of the diagonals of a quadrilateral can be found by using the mid point formula.
- If two lines bisect each other then, their mid point will be same.

MISCELLANEOUS EXERCISE 7

1. Encircle the correct option in the following.

- (i) If the coordinates of four points are $A\left(\frac{3}{2}, -\frac{7}{4}\right)$, $B\left(3, \frac{3}{4}\right)$, $C(3, -2)$ and $D\left(1, \frac{1}{2}\right)$, the relationship between the distance AB and CD is:
- (a) $AB > CD$ (b) $AB < CD$ (c) $AB = CD$ (d) $AB = \frac{1}{2} CD$
- (ii) If a and b are any two points on a coordinate line (number line), then its mid point will be:
- (a) $\frac{a+b}{2}$ (b) $\left(\frac{a}{2}, \frac{b}{2}\right)$ (c) $\left(\frac{a}{2}, b\right)$ (d) $\left(a, \frac{b}{2}\right)$
- (iii) $(5, 2)$, $(7, 0)$, $(1, -2)$ and $(-1, 0)$ are the vertices of a
- (a) parallelogram (b) square (c) trapezium (d) kite
- (iv) The triangle with vertices $(1, -3)$, $(3, 2)$ and $(-2, 4)$ is:
- (a) a right triangle (b) an isosceles triangle
(c) a right isosceles triangle (d) an equilateral triangle

(v) Mid-point of $(c, -d)$ and $(-d, c)$ is:

- (a) $\left(\frac{c}{2}, -\frac{d}{2}\right)$ (b) $\left(\frac{-c-d}{2}, \frac{-d-c}{2}\right)$
(c) $\left(\frac{-d+c}{2}, \frac{c-d}{2}\right)$ (d) $(c-d, -d+c)$

(vi) If $P(2, 3)$ is the mid point of $A(x, 4)$ and $B(-3, y)$, then the coordinates of (x, y) are:

- (a) $\left(\frac{-1}{2}, \frac{3+b}{2}\right)$ (b) $(5, -1)$ (c) $\left(\frac{x-3}{2}, \frac{y+4}{2}\right)$ (d) $(7, 2)$

(vii) If two ordered pairs $(4, 5)$ and $\left(\frac{a+1}{2}, b-3\right)$, are equal then, the value of a is:

- (a) 4 (b) 8 (c) 7 (d) 5

(viii) In which quadrant, the point $(-4, -(-6))$ lies?

- (a) first (b) second (c) third (d) fourth

(ix) In the adjoining figure of a line:

$$d(A, C) - d(B, C) =$$

- (a) $d(B, A)$ (b) $d(C, B)$ (c) $d(A, B)$ (d) both a & c

(x) The abscissa on y -axis is:

- (a) 1 (b) x (c) zero (d) y

(xi) Minimum number of sides in a polygon is:

- (a) 2 (b) 3 (c) 4 (d) 5

(xii) If $x < 0$ and $y > 0$, then $(-x, y)$ will lie in quadrant:

- (a) I (b) II (c) III (d) IV

(xiii) The point $(3, 5)$ is at minimum distance from:

- (a) x -axis (b) y -axis (c) origin (d) both a & b

(xiv) If M is the mid point of the line segment LN , then $LN : MN$ is:

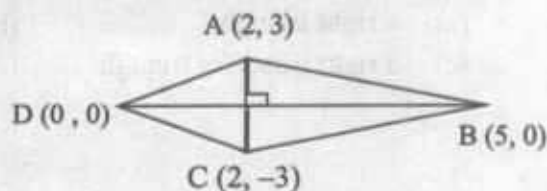
- (a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 1 : 3

(xv) All the bisectors of a line segment always pass through:

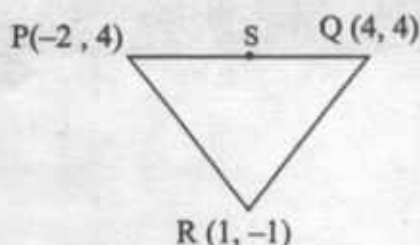
- (a) x -axis (b) origin (c) mid-point (d) y -axis

(xvi) The below figure is a kite, what will be the coordinates of the point of intersection of both diagonals?

- (a) $(0, 2)$ (b) $\left(2\frac{1}{2}, 0\right)$
(c) $(0, 0)$ (d) $(2, 0)$



- (xvii) In the given figure, if S is the mid point of PQ, then SR is



- (a) $\sqrt{2}$ (b) ± 5
(c) 6 (d) 5
- (xviii) If distance between two points A(c, 10) and B(0, -1) is 20 units, then the value of c is:
(a) 279 (b) $3\sqrt{31}$ (c) 3 (d) 40
- (xix) The length of the hypotenuse of $\triangle XYZ$ whose vertices are (7, 4), (7, 1) and (-3, 1) is:
(a) 3 (b) 10 (c) $\sqrt{109}$ (d) $\sqrt{91}$
- (xx) The mid point of the hypotenuse of a right triangle with vertices (4, 0), (2, 1) and (-1, -5) is:
(a) $\left(2, \frac{1}{2}\right)$ (b) $\left(\frac{1}{2}, -2\right)$ (c) $\left(\frac{3}{2}, -\frac{5}{2}\right)$ (d) $\left(\frac{3}{2}, \frac{5}{2}\right)$
- (xxi) If end points of a diameter of the circle are (4, 5) and (6, 9), then coordinates of its center will be:
(a) (7, 5) (b) (1, 2) (c) (5, 7) (d) (0, 0)
- (xxii) If two points (2, 3) and (4, 5) are at equal distance from (3, t) then, the value of t is:
(a) 5 (b) 4 (c) 3 (d) 7
- (xxiii) A point P(x, y) is at equal distance from both the axes and lies in the third quadrant. If it is at a distance of 4 units from y-axis, then its coordinates are:
(a) (-4, 4) (b) (4, -4) (c) (4, 4) (d) (-4, -4)
- (xxiv) A line AB intersects x-axis at C with a distance of 3 units from origin and y-axis at D with a distance of 6 units from origin, then d(C, D) is:
(a) $3\sqrt{5}$ (b) $3\sqrt{3}$ (c) 3 (d) 45
2. The consecutive vertices of a quadrilateral are A(0, 0), B(0, 5), C(4, 7) and D(4, 2). Show that quadrilateral is a parallelogram.
3. Show that the four points (5, 8), (7, 5), (3, 5) and (5, 2) are the vertices of a rhombus.
4. A(3, 4), B(-1, 7) and C(x, y) are three collinear points such that B is midpoint of $\overline{AC}$. Find values of x and y.