## Exercise 7.1

## Question 1:
Find the distance between the following pairs of points:
**(i)** $(2,3),(4,1)$ **(ii)** $(-5,7),(-1,3)$ **(iii)** $(a,b),(-a,-b)$

### Answer 1:
**(i)** $A(2,3),\ B(4,1)$
Using the distance formula: $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
Distance between $A(2,3)$ and $B(4,1)$ is given by $AB$
$=\sqrt{(4-2)^2+(1-3)^2}=\sqrt{4+4}=\sqrt{8}=2\sqrt{2}$

**(ii)** $P(-5,7),\ Q(-1,3)$
Using the distance formula: $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
Distance between $P(-5,7)$ and $Q(-1,3)$ is given by $PQ$
$=\sqrt{[-1-(-5)]^2+(3-7)^2}=\sqrt{16+16}=\sqrt{32}=4\sqrt{2}$

**(iii)** $M(a,b),\ N(-a,-b)$
Using the distance formula: $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
Distance between $M(a,b)$ and $N(-a,-b)$ is given by $MN$
$=\sqrt{[-a-(-a)]^2+[-b-(-b)]^2}=\sqrt{4a^2+4b^2}=2\sqrt{a^2+b^2}$

## Question 2:
Find the distance between the points (0, 0) and (36, 15). Can you now find the distance between the two towns A and B discussed in Section 7.2.

### Answer 2:
Here, $P(0,0)$ and $Q(36,15)$, using distance formula $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
Distance between $P(0,0)$ and $Q(36,15)$ is given by $PQ$
$=\sqrt{(36-0)^2+(15-0)^2}$
$=\sqrt{1296+225}=\sqrt{1521}$
$=39$
Using the distance formula: $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ we can find the distance between the two towns.

## Question 3:
Determine if the points (1, 5), (2, 3) and (– 2, – 11) are collinear.

### Answer 3:
Here, $A(1,5)$, B$(2,3)$ and $C(-2,-11)$.
Using distance formula: $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
$AB=\sqrt{(2-1)^2+(3-5)^2}=\sqrt{1+4}=\sqrt{5}$
$BC=\sqrt{(-2-2)^2+(-11-3)^2}=\sqrt{16+196}=\sqrt{212}$
$CA=\sqrt{[1-(-2)]^2+[5-(-11)]^2}=\sqrt{9+256}=\sqrt{265}$
Here,
$$AB+BC=\sqrt{5}+\sqrt{212}\neq\sqrt{265}=AC$$
Hence, the points $A(1,5)$, B$(2,3)$ and $C(-2,-11)$ are not collinear.

## Question 4:
Check whether (5, – 2), (6, 4) and (7, – 2) are the vertices of an isosceles triangle.

### Answer 4:
Given points: $A(5,-2)$, B$(6,4)$ and $C(7,-2)$ are vertices of triangle.

Using distance formula: $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$AB=\sqrt{(6-5)^2+[4-(-2)]^2}=\sqrt{1+36}=\sqrt{37}$

$BC=\sqrt{(7-6)^2+(-2-4)^2}=\sqrt{1+36}=\sqrt{37}$

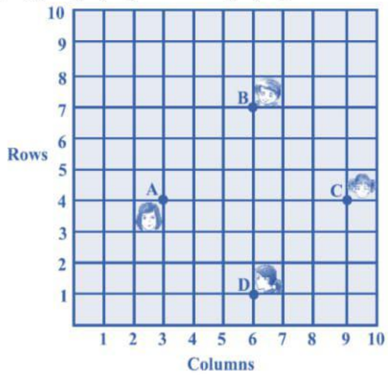
$CA=\sqrt{(5-7)^2+[-2-(-2)]^2}=\sqrt{4+0}=2$

Here, $AB=BC\neq AC$

Hence, the points (5, – 2), (6, 4) and (7, – 2) are not the vertices of an isosceles triangle.

## Question 5:
In a classroom, 4 friends are seated at the points A, B, C and D as shown in Fig. 7.8. Champa and Chameli walk into the class and after observing for a few minutes Champa asks Chameli, "Don't you think ABCD is a square?" Chameli disagrees. Using distance formula, find which of them is correct.

### Answer 5:
From the figure, the coordinates of points A, B, C and D are $A(3,4)$, B$(6,7)$, C$(9,4)$ and D$(6,1)$.




$AB=\sqrt{(6-3)^2+(7-4)^2}=\sqrt{9+9}=\sqrt{18}=3\sqrt{2}$

$BC=\sqrt{(9-6)^2+(4-7)^2}=\sqrt{9+9}=\sqrt{18}=3\sqrt{2}$

$CD=\sqrt{(6-9)^2+(1-4)^2}=\sqrt{9+9}=\sqrt{18}=3\sqrt{2}$

$DA=\sqrt{(3-6)^2+(4-1)^2}=\sqrt{9+9}=\sqrt{18}=3\sqrt{2}$

All the sides of quadrilateral are equal, so it may be a square or rhombus on the basis of its diagonal.

$AC=\sqrt{(9-3)^2+(4-4)^2}=\sqrt{36+0}=6$

$BD=\sqrt{(6-6)^2+(1-7)^2}=\sqrt{0+36}=6$

Here,

$$AB=BC=CD=DA \text{ and } AC=BD$$

Hence, ABCD is a square. So, Champa is correct.

## Question 6:
Name the type of quadrilateral formed, if any, by the following points, and give reasons for your answer:

**(i)** $(-1,-2),\ (1,0),\ (-1,2),\ (-3,0)$

**(ii)** $(-3,5),\ (3,1),\ (0,3),\ (-1,-4)$

**(iii)** $(4,5),\ (7,6),\ (4,3),\ (1,2)$

### Answer 6:
**(i)** Given points $A(-1,-2)$, B$(1,0)$, C$(-1,2)$ and D$(-3,0)$.

$AB=\sqrt{[1-(-1)]^2+[0-(-2)]^2}=\sqrt{4+4}=\sqrt{8}=2\sqrt{2}$

$BC=\sqrt{(-1-1)^2+(2-0)^2}=\sqrt{4+4}=\sqrt{8}=2\sqrt{2}$

$CD=\sqrt{[-3-(-1)]^2+(0-2)^2}=\sqrt{4+4}=\sqrt{8}=2\sqrt{2}$

$DA=\sqrt{[-1-(-3)]^2+(-2-0)^2}=\sqrt{4+4}=\sqrt{8}=2\sqrt{2}$

All the sides of quadrilateral are equal, so it may be a square or rhombus on the basis of its diagonal.

$AC = \sqrt{[1-(-1)]^2 + [2-(-2)]^2} = \sqrt{0+16} = 4$

$BD = \sqrt{(-3-1)^2 + (0-0)^2} = \sqrt{16+0} = 4$

Here, $AB = BC = CD = DA$ and $AC = BD$

Hence, ABCD is a square.

**(ii)** Given points: $A(-3,5)$, B$(3,1)$, C$(0,3)$ and D$(-1,-4)$.

$AB = \sqrt{[3-(-3)]^2 + (1-5)^2} = \sqrt{36+16} = \sqrt{52} = 2\sqrt{13}$

$BC = \sqrt{(0-3)^2 + (3-1)^2} = \sqrt{9+4} = \sqrt{13}$

$CD = \sqrt{(1-0)^2 + (-4-3)^2} = \sqrt{1+49} = \sqrt{50} = 5\sqrt{2}$

$DA = \sqrt{[-3-(-1)]^2 + [5-(-4)]^2} = \sqrt{4+81} = \sqrt{85}$

$AC = \sqrt{[0-(-3)]^2 + (3-5)^2} = \sqrt{9+4} = \sqrt{13}$

$BD = \sqrt{(-1-3)^2 + (-4-1)^2} = \sqrt{16+25} = \sqrt{41}$

Here, $AC + BC = AB$, it means the point $C$ lies on side $AB$ or A, B, C are collinear.

Hence, the quadrilateral ABCD is not possible.

**(iii)** Given points: $A(4,5)$, B$(7,6)$, C$(4,3)$ and D$(1,2)$.

$AB = \sqrt{(7-4)^2 + (6-5)^2} = \sqrt{9+1} = \sqrt{10}$

$BC = \sqrt{(4-7)^2 + (3-6)^2} = \sqrt{9+9} = \sqrt{18}$

$CD = \sqrt{(1-4)^2 + (2-3)^2} = \sqrt{9+1} = \sqrt{10}$

$DA = \sqrt{(4-1)^2 + (5-2)^2} = \sqrt{9+9} = \sqrt{18}$

The opposite sides of quadrilateral are equal. It may be a parallelogram or rectangle. It can be justified with the help of lengths of its diagonal.

$AC = \sqrt{(4-4)^2 + (3-5)^2} = \sqrt{0+4} = 2$

$BD = \sqrt{(1-7)^2 + (2-6)^2} = \sqrt{36+16} = \sqrt{52} = 2\sqrt{13}$

Here, $AB = CD,\ BC = AD$ and $AC \neq BD$.

Hence, ABCD is a parallelogram.

## Question 7:

Find the point on the $x$-axis which is equidistant from (2, –5) and (–2, 9).

### Answer 7:

Let $P(x,0)$ be any point on $x-$ axis, which is equidistant from $A(2,-5)$ and $B(-2,9)$.

Therefore, $PA = PB$

$\Rightarrow \sqrt{(2-x)^2 + (-5-0)^2} = \sqrt{(-2-x)^2 + (9-0)^2}$

$\Rightarrow \sqrt{4+x^2-4x+25} = \sqrt{4+x^2+4x+81}$

Squaring both the sides

$4+x^2-4x+25 = 4+x^2+4x+81$

$\Rightarrow -8x = 81-25 = 56$

$\Rightarrow x = -\dfrac{56}{8} = -7$

Hence, $P(-7,0)$ is the point on the $x$-axis which is equidistant from (2, –5) and (–2, 9).

## Question 8:
Find the values of $y$ for which the distance between the points P(2, – 3) and Q(10, $y$) is 10 units.

### Answer 8:
The distance between $P(2,-3)$ and $Q(10,y)$ is 10 units.
$\Rightarrow \sqrt{(10-2)^2+[y-(-3)]^2}=10$
$\Rightarrow \sqrt{64+y^2+9+6y}=10$
Squaring both sides
$64+y^2+9+6y=100$
$\Rightarrow y^2+6y-27=0$
$\Rightarrow y^2+9y-3y-27=0$
$\Rightarrow y(y+9)-3(y+9)=0$
$\Rightarrow (y+9)(y-3)=0$
$\Rightarrow (y+9)=0$ or $(y-3)=0$
$\Rightarrow y=-9$ or $y=3$

## Question 9:
If Q(0, 1) is equidistant from P(5, –3) and R($x$, 6), find the values of $x$. Also find the distances QR and PR.

### Answer 9:
$Q(0,1)$ is equidistant from the points $P(5,-3)$ and $R(x,6)$. Therefore, $QP=QR$
$\Rightarrow \sqrt{(5-0)^2+(-3-1)^2}=\sqrt{(x-0)^2+(6-1)^2}$
$\Rightarrow \sqrt{25+16}=\sqrt{x^2+25}$
Squaring both the sides
$25+16=x^2+25$
$\Rightarrow x^2=16$
$\Rightarrow x=\pm 4$
If $x=4$,
$QR=\sqrt{(4-0)^2+(6-1)^2}=\sqrt{16+25}=\sqrt{41}$
$PR=\sqrt{(4-5)^2+[6-(-3)]^2}=\sqrt{1+81}=\sqrt{82}$
If $x=-4$,
$QR=\sqrt{(-4-0)^2+(6-1)^2}=\sqrt{16+25}=\sqrt{41}$
$PR=\sqrt{(-4-5)^2+[6-(-3)]^2}=\sqrt{81+81}=\sqrt{162}=9\sqrt{2}$

## Question 10:
Find a relation between $x$ and $y$ such that the point ($x$, $y$) is equidistant from the point (3, 6) and (– 3, 4).

### Answer 10:
Point $P(x,y)$ is equidistant from $A(3,6)$ and $B(-3,4)$. Therefore, $PA=PB$
$\Rightarrow \sqrt{(3-x)^2+(6-y)^2}=\sqrt{(-3-x)^2+(4-y)^2}$
$\Rightarrow \sqrt{9+x^2-6x+36+y^2-12y}=\sqrt{9+x^2+6x+16+y^2-8y}$
Squaring both sides
$9+x^2-6x+36+y^2-12y=9+x^2+6x+16+y^2-8y$
$\Rightarrow -12x-4y=-20$
$\Rightarrow 3x+y=5$