Orienting Yourself The Use of Coordinates Class 9 Solutions Maths Ganita Manjari Chapter 1

Think and Reflect (NCERT Textbook Page No. 5)

Question 1.
What are the standard widths for a room door? Look around your home and in school.

Solution:
The standard widths for a room typically range from 36 inches to 48 inches (3 to 4 feet).

Question 2.
Are the doors in your school suitable for people in wheelchairs?

Solution: Do it yourself.

Think and Reflect (NCERT Textbook Page No. 7)

Question 1.
What is the x-coordinate of a point on the y-axis?

Solution:
The x-coordinate represents the horizontal distance of a point from the y-axis (that is, how far it is to the left or right of the y-axis). Any point on the y-axis has no horizontal distance from the y-axis—it lies exactly on it. Therefore, the x-coordinate of a point on y-axis is always 0.

Question 2.
Is there a similar generalisation for a point on the x-axis?

Solution:
Yes, there is a similar generalisation. The y-coordinate represents the vertical distance of a point from the x-axis (that is, how far it is above or below the x-axis). Any point on the x-axis has no vertical distance from the x-axis—it lies exactly on it. Therefore, y-coordinate of a point on x-axis is always 0.

Question 3.
Does point Q (y, x) ever coincide with point P (x, y)? Justify your answer.

Solution:
For two points to coincide, their corresponding coordinates must be equal. So, we need: y = x (for the first coordinate), and x = y (for the second coordinate)

Therefore, points Q (y, x) and P (x, y) coincide only when x = y.

Question 4.
If x ≠ y, then (x, y) ≠ (y, x); and (x, y) = (y, x) if and only if x =y. Is this claim true?

Solution:
Yes, the claim is true. Two ordered pairs are equal only when their corresponding coordinates are equal. So, for (x, y) = (y, x), we must have: x = y, and y = x, which is possible only when x = y. Therefore: If x ≠ y, then (x, y) ≠ (y, x), and (x, y) = (y, x) if and only if x = y.

Think and Reflect (NCERT Textbook Page No. 11)

Question 1.
What has remained the same and what has changed with this reflection?

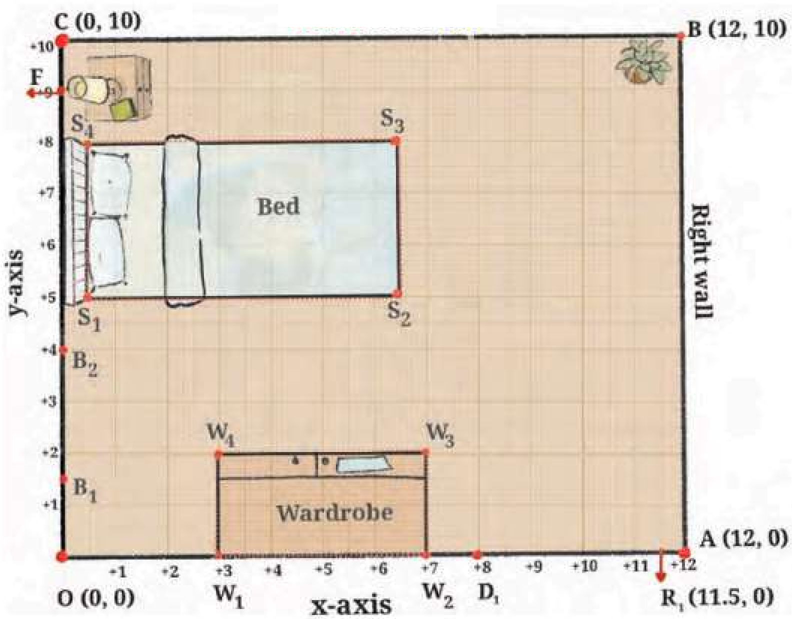
Solution:
The lengths of all the corresponding sides have remained the same, whereas the signs of the x-coordinates of all the vertices of the triangle have changed.

Question 2.
Would these observations be the same if AADM is reflected in the x-axis (instead of the y-axis)?

Solution:
If ΔADM is reflected in the x-axis (instead of the y-axis), then the signs of they-coordinates change.

Exercise Set 1.1 Solutions

Figure shows Reiaan’s room with points OABC marking its corners. The x- and y-axes are marked in the figure. Point O is the origin.



Referring to Figure, answer the following questions:

(i) If D_1 R_1 represents the door to Reiaan's room, how far is the door from the left wall (the y-axis) of the room? How far is the door from the x-axis?

Solution:
From the figure, D_1 is on the x-axis and 8 units to the right of O, its coordinates are (8, 0). Since D_1 = (8, 0) and R_1 =(11.5, 0), the door is 8 units away from the left wall (y-axis). The door lies on the x-axis, so its distance from the x-axis = 0 units.

(ii) What are the coordinates of D_1?

Solution:
Since D_1 is on the x-axis and 8 units to the right of O, its coordinates are (8, 0).

(iii) If R_1 is the point (11.5,0), how wide is the door? Do you think this is a comfortable width for the room door? If a person in a wheelchair wants to enter the room, will he/she be able to do so easily?

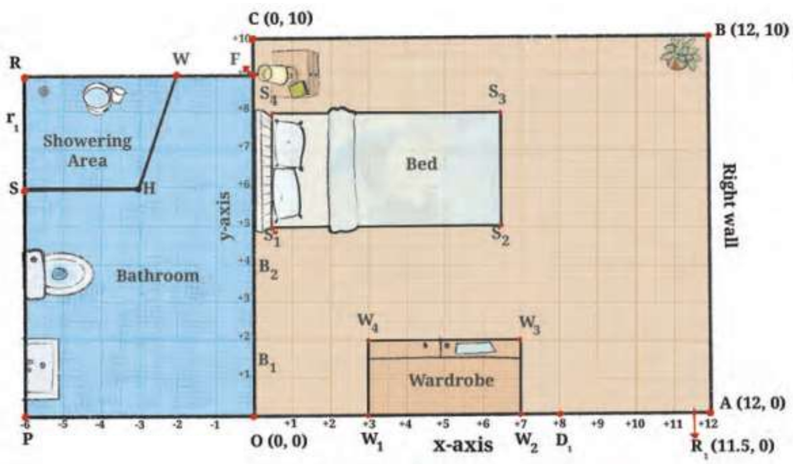
Solution:
D_1 R_1, represents the door, coordinates of D_1 = (8, 0) and R_1 = (11.5, 0).
So the width of the door = distance between x-coordinates of D_1 and R_1 points = 11.5 – 8 = 3.5 units Let 1 unit = 1 foot 3.5 units = 3.5 feet Since an average door width is 2 to 3 feet, a door with a width of 3.5 feet is quite comfortable for a room door. A wheelchair is typically 2 to 2.25 feet wide, so, if a person in a wheelchair wants to enter the room, he/ she will be able to do so easily.

(iv) If B_1 (0, 1.5) and B_2 (0, 4) represent the ends of the bathroom door, is the bathroom door narrower or wider than the room door?

Solution:
Coordinates of B_1 = (0, 1.5) and B_2 = (0, 4).
So the width of the bathroom door = distance between B_1 and B_2 = 4 – 1.5 = 2.5 units And width of room door is 3.5 feet. Since 2.5 < 3.5, the bathroom door is narrower than the room door.

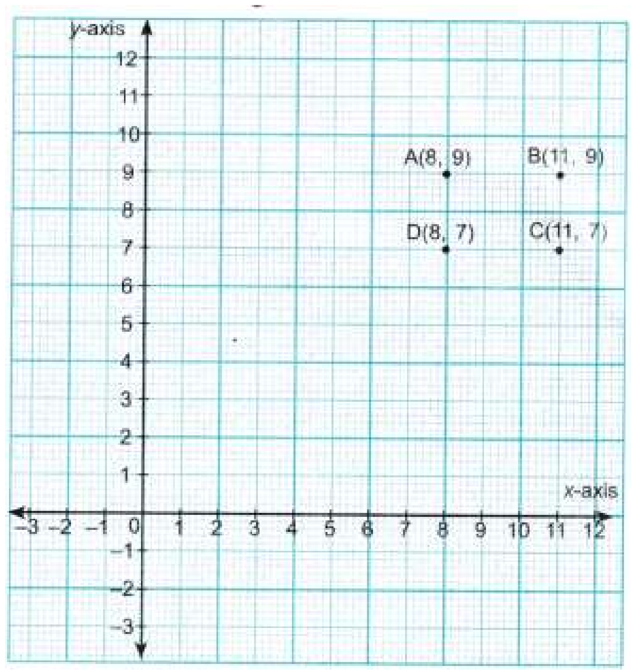
Exercise Set 1.2 Solutions

On a graph sheet, mark the x-axis and y-axis and the origin O. Mark points from (- 7, 0) to (13, 0) on the x-axis and from (0, – 15) to (0, 12) on the y-axis. (Use the scale 1 cm = 1 unit.) Using Figure, answer the given questions.



Question 1. Place Reiaan's rectangular study table with three of its feet at the points (8, 9), (11, 9) and (11,7).
(i) Where will the fourth foot of the table be?

Solution:



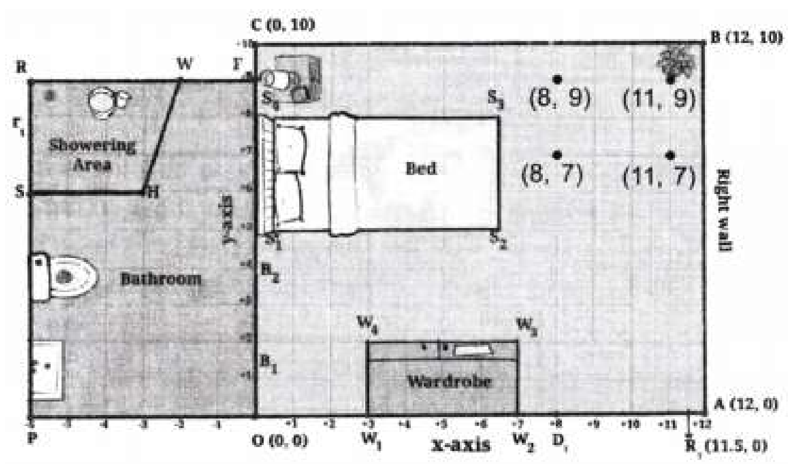
The given three points form three corners of a rectangular study table: A = (8, 9) B = (11, 9) C = (11, 7) To complete the rectangle, the fourth point must have:

- same x-coordinate as A — 8
- same y-coordinate as C — 7

Therefore, the fourth foot is at D = (8, 7).

(ii) Is this a good spot for the table?

Solution:



Yes, this is a good spot for the table because:

- The table is set neatly inside the room.
- It does not block any doors or movement areas.
- It is placed near the right wall, which makes it convenient for studying.

(iii) What is the width of the table? The length? Can you make out the height of the table?

Solution:
Length of the table = Distance between the x-coordinates of the points (8, 9) and (11, 9) = 11 – 8 = 3 units

Width of the table = Distance between the y-coordinates of the points (11, 9) and (11, 7) = 9 – 7 = 2 units The height of the table cannot be determined because the figure shows only a top view (2D) and does not provide any information about its height.

Question 2.
If the bathroom door has a hinge at B_1 and opens into the bedroom, will it hit the wardrobe? Are there any changes you would suggest if the door is made wider?

Solution:
The bathroom door extends from B_1 (0, 1.5) to B_2 (0, 4), so its width = 4 – 1.5 = 2.5 units.
If the door is fixed at (0, 1.5) and opens into the bedroom, it will move along a circular path with a radius of 2.5 units. The wardrobe is located along the line x = 3, between (3, 0) and (3, 2). The shortest distance from the hinge point B_1 (0,1.5) to the wardrobe is 3 units, which is greater than the radius of the arc traced by the door when it opens. Hence, the door will not hit the wardrobe when it opens into the bedroom.

If the door is made much wider, it may come close to or even hit the wardrobe. In that case:

- The door could be made to open inward into the bathroom.
- The wardrobe could be shifted slightly to the right.

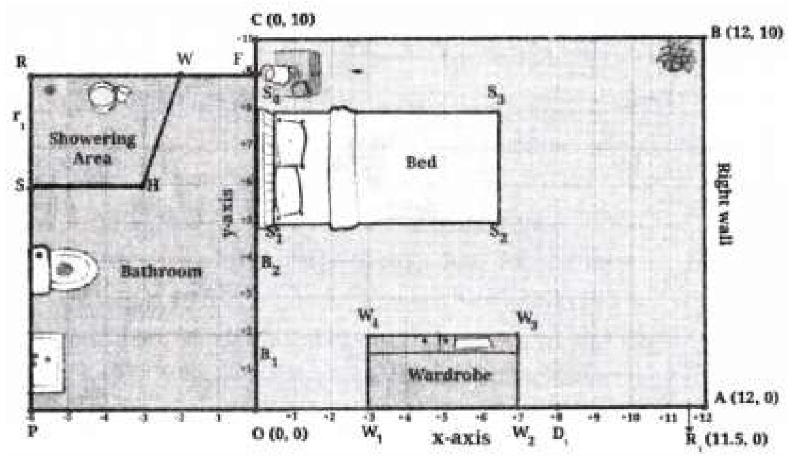
Question 3.
Look at Reiaan's bathroom. (i) What are the coordinates of the four comers O, F, R, and P of the bathroom?

Solution:
The coordinates of the four corners O, F, R, and P of the bathroom are: O = (0, 0), F = (0, 9). R = (-6, 9), P = (-6, 0)

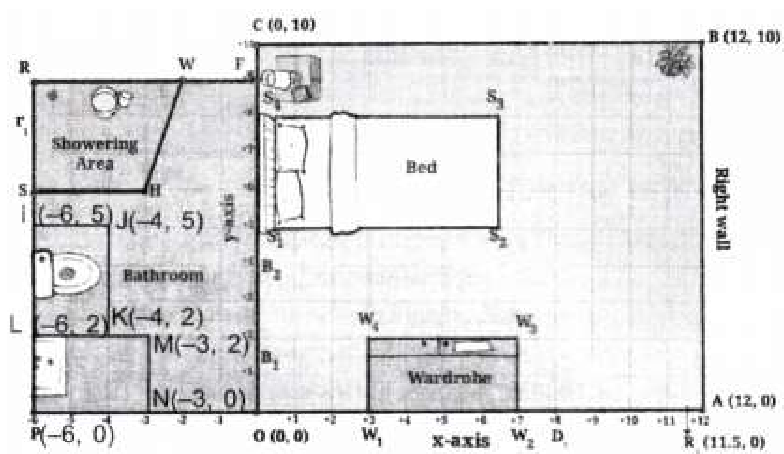
(ii) What is the shape of the showering area SHWR in Reiaan's bathroom? Write the coordinates of the four comers.

Solution:
Since one pair of opposite sides is parallel, SHWR is a trapezium. The coordinates of the four comers are: S = (-6, 6), H = (-3, 6), W = (-2, 9), R = (-6, 9)

(iii) Mark off a 3 ft × 2 ft space for the washbasin and a 2 ft × 3 ft space for the toilet. Write the coordinates of the comers of these spaces.



Solution:

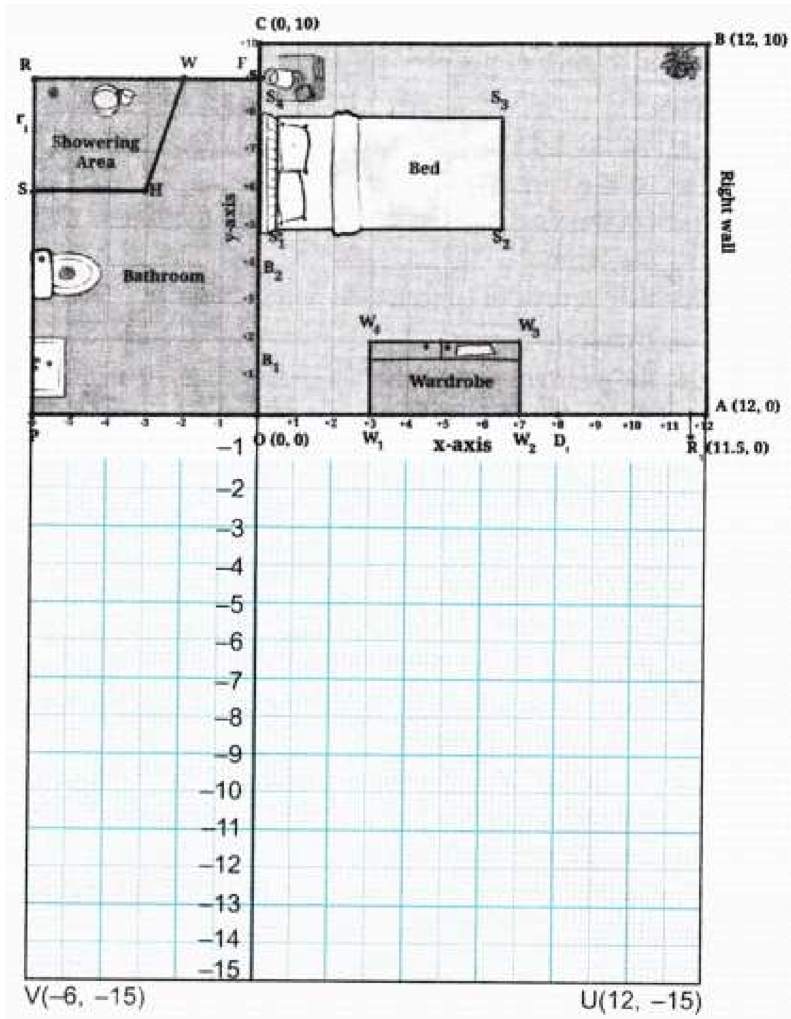


The coordinates of the corners of the washbasin space are: L = (-6, 2), M = (-3, 2), N = (-3, 0), P = (-6, 0) The coordinates of the comers of the toilet space are: I = (-6, 5), J = (-4, 5), K = (-4, 2), L = (-6, 2)

Question 4.
Other rooms in the house: (i) Reiaan's room door leads from the dining room which has the length 18 ft and width 15 ft. The length of the dining room extends from point P to point A. Sketch the dining room and mark the coordinates of its comers.

Solution:

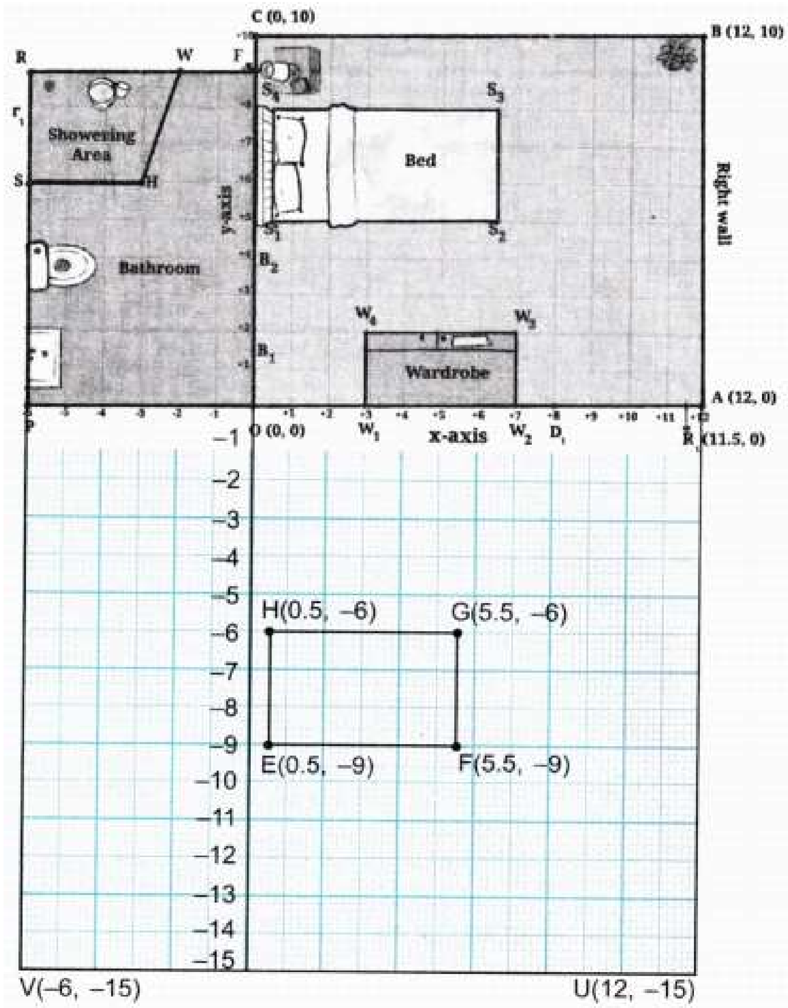
Coordinates of P = (-6, 0) and Coordinates of A = (12,0) So, the length of PA = 12 – (-6) = 18 ft, which matches the given length. If the dining room is 15 ft wide and lies below PA, then its upper side is PA and it extends downward 15 units.



PAUV is the required dining room. The coordinates of its comers are: P = (-6, 0), A = (12, 0), U = (12, -15), V = (-6, -15)

(ii) Place a rectangular 5 ft × 3 ft dining table precisely in the centre of the dining room. Write down the coordinates of the feet of the table.

Solution:



The dining room extends:
From x = – 6 to x = 12 and y = 0 to y = -15
Centre of the room:
x = −6+122 3 and y = 0−152 = -7.5 A 5 ft × 3ft table is placed at the centre. Half length = 2.5 ft and half width = 1.5 ft So, the coordinates of comers of the table are: E = (3 – 2.5, -7.5 -1.5) = (0.5, -9) F = (3 + 2.5, -7.5 – 1.5) = (5.5, -6) G = (3 + 2.5, -7.5 + 1.5) = (5.5, -6) H = (3 – 2.5, -7.5 + 1.5) = (0.5, -6)

End of Chapter Exercises Solutions

Question 1.
What are the x-coordinate and y-coordinate of the point of intersection of the two axes?

Solution:
The x-axis and y-axis intersect at the origin. Therefore, the x-coordinate = 0 and they-coordinate = 0 So, the point of intersection is (0, 0).

Question 2.
Point W has x-coordinate equal to -5. Can you predict the coordinates of point H which is on the line through W parallel to the y-axis? Which quadrants can H lie in?

Solution:
If the point W has x-coordinate of -5, then any point on the line through which is parallel to the y-axis will also have x-coordinate of -5. Hence, the coordinates of any point H on this line will be of the form (-5, y), where y can be any real number.

- If $y > 0$, point H lies in Quadrant II.
- If $y < 0$, point H lies in Quadrant III.
- If $y = 0$, point H lies on the x-axis.

Question 3.
Consider the points R (3, 0), A (0, -2), M (-5, -2) and P (-5, 2). If they are joined in the same order, predict: (i) Two sides of RAMP that are perpendicular to each other.

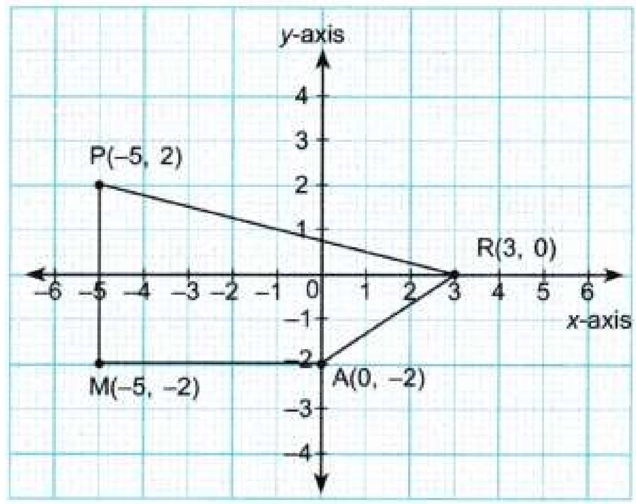
Solution:
Since y-coordinates of A and M are equal, i.e.,-2, so it is horizontal line AM. Since x-coordinates of M and P are equal, i.e. -5, so it is vertical, line MP. Hence, AM ⊥ MP The two perpendicular sides are AM and MP.

(ii) One side of RAMP that is parallel to one of the axes.

Solution:
The line AM is parallel to the x-axis because both points A and M share the same x-coordinate (-2). The line MP is parallel to the y-axis because both points M and P have the same x-coordinate (-5).

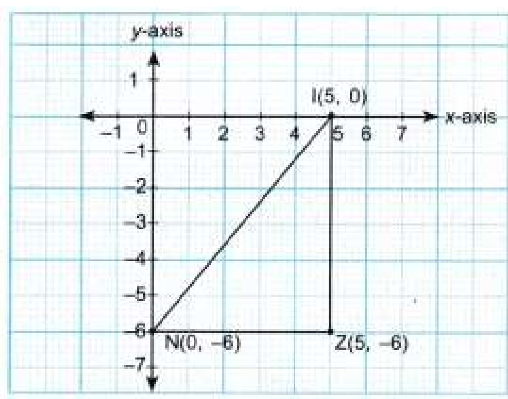
(iii) Two points that are mirror images of each other in one axis. Which axis will this be? Now plot the points and verily your predictions.

Solution:
Compare M (-5, -2) and P (-5, 2) They have the same x-coordinate and their y-coordinates are equal in magnitude but opposite in sign. So, they are mirror images of each other in the x-axis.



Question 4. Plot point Z (5, -6) on the Cartesian plane. Construct a right-angled triangle IZN and find the lengths of the three sides. (Comment: Answers may differ from person to person.)

Solution:



To construct a right-angled triangle from the point Z (5, -6), draw a horizontal and a vertical line to the axes, and join the points where these lines intersect the axes.

The coordinates of the triangle IZN are:

I = (5, 0), Z = (5, -6), N = (0, -6)

The lengths of the sides are:

IZ: Distance between (5,0) and (5, -6) = 0 – (-6) = 6 units

ZN: Distance between (5, -6) and (0, -6) = 5-0 = 5 units

IN: Using distance formula:

IN = $\sqrt{(5-0)^2+\{0-(-6)\}^2}$

= $\sqrt{5^2+6^2} = \sqrt{25+36}$

= $\sqrt{61}$ units

Question 5.
What would a system of coordinates be like if we did not have negative numbers? Would this system allow us to locate all the points on a 2-D plane?

Solution:
Without negative numbers the coordinates would be limited to zero or positive values only. Thus,

- On the x-axis, we could mark only the points to the right of the origin.
- On the y-axis, we could mark only the points above the origin.

This would restrict us to locate points only in:

- Quadrant I
- the positive part of the x-axis
- the positive part of the y-axis
- and the origin

We would not be able to locate:

- points in Quadrant II
- points in Quadrant III
- points in Quadrant IV
- points on the negative parts of the axes

Therefore, such a system would not allow us to locate all the points on a 2-D plane.

Question 6.
Are the points M (-3, -4), A (0, 0) and G (6, 8) on the same straight line? Suggest a method to check this without plotting and joining the points.

Solution:
We can check whether all the given points lie on the same straight line using the Distance formula. To check whether the points M (-3,-4), A (0, 0), and G (6, 8) lie on the same straight line using the Distance formula: $d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
MA = $\sqrt{(0+3)^2+(0+4)^2}$
= $\sqrt{(3^2+4^2)} = \sqrt{9+16} = \sqrt{25}$ = 5 units

AG = $\sqrt{(6-0)^2+(8-0)^2}$
= $\sqrt{36+64} = \sqrt{100}$ = 10 units

MG = (6+3)2+(8+4)2−−−−−−−−−−−−−−−√
= 81+144−−−−−−−√=225−−−√ = 15 units Checking: MA + AG = 5 + 10 = 15 = MG Since the sum of two distances equals the third, the points M, A and G lie on the same straight Line.

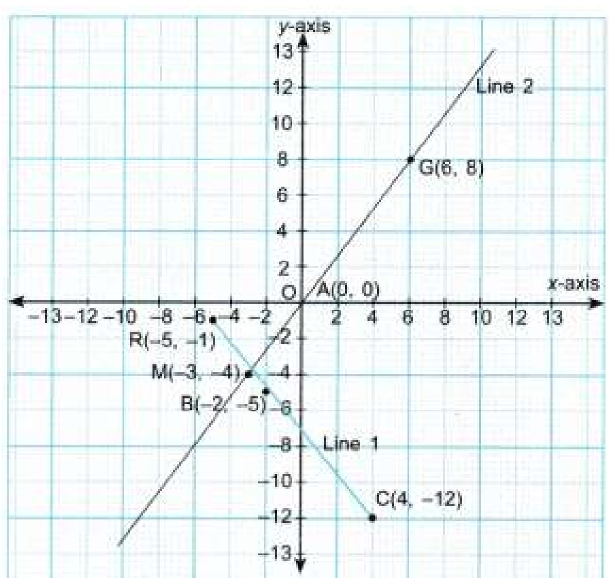
Question 7.
Use your method (from Problem 6) to check if the points R (-5, -1), B (-2, -5) and C (4, -2) are on the same straight line. Now plot both sets of points and check your answers.

Solution:
To check whether the points R (-5, -1), B (-2, -5) and C(4, -12) lie on the same straight line using the distance formula: d =
(x2−x1)2+(y2−y1)2−−−−−−−−−−−−−−−−−−√
RB = (−2+5)2+(−5+1)2−−−−−−−−−−−−−−−−−√
= 32+(4)2−−−−−−−√=9+16−−−−−√=25−−√= = 5 units

BC = (4+2)2+(−12+5)2−−−−−−−−−−−−−−−−−√
= =62+(−7)2−−−−−−−−−√=36+49−−−−−−√
= 85−−√ units

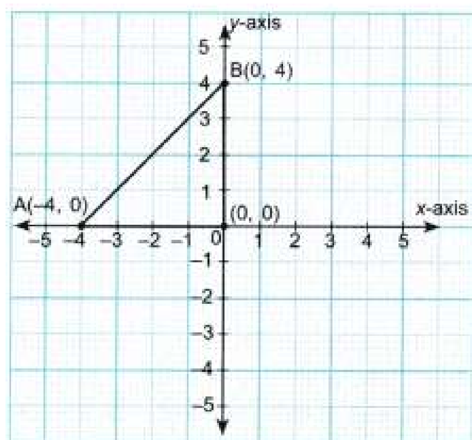
RC = (4+5)2+(−12+1)2−−−−−−−−−−−−−−−−−√
= 92+(−11)2−−−−−−−−−−√=81+121−−−−−−−√
= 202−−−√ units
Now: RB + BC = 5 + 85−−√≠202−−−√ Since the sum of two distances is not equal to the third, the points R, B and C. do not lie on the same straight line.

Checking: Line 1 for points: R (-5, -1), B (-2, -5) and C (4, -12): Line 2 for points: M (-3, -4), A (0, 0) and G (6, 8) (from Problem 6)



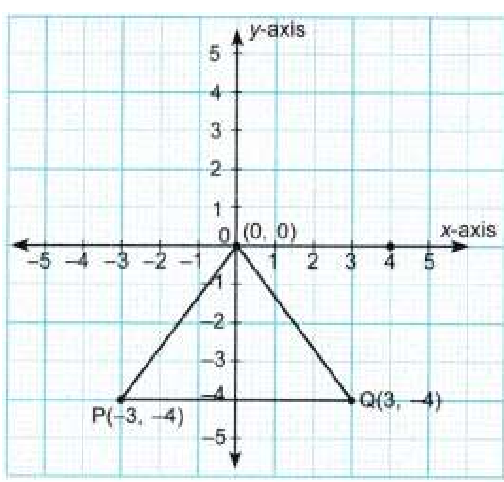
Question 8.
Using the origin as one vertex, plot the vertices of: (i) A right-angled isosceles triangle.

Solution:
One of the possible set of vertices of triangle OAB is: O = (0, 0), A = (-4, 0), B = (0, 4) Because: OA = 4 units OB = 4 units OA is perpendicular to OB So triangle OAB is a right-angled isosceles triangle.



(ii) An isosceles triangle with one vertex in Quadrant III and the other in Quadrant IV.

Solution:
One of the possible set of vertices is: O = (0, 0), P = (-3, -4), Q (3, -4) Explanation: P lies in Quadrant III Q lies in Quadrant IV OP = OQ = 5 units So, triangle OPQ is an isosceles triangle.



Question 9.
The following table shows the coordinates of points S, M and T. In each case, state whether M is the midpoint of segment ST. Justify your answer.

S	M	T	Is M the midpoint of ST? Yes or No	Reason for your answer
(−3, 0)	(0, 0)	(3, 0)		
(2, 3)	(3, 4)	(4, 5)		
(0, 0)	(0, 5)	(0, −10)		
(−8, 7)	(0, −2)	(6, −3)		

When M is the mid-point of ST, can you find any connection between the coordinates of M, S and T?

Solution:
Using distance formula: d = (x2−x1)2+(y2−y1)2−−−−−−−−−−−−−−−−−−√
Row I: S(-3, 0), M(0, 0), T(3, 0)
SM = {(0−(−3)}2+(0−0)2−−−−−−−−−−−−−−−−−−−−√=9−0−−−−√
= 3
MT = (3−0)2+(0−0)2−−−−−−−−−−−−−−−−√=9−0−−−−√
= 3
ST = {3−(−3)}2+(0−0)2−−−−−−−−−−−−−−−−−−−√=36−−√ = 6 SM + MT= 3 + 3 = 6 = ST Yes, M is the midpoint of SM and MT.

Row 2: S(2, 3), M(3, 4), T(4, 5) SM = (3−2)2+(4−3)2−−−−−−−−−−−−−−−−√=1+1−−−−√
= √2
MT = (3−2)2+(4−3)2−−−−−−−−−−−−−−−−√=1+1−−−−√
= √2
ST = (4−2)2+(5−3)2−−−−−−−−−−−−−−−−√=22+22−−−−−−√ = √8 = 2√2 SM + MT = √2 + √2 = 2√2 = ST Yes, M is the midpoint of SM and MT.

Row 3: S(0, 0), M(0, 5), T(0, -10) SM = (0−0)2+(5−0)2−−−−−−−−−−−−−−−−√=0+25−−−−−√ = 5
MT = (0−0)2+(−10−5)2−−−−−−−−−−−−−−−−−−√=0+225−−−−−−√ = 15
ST = (0−0)2+(−10−0)2−−−−−−−−−−−−−−−−−−√=100−−−√ = 10 SM + MT = 5+ 15 = 20 ≠ 10 So, M is not the midpoint of SM and MT.

Row 4: S(-8, 7), M(0, -2), T(6, -3) SM = {0−(−8)2}+(−2−7)2−−−−−−−−−−−−−−−−−−−−√=64+81−−−−−−√=145−−−√
MT = (6−0)2+{−3−(−2)}2−−−−−−−−−−−−−−−−−−−−√=36+1−−−−−√=37−−√
ST = {6−(−8)}2+(−3−7)2−−−−−−−−−−−−−−−−−−−−√=196+100−−−−−−−−√=296−−−√
SM + MT = 145−−−√+37−−√≠296−−−√ So, M is not the midpoint of SM and MT.

When M is the midpoint of ST, its x-coordinate is the average of the x-coordinates of S and T, and its y-coordinate is the average of the y-coordinates of S and T. Or If M = (x, y), S = (x_1, y_1), and T = (x_2, y_2),
M = (x, y) = (x1+x22,y1+y22)

Question 10.
Use the connection you found to find the coordinates of B given that M (-7, 1) is the midpoint of A (3, – 4) and B (x, y).

Solution:
Given: A = (3, -4), B = (x, y), M = (-7, 1) Using the above connection: Midpoint M = (x1+x22,y1+y22)
so, 3+x2 ⇒ 3 + x = -14 ⇒ x = -17
and −4+y2 ⇒ —4 + y = 2 ⇒ y = 6 Therefore, coordinates of point B is (-17, 6).

Question 11.
Let P, Q be points of trisection of AB, with P closer to A, and Q closer to B. Using your knowledge of how to find the coordinates of the midpoint of a segment, how would you find the coordinates of P and Q? Do this for the case when the points are A (4, 7) and B (16, -2).

Solution:
To trisect the segment AB, points P and Q divides the line segment into three equal parts. Given: A(4, 7), B(16,-2) Let the coordinates of P and Q are (x_1, y_1) and (x_2, y_2) respectively.

Here, P is midpoint of A and Q.
So, x_1 = 4+x22− ………. (1)
y_1 = 7+y12 ….. (2)

Q is mis point of P and B, So x_2 = x1+162 ………. (3)
y_2 = y1−22 ….. (4)

Solving for x-coordinates, from (1): x_1 = 4+x12 and from (3): x_2 = x1+162

Substituting (1) into (3), we get x_2 = (4+x2)2+162=(4+x2+32)4=x2+364
⇒ $4x_2$ = x_2 + 36
⇒ $3x_2$ =36
⇒ x_2 = 12
Then from (1): x_1 = 4+122 = 8
Solving for y-coordinates, from (2):
y_1 = 7+y22 and
From (4): y_2 = y1−22
Substituting (2) into (4) we get

y_2 = 7+y22−22=7+y2−44=y2+34
⇒ $4y_2 = y_2 + 3$
⇒ $3y_2 = 3$
⇒ $y_2 = 1$
Then from (2): y_1 = 7+12 = 4 Therefore, P = (8, 4) and Q = (12, 1).

Question 12.
(i) Given the points A (1,- 8), B (-4,7) and C (-7, -4), show that they lie on a circle K whose center is the origin O (0, 0). What is the radius of circle K?

Solution:
Given Points: A(1, -8), B(-4, 7), C(-7, -4), and 0(0, 0) OA =
(0−1)2+{0−(−8)}2−−−−−−−−−−−−−−−−−−√=1+64−−−−−√=65−−√
OB = {0−(−4)}2+(0−7)2−−−−−−−−−−−−−−−−−−√=16+49−−−−−−√=65−−√
OC =
{0−(−7)}2+{0−(−4)}2−−−−−−−−−−−−−−−−−−−−−√=49+16−−−−−−√=65−−√
The three points A, B, and C are equidistant from the origin, meaning they lie on a circle with its centre at at (0, 0) and a radius of 65−−√ units. This circle is denoted as circle K.

(ii) Given the points D (- 5,6) and E (0,9), check whether D and E lie within the circle, on the circle, or outside the circle K. Solution: OD =
{0−(−5)}2+(0−6)2−−−−−−−−−−−−−−−−−−√=25+36−−−−−−√=61−−√
OE = (0−0)2+(0−9)2−−−−−−−−−−−−−−−√=81−−√ = 9
Compare with radius:
65−−√ ≈ 8.06 and 61−−√ ≈ 7.81 < 65−−√ So, D lies inside the circle 9 > 65−−√ So, E lies outside the circle K.

Question 13.
The midpoints of the sides of triangle ABC are the points D, E, and F. Given that the coordinates of D, E, and F are (5, 1), (6, 5), and (0, 3), respectively, find the coordinates of A, B and C.

Solution:
Let the vertices of triangle ABC be A(x_1, y_1), B(x_2, y_2) and C(x_3, y_3). Given midpoints: D(5, 1), E(6, 5), and F(0, 5)

D is midpoint of BC, so using midpoint formula: $x_2 + x_3 = 10$ …… (1)
$y_2 + y_3 = 2$ …… (2)

E is midpoint of CA, therefore: $x_3 + x_1 = 12$ …… (3)
$y_3 + y_2 = 10$ …… (4)

F is midpoint of AB, therefore: $x_1 + x_2 = 0$ …… (5)
$y_1 + y_2 = 6$ …… (6)

Solving for x-coordinates, from (5): $x_2 = -x_1$

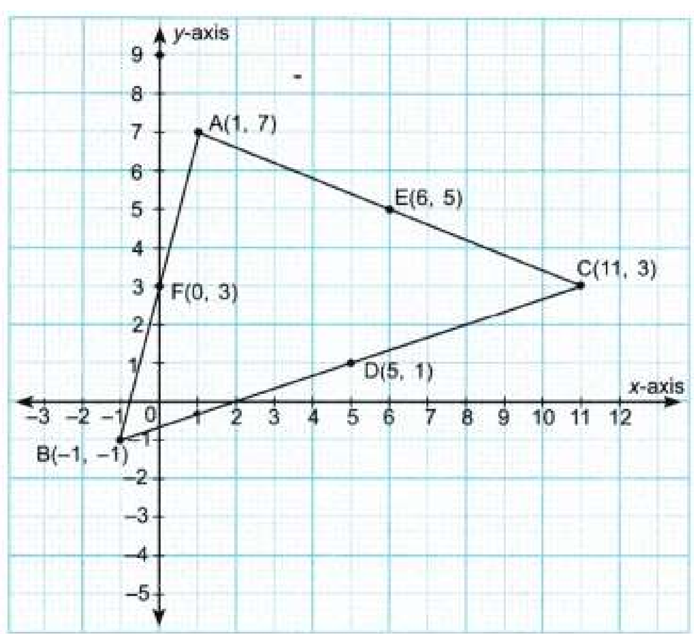
Substitute into (1): $- x_1 + x_3 = 10$
$\Rightarrow x_3 = 10 + x_1$ …(7)

Substituting into (3): $(10 + x_1) + x_1 = 12$
$\Rightarrow 2x_1 + 10 = 12$
$\Rightarrow 2x_1 = 2$
$\Rightarrow x_1 = 1$

Then: $x_2 = -1$ and $x_3 = 10 + 1 = 11$ from (7)
Solving y-coordinates, from (6):
$y_3 = 6 - y_1$

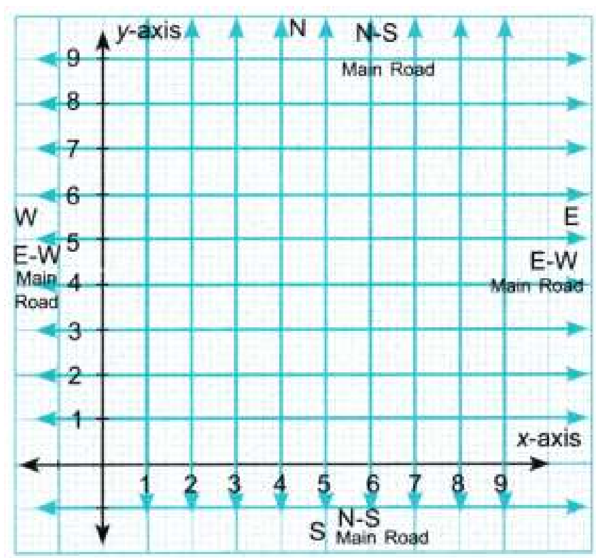
Substituting into (2): $(6 - y_1) + y_3 = 2$
$\Rightarrow y_3 = y_1 - 4$ …(8)

Substituting into (4): $(y_1 - 4) + y_1 = 10$
$\Rightarrow 2y_1 - 4 = 10$
$\Rightarrow 2y_1 = 14$
$\Rightarrow y_1 = 7$
Then $y_3 = 6 - 7 = -1$
$\Rightarrow y_2 = 7 - 4 = 3$ and $y_3 = 7 - 4 = 3$ from (8)
Therefore, the coordinates of the points are A(1, 7), B(-1, -1) and C(11, 3).



Question 14.
A city has two main roads which cross each other at the centre of the city. These two roads are along the North- South (N-S) direction and East-West (E-W) direction. All the other streets of the city run parallel to these roads and are 200 m apart. There are 10 streets in each direction. (i) Using 1 cm = 200 m, draw a model of the city in your notebook. Represent the roads/streets by single lines.

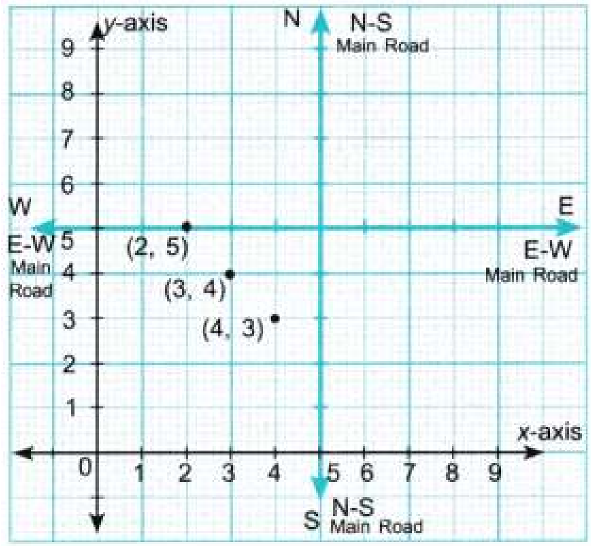
Solution:
Drawing the model of the city Since: 1 cm = 200 m Each pair of adjacent streets is 200 m apart. Given that: 10 streets in the N-S direction and 10 streets in the E-W direction Hence, the model will consist of: 10 vertical parallel lines (for N-S streets) 10 horizontal parallel lines (for E-W streets) Each consecutive line 1 cm apart, which forms a square grid.



(ii) There are street intersections in the model. Each street intersection is formed by two streets — one running in the N-S direction and another in the E-W direction. Each street intersection is referred to in the following manner: If the second street running in the N-S direction and 5th street in the E-W direction meet at some crossing, then we call this street intersection (2, 5). Using this convention, find: (a) how many street intersections can be referred to as (4, 3). (b) how many street intersections can be referred to as (3,4).

Solution:
A street intersection is named by: (first number, second number) = (N—S street number, E—W street number) (4, 3) represents the 4th N-S street and the 3rd E-W street (3,4) represents the 3rd N-S street and the 4th E-W street Now, one

N-S street and one E-W street can meet at only one point. Therefore: (a) Only one intersection can be called (4, 3). (b) Only one intersection can be called (3, 4).

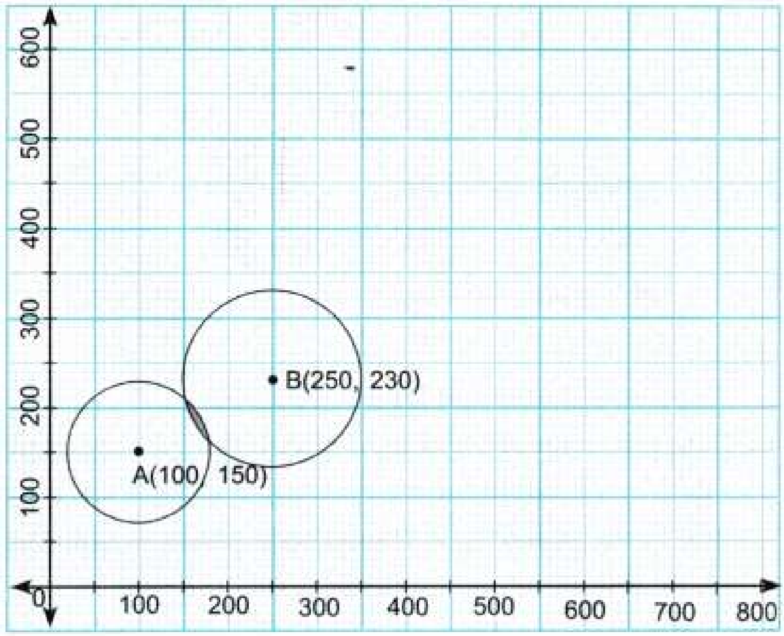


Question 15.

A computer graphics program displays images on a rectangular screen whose coordinate system has the origin at the bottom-left comer. The screen is 800 pixels wide and 600 pixels high. A circular icon of radius 80 pixels is drawn with its centre at the point A (100, 150). Another circular icon of radius 100 pixels is drawn with its centre at the point B (250, 230). Determine: (i) whether any part of either circle lies outside the screen. (ii) whether the two circles intersect each other.

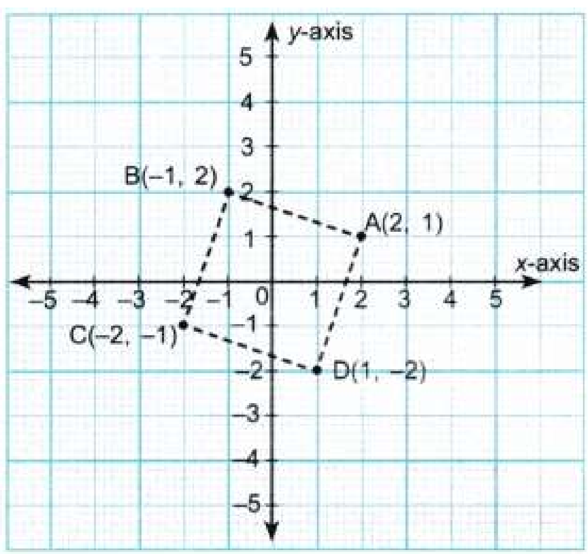
Solution:

(i) No. Each of the two circles lies inside the screen. (ii) Yes. The two circle intersect each other as shown.



Question 16.
Plot the points A (2, 1), B (-1, 2), C (-2, -1), and D (1, -2) in the coordinate plane. Is ABCD a square? Can you explain why? What is the area of this square?

Solution:



We can check it finding the lengths of sides and diagonals Finding the lengths of all sides:

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

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

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

DA = $\sqrt{(2-1)^2+\{1-(-2)\}^2}$
= $\sqrt{1^2+3^2}=\sqrt{1+9}=\sqrt{10}$ units All four sides are equal.

Now, finding diagonals AC = $\sqrt{(-2-2)^2+(-1-1)^2}$
= $\sqrt{(-4)^2+(-2)^2}=\sqrt{16+4}=\sqrt{20}$ units

BD = $\sqrt{\{1-(-1)\}^2+(-2-2)^2}$
= $\sqrt{2^2+(-4)^2}=\sqrt{4+16}=\sqrt{20}$ units
Diagonals AC and BD are equal.
All sides are equal and diagonals are equal, so ABCD is a square.
Area of square ABCD = $(\text{side})^2$ = $(\sqrt{10})^2$ = 10 square units.