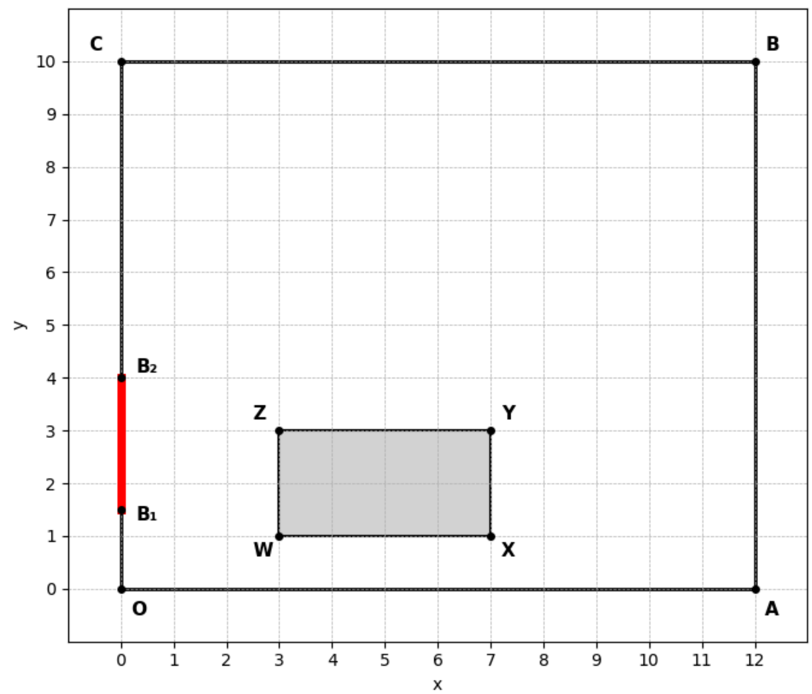
Case Study on Chapter 1: Orienting Yourself - The Use of Coordinates for Class 9

Case Study 1: Reiaan's Bedroom on a Grid

Shalini draws Reiaan's new bedroom on graph paper using a scale of 1 unit = 1 foot, placing one corner of the room at the origin. The room is a rectangle with corners O(0, 0), A(12, 0), B(12, 10), and C(0, 10). Along the left wall (the y-axis), the bathroom door is represented by two points, B_1(0, 1.5) and B_2(0, 4). The wardrobe is a rectangle with corners W(3, 1), X(7, 1), Y(7, 3), and Z(3, 3).



Questions:

(i) The coordinates of corner B of the room are:

(a) (0, 12) (b) (12, 10) (c) (10, 12) (d) (0, 0)

(ii) The bathroom door, B_1B_2, lies along which axis, and what does this tell you about its coordinates?

(iii) Find the width of the bathroom door using the coordinates of B_1 and B_2.

(iv) Using the coordinates of the wardrobe's corners, find its length and breadth. What is its area?

(v) A standard interior door is usually about 2.5 to 3 feet wide. Based on your answer to (iii), comment on whether the bathroom door is wide enough for someone using a wheelchair.

Solutions:
(i) The correct option is (b) (12, 10). Corner B is 12 units along the x-axis (the width of the room) and 10 units up along the y-axis (its length), which matches the rectangle O-A-B-C.

(ii) Both $B_1(0, 1.5)$ and $B_2(0, 4)$ have an x-coordinate of 0, so the segment B_1B_2 lies along the y-axis. The y-axis represents the left wall of the room, and the door is cut into that wall.

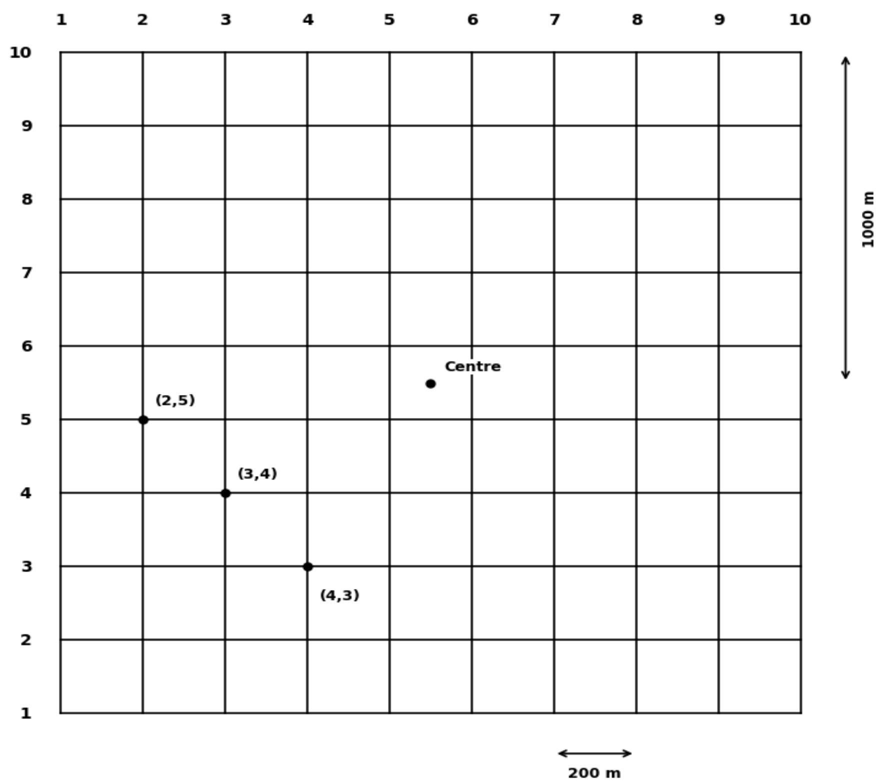
(iii) Since B_1 and B_2 lie on the same vertical line (the y-axis), the distance between them is simply the difference of their y-coordinates:
Width of door = $|4 – 1.5| = 2.5$ feet

(iv) Length WX = $|7 – 3| = 4$ feet
Breadth WZ = $|3 – 1| = 2$ feet
Area = length × breadth = $4 \times 2 = 8$ square feet

(v) A 2.5-feet-wide door is on the narrower side of the standard range. While it would work for most people, it could be a tight fit for a wheelchair, which typically needs close to 2.5–3 feet of clear width to pass through comfortably with some margin. So the answer is a reasonable 'it's workable, but a slightly wider door (closer to 3 feet) would make the room more accessible.'

Case Study 2: Planning a City's Street Grid

A city planner is laying out a new sector of a city. Two main roads cross at the centre of the sector, running north-south and east-west. In the new sector, the streets running north-south are numbered 1 to 10 from west to east, and the streets running east-west are numbered 1 to 10 from south to north. Each street intersection is named using an ordered pair (m, n), where m is the number of the north-south street and n is the number of the east-west street that meet at that point. All streets in the same direction are 200 m apart.



Questions:

(i) The intersection named (2, 5) is formed by:
(a) the 5th north-south street and the 2nd east-west street
(b) the 2nd north-south street and the 5th east-west street
(c) a point 2 m east and 5 m north of the centre
(d) none of these

(ii) How far apart, in metres, are two consecutive north-south streets?

(iii) Using a scale of 1 cm = 200 m, what length on the model would represent the distance from the centre to the 5th east-west street?

(iv) How many distinct intersections in this sector can be referred to as (4, 3)? Briefly justify your answer.

(v) Are the intersections (4, 3) and (3, 4) the same location? Use the idea of ordered pairs to explain your reasoning.

Solutions:

(i) By the definition given, the first number in the ordered pair refers to the north-south street, and the second to the east-west street. So (2, 5) is formed by the 2nd north-south street and the 5th east-west street. Correct option: (b).

(ii) Since all streets in the same direction are 200 m apart, two consecutive north-south streets are 200 m apart.

(iii) The distance from the centre to the 5th east-west street covers 5 gaps of 200 m each, i.e., $5 \times 200 = 1000$ m. Using the scale 1 cm = 200 m, this distance on the model would be $1000 \div 200 = 5$ cm.

(iv) Since each north-south street is numbered uniquely from 1 to 10, and each east-west street is numbered uniquely from 1 to 10, the 4th north-south street and the 3rd east-west street meet at exactly one point. So there is only one intersection that can be referred to as (4, 3).

(v) No, they are not the same location. (4, 3) is the meeting point of the 4th north-south street and the 3rd east-west street, while (3, 4) is the meeting point of the 3rd north-south street and the 4th east-west street, two different pairs of streets, and therefore two different intersections. This is the same idea the chapter raises with (x, y) and (y, x): an ordered pair (m, n) is only equal to (n, m) when $m = n$, and here $4 \neq 3$.