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FREE LEARNING NOTES FOR ZAMBIA

FORM 2

Mathematics

Coordinate geometry: the Cartesian plane

Lesson notes for learners · Competence-Based Curriculum

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Maps, the GPS on a phone and the grid used to plan a building all describe where something is by using numbers. Coordinate geometry joins algebra and geometry by using pairs of numbers to place points on a flat surface. This note shows how to describe a position and how to read and plot points on the Cartesian plane.

AFTER THESE NOTES YOU SHOULD BE ABLE TO

- Describe a location in more than one way
- Name the x-axis, the y-axis, the origin and the quadrants of the Cartesian plane
- Plot a point from an ordered pair (x, y)
- Read the coordinates of a point on the plane

KEY WORDS

coordinate geometry	the part of mathematics that places points on a plane using ordered pairs (x, y)
Cartesian plane	a system used to locate points on a plane, also called the XOY plane
x-axis	the horizontal number line
y-axis	the vertical number line
origin	the point where the two axes meet, where both x and y are zero
quadrant	one of the four parts into which the axes divide the plane
ordered pair	two numbers (x, y), with the x-coordinate first and the y-coordinate second

1 Describing where something is

Coordinate geometry is the part of mathematics that locates and describes the position of points on a plane using ordered pairs (x, y). It is used in maps and GPS, in architecture and engineering, in computer graphics and in the navigation systems of cars and aeroplanes.

There are several ways to describe a location in your school. You can give a relative position, such as next to the office or behind the classroom. You can give directions with landmarks, such as walk straight and turn left at the office. Or you can use a grid, where a place is named by a letter and a number, such as (C, 4). A grid gives a position that anyone can find without guessing.

Method	Example
Relative position	Next to the office, behind the classroom
Directions and landmarks	Walk straight, turn left at the office
Grid reference	(C, 4)

Figure 1. Three ways to describe a place at school

2 The Cartesian plane

The Cartesian plane is a system used to locate points on a plane. To make it, draw a horizontal number line and a vertical number line that cross each other. The horizontal line is the x-axis and the vertical line is the y-axis.

The point where the axes meet is the origin. At the origin both x and y are zero, so it is written (0, 0). It is the reference point for locating every other point on the plane. The two axes divide the plane into four parts called quadrants.

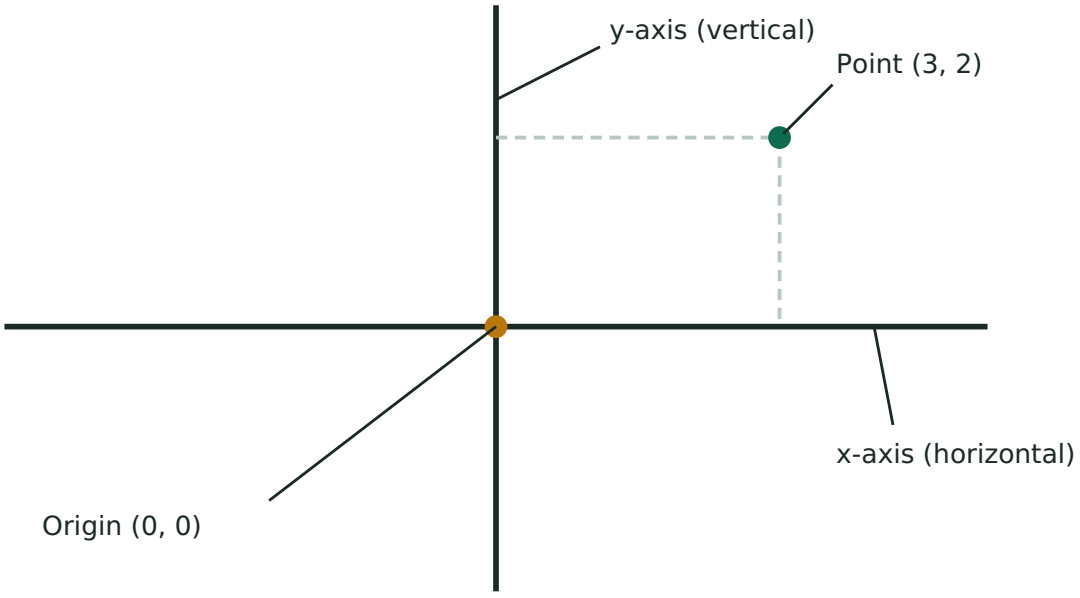

Figure 2. The Cartesian plane with the point (3, 2)

3 Plotting and reading ordered pairs

A point is written as an ordered pair (x, y). The x-coordinate always comes first and the y-coordinate second. The order matters, because (3, 2) and (2, 3) are different points.

To plot (3, 2), start at the origin, move 3 steps to the right along the x-axis, then 2 steps up. To read a point, count how many steps it is from the origin along the x-axis first, then up or down.

A good way to practise is a human coordinate plane. Mark a large grid on the ground, label the origin and the two axes, and let one learner stand on the origin. When the teacher calls out a move, such as 2 steps to the right and 3 steps up, the learner walks to that point.

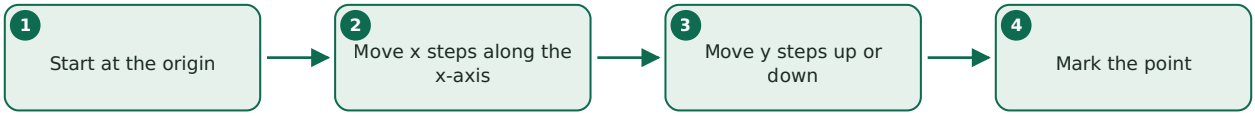

Figure 3. Plotting a point (x, y)

WORKED EXAMPLE

Learner A starts at the origin and moves 3 steps right, then 2 steps up. Learner B moves 3 steps up, then 2 steps right. Where does each learner stop?

Learner A: 3 right and 2 up, so the point is (3, 2)

Learner B: 2 right and 3 up, so the point is (2, 3)

The points are different, because the order of x and y matters

TRY THIS

In groups, draw a grid map of a part of your school, such as the classroom, with a letter along one side and a number along the other. Choose three places and describe each one in the three ways: relative position, directions with landmarks, and grid reference. Then write three clues for a hidden place and let another group follow them to find it. Discuss which method was the most accurate and which was the easiest to understand.

REMEMBER

- Coordinate geometry places points on a plane using ordered pairs (x, y).
- A location can be described by relative position, by directions and landmarks, or by a grid.
- The x-axis is horizontal and the y-axis is vertical.
- The axes meet at the origin (0, 0).
- The axes divide the plane into four quadrants.
- In an ordered pair the x-coordinate comes first, then the y-coordinate.

? Check yourself

1. Which axis is horizontal, and which is vertical?
2. What are the coordinates of the origin?
3. How many quadrants does the Cartesian plane have?
4. Starting at the origin, how do you plot the point (4, 1)?
5. Are (3, 2) and (2, 3) the same point? Explain.
6. Your group draws a grid map of your classroom. The door is at (A, 1), the teacher's desk is at (C, 4) and the window is at (E, 2). (a) Give the grid reference of the desk. (b) Describe the position of the desk to a visitor in two other ways. (c) Say which method you think is the most accurate and wh
7. In a human coordinate plane game on the school ground, the teacher tells learner A, who stands on the origin, to move 4 steps to the right and 3 steps up. Then learner B, also starting at the origin, is told to move 3 steps to the right and 4 steps up. (a) Write the ordered pair for each learner. (b

ANSWERS

1. The x-axis is horizontal and the y-axis is vertical.
2. (0, 0).
3. Four.
4. Move 4 steps right along the x-axis, then 1 step up.
5. No. In an ordered pair the x-coordinate comes first, so (3, 2) is 3 right and 2 up, while (2, 3) is 2 right and 3 up.
6. (a) (C, 4). (b) For example, relative position: the desk is at the front, in the middle of the room; directions: walk straight from the door and the desk is on the far side. (c) The grid reference, because it names one exact place and does not depend on the person guessing.
7. (a) Learner A is at (4, 3) and learner B is at (3, 4). (b) No, they stand at different places. (c) The order matters: the x-coordinate (steps right) comes first and the y-coordinate (steps up) second, so swapping them gives a different point.

Written by 25Schools to follow the Form 2 Mathematics syllabus of the Zambian competence-based curriculum. Free for learners to read, download and share. More notes and quizzes at 25schools.com.