The Coordinates Of The Vertices Of A Rectangle Are Given By R(- 3, - 4), E(- 3, 4), C (4, 4), And T (4,

Introduction

The Coordinates Of The Vertices Of A Rectangle Are Given By R(- 3, - 4), E(- 3, 4), C (4, 4), And T (4,. In coordinate geometry, understanding how to analyze and interpret the properties of geometric figures based on their vertices is essential. When given the vertices of a rectangle, the goal is often to determine various attributes such as side lengths, diagonals, area, perimeter, and the orientation of the figure in the coordinate plane. This article explores these concepts in depth, using the given vertices to illustrate key principles of rectangle analysis in the Cartesian plane.

Understanding the Given Coordinates

Listing the Vertices

The vertices provided are:

- R(-3, -4)
- E(-3, 4)
- C(4, 4)
- T(4, -4)

Plotting these points on the Cartesian plane reveals the shape's layout and allows for an initial understanding of its structure.

Visualizing the Rectangle

- The points R(-3, -4) and E(-3, 4) share the same x-coordinate (-3), indicating a vertical line segment.
- Similarly, points C(4, 4) and T(4, -4) share the same x-coordinate (4), forming another vertical side.

- The points R and T share the same y-coordinate (-4), suggesting a horizontal side.
- Points E and C share the same y-coordinate (4), forming the opposite horizontal side.

This arrangement suggests the figure is a rectangle aligned with the axes, with sides parallel to the x and y axes.

Identifying the Properties of the Rectangle

Determining the Lengths of the Sides

Calculating the distances between adjacent vertices helps verify the shape's nature:

- Length of segment RE:

Since R(-3, -4) and E(-3, 4) have the same x-coordinate:

$$
\text{RE} = |y_2 - y_1| = |4 - (-4)| = 8
$$

- Length of segment EC:

C(4, 4) and E(-3, 4):

$$
\text{EC} = |x_2 - x_1| = |4 - (-3)| = 7
$$

- Length of segment CT:

C(4, 4) and T(4, -4):

$$
\text{CT} = |y_2 - y_1| = |4 - (-4)| = 8
$$

- Length of segment TR:

T(4, -4) and R(-3, -4):

$$
\text{TR} = |x_2 - x_1| = |4 - (-3)| = 7
$$

Observation: Opposite sides are equal and parallel, confirming the figure's rectangle properties.

Verifying the Rectangle Properties

- Opposite sides are equal in length: RE and CT both measure 8 units; EC and TR both measure 7 units.
- Adjacent sides are perpendicular: The sides aligned vertically are perpendicular to the sides aligned horizontally.

Since the sides are parallel to the axes, the figure is a rectangle with sides parallel to the axes, making it an axis-aligned rectangle.

Calculating the Area and Perimeter

Area Calculation

The area of a rectangle is given by:

$$
\text{Area} = \text{length} \times \text{width}
$$

Using the side lengths:

$$
\text{Area} = 8 \times 7 = 56
$$

Therefore, the area of the rectangle is 56 square units.

Perimeter Calculation

The perimeter is the sum of all sides:

$$
\text{Perimeter} = 2 \times (\text{length} + \text{width}) = 2 \times (8 + 7) = 2 \times 15 = 30
$$

Hence, the perimeter of the rectangle is 30 units.

Determining the Coordinates of the Fourth Vertex

In coordinate geometry, when three vertices of a rectangle are known, the fourth can often be found by vector addition or by leveraging the properties of rectangles.

Method 1: Using the Parallelogram Law

Given three vertices, the fourth vertex D can be found by:

$$
D = R + C - E \quad \text{or} \quad D = E + R - C \quad \text{or} \quad D = E + C - R
$$

Testing these options:

- Using $D = R + C - E$:

$$
D_x = -3 + 4 - (-3) = -3 + 4 + 3 = 4
$$
$$
D_y = -4 + 4 - 4 = -4 + 4 - 4 = -4
$$

Result: $D(4, -4)$

- Checking with the other methods confirms that the fourth vertex is $D(4, -4)$, which coincides with point T.

Conclusion:

The points R, E, C, and T form a rectangle with vertices:

$$
\boxed{
\begin{aligned}
R(-3, -4), \\
E(-3, 4), \\
C(4, 4), \\
T(4, -4)
\end{aligned}
}
$$

Note:

- The point T is already given as (4, -4), confirming the rectangle's vertices.

Properties of the Rectangle in Coordinate

Geometry

Parallelism and Right Angles

- Since the sides are aligned with axes, the sides are parallel to the x and y axes.
- All interior angles are right angles, characteristic of rectangles.

Diagonal Lengths

The diagonals of a rectangle are equal in length. Calculating the diagonal:

- Diagonal between R(-3, -4) and C(4, 4):

$$
\text{Diagonal} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(4 - (-3))^2 + (4 - (-4))^2} = \sqrt{7^2 + 8^2} = \sqrt{49 + 64} = \sqrt{113} \approx 10.63
$$

- Diagonal between E(-3, 4) and T(4, -4):

$$
\text{Diagonal} = \sqrt{(4 - (-3))^2 + (-4 - 4)^2} = \sqrt{7^2 + (-8)^2} = \sqrt{49 + 64} = \sqrt{113} \approx 10.63
$$

The diagonals are equal, confirming the rectangle's properties.

Coordinate Geometry Applications and Insights

Finding the Center of the Rectangle

The center O of the rectangle can be found by averaging the x and y coordinates of opposite vertices:

$$
O_x = \frac{x_1 + x_3}{2} = \frac{-3 + 4}{2} = \frac{1}{2} = 0.5
$$

$$
O_y = \frac{y_1 + y_3}{2} = \frac{-4 + 4}{2} = 0
$$

Center coordinates: $(0.5, 0)$

This point is also the intersection point of the diagonals, which bisect each other in rectangles.

Line Equations of the Sides

Given the sides are aligned with axes, their equations are straightforward:

- Line RE: \(x = -3\)
- Line EC: \(y = 4\)
- Line CT: \(x = 4\)
- Line TR: \(y = -4\)

These equations exemplify the simplicity of axis-aligned rectangles in coordinate geometry.

Summary and Final Remarks

- The given vertices R, E, C, and T form an axis-aligned rectangle with sides of lengths 8 and 7 units.
- The area of this rectangle is 56 square units, and its perimeter is 30 units.
- The diagonals are equal, measuring approximately 10.63 units, and intersect at the rectangle's center at \((0.5, 0)\).
- The vertices are positioned such that the sides are parallel to the axes, simplifying many calculations.

Understanding how to analyze such rectangles in coordinate geometry is fundamental in various fields, including computer graphics, engineering, and mathematics. Recognizing the properties of rectangles based on vertex coordinates allows for efficient calculations of geometric attributes and provides a foundation for more complex geometric analyses.

In conclusion, the provided vertices delineate a well-defined rectangle with clear properties that can be systematically analyzed using coordinate geometry principles,

Frequently Asked Questions

How can we verify if the points R(-3, -4), E(-3, 4), C(4, 4), and T(4, -4) form a rectangle?

To verify, check if opposite sides are equal and parallel. Calculate the slopes of adjacent sides; if pairs of opposite sides are equal in length and have the same slope, the figure is a rectangle. For these points, the sides RE and CT are vertical and equal in length, and the sides EC and RT are horizontal and equal in length, confirming a rectangle.

What are the lengths of the sides of the rectangle formed by points R, E, C, and T?

The length of RE (and CT) is 8 units, calculated as |4 - (-4)| = 8. The length of EC (and RT) is 7 units, calculated as |4 - (-3)| = 7.

How do you find the coordinates of the fourth vertex T if you know R, E, and C?

Given three vertices R, E, and C, you can find T by using the parallelogram rule or vector addition. Since the points form a rectangle, T can be found as T = C + (E - R). Substituting, T = (4, 4) + ((-3, 4) - (-3, -4)) = (4, 4) + (0, 8) = (4, 12).

What is the area of the rectangle with vertices R(-3, -4), E(-3, 4), C(4, 4), and T(4, -4)?

The area is calculated as length × width. Length (vertical side) is 8 units, and width (horizontal side) is 7 units. So, area = 8 × 7 = 56 square units.

What are the coordinates of the centroid of the rectangle formed by these points?

The centroid is the average of the x-coordinates and y-coordinates of all vertices. Centroid X = (-3 + -3 + 4 + 4) / 4 = 0, Centroid Y = (-4 + 4 + 4 + -4) / 4 = 0. So, the centroid is at (0, 0).

Additional Resources

The Coordinates of the Vertices of a Rectangle Are Given By R(-3, -4), E(-3, 4), C(4, 4), And T(4, -4): A Comprehensive Guide

Understanding how to analyze and verify the coordinates of a rectangle’s vertices is fundamental in coordinate geometry. When the vertices are given as R(-3, -4), E(-3, 4), C(4, 4), and T(4, -4), it provides an excellent opportunity to explore geometric properties, verify the shape, and understand the underlying principles of coordinate analysis. This guide aims to walk you through the step-by-step process of analyzing these points to confirm the shape, find its dimensions, and understand its properties.

Introduction to Coordinate Geometry and Rectangles

Coordinate geometry allows us to analyze geometric shapes using the coordinate plane. Each point is identified by a pair of numbers (x, y) representing its position along the horizontal (x-axis) and vertical (y-axis) axes.

Why Focus on Rectangles?

Rectangles are parallelograms with four right angles, and their properties make them particularly easy to analyze in the coordinate plane:
- Opposite sides are equal and parallel.
- All angles are 90 degrees.
- The diagonals bisect each other and are equal in length.

Given the vertices, our goal is to confirm whether these points indeed form a rectangle and to understand its dimensions and properties.

Step 1: Visualize and Plot the Points

First, let’s understand the positions of the points:

- R(-3, -4): Located 3 units left of the y-axis and 4 units below the x-axis.
- E(-3, 4): Same x-coordinate as R, but 4 units above the x-axis.
- C(4, 4): 4 units right of the y-axis and 4 units above the x-axis.
- T(4, -4): Same x-coordinate as C, but 4 units below the x-axis.

Notice that points R and E share the same x-coordinate (-3), and points C and T share the same x-coordinate (4). Similarly, R and T share the same y-coordinate (-4), and E and C share the same y-coordinate (4). This suggests that the points are aligned to form a rectangle.

Step 2: Confirming the Shape—Verifying the Rectangular Nature

2.1 Calculating the Lengths of Opposite Sides

To confirm the shape, calculate the distances between the points:

- Distance between R and E: Vertical side
- Distance between E and C: Horizontal side
- Distance between C and T: Vertical side
- Distance between T and R: Horizontal side

Distance formula:

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

2.2 Computing Each Side

- R(-3, -4) and E(-3, 4):

$$
d_{RE} = \sqrt{(-3 + 3)^2 + (4 + 4)^2} = \sqrt{0^2 + 8^2} = \sqrt{64} = 8
$$

- E(-3, 4) and C(4, 4):

$$
d_{EC} = \sqrt{(4 + 3)^2 + (4 - 4)^2} = \sqrt{7^2 + 0^2} = \sqrt{49} = 7
$$

- C(4, 4) and T(4, -4):

$$
d_{CT} = \sqrt{(4 - 4)^2 + (-4 - 4)^2} = \sqrt{0^2 + (-8)^2} = \sqrt{64} = 8
$$

- T(4, -4) and R(-3, -4):

$$
d_{TR} = \sqrt{(-3 + 3)^2 + (-4 + 4)^2} = \sqrt{0^2 + 0^2} = 0
$$

Wait — that indicates zero length, which suggests an error. Let's re-express the calculations carefully for T and R:

$$
d_{TR} = \sqrt{(-3 - 4)^2 + (-4 + 4)^2} = \sqrt{(-7)^2 + 0^2} = \sqrt{49} = 7
$$

Correction: The previous calculation mistakenly set the points as same x-coordinate, but from the points, T(4, -4) and R(-3, -4):

$$
d_{TR} = \sqrt{(4 - (-3))^2 + (-4 - (-4))^2} = \sqrt{(7)^2 + 0^2} = 7
$$

Now, the side lengths:

Side	Points	Length
R-E	R(-3,-4) and E(-3,4)	8 units (vertical)
E-C	E(-3,4) and C(4,4)	7 units (horizontal)
C-T	C(4,4) and T(4,-4)	8 units (vertical)
T-R	T(4,-4) and R(-3,-4)	7 units (horizontal)

2.3 Confirming Parallel Sides and Right Angles

- Opposite sides are equal: R–E and C–T both 8 units; E–C and T–R both 7 units.
- The sides are aligned horizontally and vertically, indicating that the shape is a rectangle.

2.4 Checking the Slopes of Adjacent Sides

- Slope of R–E:

\[

$$
m_{RE} = \frac{4 - (-4)}{-3 - (-3)} = \frac{8}{0} \implies \text{undefined (vertical line)}
$$

- Slope of E–C:

$$
m_{EC} = \frac{4 - 4}{4 - (-3)} = \frac{0}{7} = 0 \quad \text{(horizontal line)}
$$

- Slope of C–T:

$$
m_{CT} = \frac{-4 - 4}{4 - 4} = \frac{-8}{0} \implies \text{undefined}
$$

- Slope of T–R:

$$
m_{TR} = \frac{-4 - (-4)}{-3 - 4} = \frac{0}{-7} = 0
$$

Since adjacent sides are perpendicular (vertical and horizontal), and the sides are equal in pairs, these points form a rectangle aligned with the axes.

Step 3: Determining the Coordinates of the Center and Diagonals

3.1 Finding the Center

The center of the rectangle is the midpoint of either diagonal.

- Diagonal R–C:

$$
\text{Midpoint} = \left(\frac{-3 + 4}{2}, \frac{-4 + 4}{2} \right) = \left(\frac{1}{2}, 0 \right)
$$

- Diagonal E–T:

$$
\text{Midpoint} = \left(\frac{-3 + 4}{2}, \frac{4 + (-4)}{2} \right) = \left(\frac{1}{2}, 0 \right)
$$

Both diagonals share the same midpoint, confirming the points form a rectangle centered at (0.5, 0).

3.2 Lengths of the Diagonals

- R–C:

$$
d_{RC} = \sqrt{(4 - (-3))^2 + (4 - (-4))^2} = \sqrt{7^2 + 8^2} = \sqrt{49 + 64} = \sqrt{113} \approx 10.63
$$

- E–T:

$$
d_{ET} = \sqrt{(4 - (-3))^2 + (-4 - 4)^2} = \sqrt{7^2 + (-8)^2} = \sqrt{49 + 64} = \sqrt{113} \approx 10.63
$$

The diagonals are equal, confirming the shape is a rectangle.

Step 4: Summary of Properties

Based on the calculations:

- Opposite sides are equal and parallel.
- All angles are right angles (since sides are aligned with axes).
- Diagonals are equal in length.
- The shape is axis-aligned, with vertices at R(-3, -4), E(-3, 4), C(4, 4), and T(4, -4).

Conclusion: The Coordinates of the Vertices of a Rectangle Are Given By R(-3, -4), E(-3, 4), C(4, 4), And T(4, -4)

This set of points confirms a rectangle aligned with the coordinate axes, with vertices at the specified points. Its dimensions are 7 units wide (horizontal sides) and

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