

The Coordinates Of The Vertices Of Quadrilateral CDEF Are C(6, 6), D(6, 8), E(8, 10), And F(10, 8). The

The Coordinates Of The Vertices Of Quadrilateral CDEF Are C(6, 6), D(6, 8), E(8, 10), And F(10, 8). The understanding of these coordinate points is essential in analyzing the properties, shape, and characteristics of the quadrilateral they form. In this comprehensive guide, we will explore how to interpret these vertices, analyze the shape's geometry, calculate various properties such as area, perimeter, and angles, and understand how coordinate geometry helps in visualizing and solving problems related to quadrilaterals.

Understanding the Coordinates of Quadrilateral CDEF

What Do the Coordinates Represent?

The coordinates given—C(6, 6), D(6, 8), E(8, 10), and F(10, 8)—are points plotted on a Cartesian plane. Each point has an x-coordinate (horizontal position) and a y-coordinate (vertical position). These points serve as the vertices of the quadrilateral CDEF.

- C(6, 6): Located 6 units along the x-axis and 6 units along the y-axis.
- D(6, 8): Same x-coordinate as C, but 8 units along the y-axis.
- E(8, 10): Located 8 units along x and 10 units along y.
- F(10, 8): Located 10 units along x and 8 units along y.

Understanding these points allows us to visualize the shape and analyze its properties systematically.

Plotting and Visualizing Quadrilateral CDEF

Plotting the Points

Plotting the points on a Cartesian plane provides a visual representation:

- Start by marking the point C at (6, 6).
- Mark D at (6, 8), directly above C.
- Mark E at (8, 10), to the right and above D.
- Mark F at (10, 8), to the right of E and below it.

Connecting these points sequentially ($C \rightarrow D \rightarrow E \rightarrow F \rightarrow C$) forms the quadrilateral.

Shape Analysis

Plotting these points reveals a quadrilateral that appears to be a trapezoid or irregular quadrilateral with one pair of parallel sides. To confirm this, we analyze the slopes of the sides.

Analyzing the Properties of Quadrilateral CDEF

Calculating the Slopes of the Sides

The slope of a line segment between two points (x_1, y_1) and (x_2, y_2) is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Let's compute the slopes of each side:

- Side CD: between C(6,6) and D(6,8)

$$m_{\{CD\}} = \frac{8 - 6}{6 - 6} = \frac{2}{0} \rightarrow \text{Undefined (vertical line)}$$

- Side DE: between D(6,8) and E(8,10)

$$m_{\{DE\}} = \frac{10 - 8}{8 - 6} = \frac{2}{2} = 1$$

- Side EF: between E(8,10) and F(10,8)

$$m_{\{EF\}} = \frac{8 - 10}{10 - 8} = \frac{-2}{2} = -1$$

- Side FC: between F(10,8) and C(6,6)

$$m_{\{FC\}} = \frac{6 - 8}{6 - 10} = \frac{-2}{-4} = \frac{1}{2}$$

Summary:

Side	Coordinates	Slope	Type
CD	(6,6) to (6,8)	∞	Vertical side
DE	(6,8) to (8,10)	1	Diagonal
EF	(8,10) to (10,8)	-1	Diagonal
FC	(10,8) to (6,6)	$1/2$	Sloped side

Determining the Shape and Classification

Parallel Sides and Type of Quadrilateral

From the slopes:

- Side CD is vertical.
- Side EF has a slope of -1.
- Side DE has a slope of 1.
- Side FC has a slope of $1/2$.

Since CD is vertical and DE has a slope of 1, they are not parallel. EF's slope of -1 is not parallel to DE or FC. Side FC with slope $1/2$ is different from the others.

Conclusion:

The quadrilateral CDEF does not have any pair of sides that are clearly parallel, indicating it is an irregular quadrilateral, possibly a trapezoid if any pair of sides is parallel, but in this case, it is irregular with no parallel sides.

Calculating the Area of Quadrilateral CDEF

Using the Shoelace Theorem

The shoelace formula provides an efficient way to calculate the area of a polygon when vertices are known:

$$\text{Area} = \frac{1}{2} \left| (x_1 y_2 + x_2 y_3 + \dots + x_{n-1} y_n + x_n y_1) - (y_1 x_2 + y_2 x_3 + \dots + y_{n-1} x_n + y_n x_1) \right|$$

Applying to points C(6,6), D(6,8), E(8,10), F(10,8):

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\begin{aligned}
\text{Sum 1} &= (6 \times 8) + (6 \times 10) + (8 \times 8) + (10 \times 6) \\
&= 48 + 60 + 64 + 60 = 232 \\
\text{Sum 2} &= (6 \times 6) + (8 \times 8) + (10 \times 10) + (8 \times 6) \\
&= 36 + 64 + 100 + 48 = 248
\end{aligned}

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Now,

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\text{Area} = \frac{1}{2} |232 - 248| = \frac{1}{2} \times 16 = 8

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Result:

The area of quadrilateral CDEF is 8 square units.

Calculating the Perimeter of Quadrilateral CDEF

To find the perimeter, compute the lengths of all sides:

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

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- CD:

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d_{CD} = \sqrt{(6 - 6)^2 + (8 - 6)^2} = \sqrt{0 + 4} = 2

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- DE:

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d_{DE} = \sqrt{(8 - 6)^2 + (10 - 8)^2} = \sqrt{4 + 4} = \sqrt{8} \approx 2.83

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- EF:

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d_{EF} = \sqrt{(10 - 8)^2 + (8 - 10)^2} = \sqrt{4 + 4} = \sqrt{8} \approx 2.83

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- FC:

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d_{FC} = \sqrt{(10 - 6)^2 + (8 - 6)^2} = \sqrt{16 + 4} = \sqrt{20} \approx 4.47

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Perimeter:

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$$P \approx 2 + 2.83 + 2.83 + 4.47 \approx 12.13 \text{ units}$$

\]

Angles and Other Properties

Calculating Interior Angles

Using vector dot products or coordinate geometry, we can determine the measure of interior angles at each vertex.

For example, at vertex D(6,8):

- Vectors:

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$$\vec{DC} = (6 - 6, 6 - 8) = (0, -2)$$

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$$\vec{DE} = (8 - 6, 10 - 8) = (2, 2)$$

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- Dot product:

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$$\vec{DC} \cdot \vec{DE} = (0)(2) + (-2)(2) = 0 - 4 = -4$$

\]

- Magnitudes:

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$$|\vec{DC}| = 2, \quad |\vec{DE}| = \sqrt{2^2 + 2^2} =$$

Frequently Asked Questions

What are the coordinates of the vertices of quadrilateral CDEF?

C(6, 6), D(6, 8), E(8, 10), and F(10, 8).

How can you determine if quadrilateral CDEF is a square, rectangle, or other type?

By calculating the distances between vertices to find side lengths and checking angles using slopes or the dot product to identify right angles.

What is the length of side CD in quadrilateral CDEF?

Using the distance formula: $CD = \sqrt{(6-6)^2 + (8-6)^2} = \sqrt{0 + 4} = 2$.

Are any sides of quadrilateral CDEF parallel?

Yes, side CD is vertical and side EF is horizontal, so they are parallel to the y-axis and x-axis respectively.

What is the area of quadrilateral CDEF?

The area can be found using the shoelace formula or by dividing it into triangles; for this quadrilateral, the area is 16 square units.

Is quadrilateral CDEF a parallelogram?

Since both pairs of opposite sides are not parallel (based on slopes), it is not a parallelogram.

What is the shape of quadrilateral CDEF based on its vertices?

Given the coordinates, it appears to be an irregular quadrilateral, possibly a trapezoid, since one pair of sides appears parallel.

How can you verify the type of quadrilateral CDEF using coordinate geometry?

Calculate side lengths and slopes to check for equal sides or parallel sides, and verify angles, to classify the quadrilateral accurately.

Additional Resources

The Coordinates of the Vertices of Quadrilateral CDEF Are C(6, 6), D(6, 8), E(8, 10), and F(10, 8): A Comprehensive Geometric Analysis

Understanding the properties and characteristics of a quadrilateral based on its vertices is a fundamental aspect of coordinate geometry. In particular, analyzing the quadrilateral with the vertices C(6, 6), D(6, 8), E(8, 10), and F(10, 8) involves exploring its shape, sides, angles, and area. This article provides a detailed breakdown of this specific quadrilateral, offering insights into how to interpret its geometric features from the given coordinates. Whether you're a student, educator, or enthusiast, this guide aims to deepen your understanding of coordinate-based shape analysis.

Introduction to Coordinate Geometry and Quadrilaterals

Coordinate geometry, also known as analytic geometry, involves representing geometric figures through algebraic equations and coordinate pairs. This approach allows precise calculations of lengths, slopes, midpoints, and areas, facilitating a rigorous analysis of geometric shapes.

A quadrilateral is a four-sided polygon, and its properties can vary widely—from rectangles and squares to irregular shapes. The key to understanding any quadrilateral lies in examining its vertices' coordinates, which helps determine its classification, symmetry, and other attributes.

Step 1: Listing the Given Coordinates

The first step in analyzing quadrilateral CDEF is to clearly list its vertices:

- C(6, 6)
- D(6, 8)
- E(8, 10)
- F(10, 8)

Plotting these points on the Cartesian plane provides an initial visual understanding of the shape. Alternatively, one can analyze the coordinates algebraically to infer properties.

Step 2: Visualizing the Quadrilateral

Plotting the points:

- C(6, 6): Located at 6 units right of the origin along the x-axis and 6 units up along the y-axis.
- D(6, 8): Directly above C, at the same x-coordinate but higher y-coordinate.
- E(8, 10): To the right and above D.
- F(10, 8): Further to the right and at a similar height as D.

Connecting these points in order (C → D → E → F → C) produces the quadrilateral. The shape appears to be a convex quadrilateral with some symmetry, but to confirm, calculations are necessary.

Step 3: Calculating Lengths of Sides

The side lengths are foundational in understanding the shape's classification. The distance formula between two points $((x_1, y_1))$ and $((x_2, y_2))$ is:

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

Applying this to each side:

Side CD:

$$d_{\{CD\}} = \sqrt{(6 - 6)^2 + (8 - 6)^2} = \sqrt{0 + 4} = 2$$

Side DE:

$$d_{\{DE\}} = \sqrt{(8 - 6)^2 + (10 - 8)^2} = \sqrt{4 + 4} = \sqrt{8} \approx 2.83$$

Side EF:

$$d_{\{EF\}} = \sqrt{(10 - 8)^2 + (8 - 10)^2} = \sqrt{4 + 4} = \sqrt{8} \approx 2.83$$

Side FC:

$$d_{\{FC\}} = \sqrt{(6 - 10)^2 + (6 - 8)^2} = \sqrt{16 + 4} = \sqrt{20} \approx 4.47$$

Summary of side lengths:

- CD $\approx$ 2 units
- DE $\approx$ 2.83 units
- EF $\approx$ 2.83 units
- FC $\approx$ 4.47 units

This indicates that side FC is notably longer than the other sides, which can influence the shape's classification.

Step 4: Calculating Slopes to Understand the Shape

The slope of a line segment indicates its inclination and helps determine whether sides are parallel or perpendicular.

The slope formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Calculating for each side:

Slope of CD:

$$m_{\{CD\}} = \frac{8 - 6}{6 - 6} = \frac{2}{0} \rightarrow \text{undefined (vertical line)}$$

Slope of DE:

$$m_{DE} = \frac{10 - 8}{8 - 6} = \frac{2}{2} = 1$$

Slope of EF:

$$m_{EF} = \frac{8 - 10}{10 - 8} = \frac{-2}{2} = -1$$

Slope of FC:

$$m_{FC} = \frac{6 - 8}{6 - 10} = \frac{-2}{-4} = 0.5$$

Step 5: Analyzing Parallelism and Perpendicularity

- CD is vertical; its slope is undefined.
- DE has slope 1.
- EF has slope -1.
- FC has slope 0.5.

Check for parallel sides:

- DE and EF: slopes are 1 and -1 → not parallel.
- DE and FC: slopes are 1 and 0.5 → not parallel.
- EF and FC: slopes are -1 and 0.5 → not parallel.
- CD is vertical, while others are not, so no sides are parallel unless explicitly checked.

Since none of the sides share the same slope (except when explicitly parallel), the quadrilateral is irregular and not a special type like a rectangle or parallelogram.

Step 6: Calculating the Area

One efficient way to find the area of a quadrilateral given its vertices is to use the shoelace formula (also known as Gauss's area formula):

$$\text{Area} = \frac{1}{2} \left| x_1 y_2 + x_2 y_3 + x_3 y_4 + x_4 y_1 - (y_1 x_2 + y_2 x_3 + y_3 x_4 + y_4 x_1) \right|$$

Assigning the vertices in order:

- C(6, 6)
- D(6, 8)
- E(8, 10)

- $(F(10, 8))$

Calculations:

```
\[
\begin{aligned}
\text{Sum1} &= (6)(8) + (6)(10) + (8)(8) + (10)(6) \\
&= 48 + 60 + 64 + 60 = 232 \\
\text{Sum2} &= (6)(6) + (8)(8) + (10)(10) + (8)(6) \\
&= 36 + 64 + 100 + 48 = 248
\end{aligned}
\]
```

Thus,

```
\[
\text{Area} = \frac{1}{2} | 232 - 248 | = \frac{1}{2} \times 16 = 8
\]
```

The area of quadrilateral CDEF is 8 square units.

Step 7: Shape Classification and Summary

Based on the calculations and visual analysis:

- The quadrilateral is convex, as all interior angles are less than 180 degrees, and the vertices are ordered correctly.
- No sides are parallel, indicating it's not a parallelogram, rectangle, or square.
- The shape resembles an irregular quadrilateral with one notably longer side (FC).

Additional Insights and Practical Applications

Symmetry and Special Properties

While the shape does not display classic symmetry or fall into standard categories (like rectangles or rhombuses), understanding its properties can be useful in various contexts, such as:

- Design and architecture: Recognizing irregular shapes helps in optimizing space.
- Navigation and mapping: Coordinate analysis assists in plotting and understanding spatial relationships.
- Mathematical education: Serves as a practical example of applying coordinate geometry formulas.

Using Coordinates for Further Analysis

Beyond the basic calculations, one can explore:

- Diagonals: Calculating their lengths and slopes.

- Angles: Using vector dot products to find interior angles.
- Centroid: Finding the shape's center point using average of vertices.

Conclusion

Analyzing the quadrilateral with vertices C(6, 6), D(6, 8), E(8, 10), and F(10, 8) showcases how coordinate geometry principles can be employed to uncover its properties thoroughly. From side lengths and slopes to area and shape classification, each step offers valuable insights. Such detailed analysis not only enhances geometric understanding but also equips learners and professionals

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