A Triangle Has Vertices Of (1, 2) (3, 1) (-2, -1) What Is The Perimeter Of The Triangle, Rounded To The

A Triangle Has Vertices Of (1, 2), (3, 1), (-2, -1). What Is The Perimeter Of The Triangle, Rounded To The

Understanding the perimeter of a triangle given its vertices involves calculating the lengths of its sides using the coordinate plane. The vertices provided are (1, 2), (3, 1), and (-2, -1). To find the perimeter, we need to determine the distances between each pair of these points, then sum these distances. This process involves applying the distance formula derived from the Pythagorean theorem, which is essential in coordinate geometry for calculating the length of a segment between two points.

Understanding the Coordinates and the Distance Formula

Coordinates of the Triangle's Vertices

The vertices of the triangle are given as:
- Point A: (1, 2)
- Point B: (3, 1)
- Point C: (-2, -1)

These points reside on the Cartesian plane, with the x-coordinate indicating the horizontal position and the y-coordinate indicating the vertical position.

The Distance Formula

To find the length of the side between any two points, say (x_1, y_1) and (x_2, y_2), we use the distance formula:

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

This formula arises from the Pythagorean theorem, which relates the lengths of the sides of a right triangle.

Calculating the Lengths of the Sides

Side AB: Distance Between (1, 2) and (3, 1)

Applying the distance formula:

$$
d_{AB} = \sqrt{(3 - 1)^2 + (1 - 2)^2} = \sqrt{(2)^2 + (-1)^2} = \sqrt{4 + 1} = \sqrt{5}
$$

Numerically, $\sqrt{5} \approx 2.236$.

Side BC: Distance Between (3, 1) and (-2, -1)

Applying the distance formula:

$$
d_{BC} = \sqrt{(-2 - 3)^2 + (-1 - 1)^2} = \sqrt{(-5)^2 + (-2)^2} = \sqrt{25 + 4} = \sqrt{29}
$$

Numerically, $\sqrt{29} \approx 5.385$.

Side CA: Distance Between (-2, -1) and (1, 2)

Applying the distance formula:

$$
d_{CA} = \sqrt{(1 - (-2))^2 + (2 - (-1))^2} = \sqrt{(3)^2 + (3)^2} = \sqrt{9 + 9} = \sqrt{18}
$$

Numerically, $\sqrt{18} \approx 4.243$.

Calculating the Perimeter

Summing the Lengths of the Sides

The perimeter P of the triangle is sum of all three side lengths:

$$
P = d_{AB} + d_{BC} + d_{CA}
$$

Using the approximate values:

$$
P \approx 2.236 + 5.385 + 4.243
$$

Adding these:

$$
P \approx 11.864
$$

Rounding the Perimeter

Depending on the required precision, the perimeter can be rounded to the nearest whole number, tenth, or other decimal places. For instance, rounded to the nearest whole number:

$$
P \approx 12
$$

If the instruction specifies rounding to a specific decimal place, adjust accordingly. Here, we'll round to two decimal places:

$$
\boxed{\text{Perimeter} \approx 11.86}
$$

Conclusion and Summary

Calculating the perimeter of a triangle when given its vertices involves understanding the coordinate plane and applying the distance formula to each pair of vertices. In this specific case, the vertices are at (1, 2), (3, 1), and (-2, -1). The computed side lengths are approximately:

- AB: $\sqrt{5} \approx 2.236$
- BC: $\sqrt{29} \approx 5.385$
- CA: $\sqrt{18} \approx 4.243$

Adding these gives an approximate perimeter of 11.86 units, rounded to two decimal places. This process demonstrates how coordinate geometry provides a straightforward method to calculate the perimeter of a triangle when the vertices are known. Mastery of the distance formula and careful calculation are essential in solving such geometric problems efficiently.

Additional Tips for Calculating Perimeter in Coordinate Geometry

- Always double-check the coordinates before plugging into the formula.
- Use a calculator for square roots and addition to improve accuracy.
- Remember to write the final answer with appropriate rounding based on the problem requirements.
- Visualize the points on the coordinate plane to better understand the triangle's shape and orientation.

Frequently Asked Questions

How do I find the perimeter of a triangle with vertices at (1, 2), (3, 1), and

(-2, -1)?

To find the perimeter, calculate the distances between each pair of vertices using the distance formula, then sum those lengths.

What is the distance formula used for calculating the sides of the triangle?

The distance between two points (x_1, y_1) and (x_2, y_2) is ⍰ $[(x_2 - x_1)^2 + (y_2 - y_1)^2]$.

How do I compute the length of side between (1, 2) and (3, 1)?

Distance = ⍰ $[(3 - 1)^2 + (1 - 2)^2]$ = ⍰ $[4 + 1]$ = ⍰ $5 \approx 2.236$.

What is the length of the side between (3, 1) and (-2, -1)?

Distance = ⍰ $[(-2 - 3)^2 + (-1 - 1)^2]$ = ⍰ $[25 + 4]$ = ⍰ $29 \approx 5.385$.

How do I find the length of the side between (1, 2) and (-2, -1)?

Distance = ⍰ $[(-2 - 1)^2 + (-1 - 2)^2]$ = ⍰ $[9 + 9]$ = ⍰ $18 \approx 4.243$.

Once I have all three side lengths, how do I find the perimeter of the triangle?

Add the three side lengths together: perimeter = side1 + side2 + side3.

What is the approximate perimeter of the triangle with given vertices?

Perimeter $\approx 2.236 + 5.385 + 4.243 \approx 11.864$ units; rounded to two decimal places, it's 11.86.

Should I round the perimeter to the nearest whole number or decimal?

Typically, you round to the desired decimal place; in most cases, rounding to two decimal places is standard unless specified otherwise.

Can I verify the calculations using a graphing tool or calculator?

Yes, graphing tools or scientific calculators can help verify the distances and the perimeter calculations for accuracy.

Additional Resources

A Triangle Has Vertices Of (1, 2), (3, 1), (-2, -1). What Is The Perimeter Of The Triangle, Rounded To The? Understanding the perimeter of a triangle with given vertices is a fundamental problem in coordinate geometry. This involves calculating the distances between each pair of vertices and summing these lengths to find the total perimeter. In this guide, we will explore the detailed process of computing the perimeter of a triangle with vertices at (1, 2), (3, 1), and (-2, -1), providing step-by-step instructions, formulas, and insights to help you master this concept.

Introduction to Perimeter Calculation in Coordinate Geometry

In coordinate geometry, the perimeter of a triangle can be determined by calculating the distances between each pair of vertices and then summing these distances. The vertices are given as points in the Cartesian plane, and the key task is to find the length of each side using the distance formula.

Why Is This Important?

Knowing how to compute the perimeter from coordinates is essential for various applications, including:

- Geometry and trigonometry problems
- Real-world measurements in engineering and design
- Computer graphics and modeling
- Mathematical competitions and exams

Step-by-Step Guide to Find the Perimeter

Step 1: List the Coordinates of the Vertices

The vertices of the triangle are given as:

- A: (1, 2)
- B: (3, 1)
- C: (-2, -1)

Our goal is to find the lengths of sides AB, BC, and CA, then sum these lengths.

Step 2: Recall the Distance Formula

The distance d between two points (x_1, y_1) and (x_2, y_2) is given by:

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

This formula is derived from the Pythagorean theorem and is fundamental in coordinate geometry.

Step 3: Calculate Each Side Length

Now, we'll compute each side:

Side AB: Between points (1, 2) and (3, 1)

$$
AB = \sqrt{(3 - 1)^2 + (1 - 2)^2} = \sqrt{(2)^2 + (-1)^2} = \sqrt{4 + 1} = \sqrt{5}
$$

Side BC: Between points (3, 1) and (-2, -1)

$$
BC = \sqrt{(-2 - 3)^2 + (-1 - 1)^2} = \sqrt{(-5)^2 + (-2)^2} = \sqrt{25 + 4} = \sqrt{29}
$$

Side CA: Between points (-2, -1) and (1, 2)

$$
CA = \sqrt{(1 - (-2))^2 + (2 - (-1))^2} = \sqrt{(3)^2 + (3)^2} = \sqrt{9 + 9} = \sqrt{18}
$$

Step 4: Simplify the Lengths

Express the lengths in simplest radical form:

- $AB = \sqrt{5}$
- $BC = \sqrt{29}$
- $CA = \sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}$

Step 5: Compute the Perimeter

Sum the lengths:

$$
\text{Perimeter} = AB + BC + CA = \sqrt{5} + \sqrt{29} + 3\sqrt{2}
$$

Since these are irrational numbers, the perimeter can be approximated to a decimal value for practical purposes.

Step 6: Approximate the Perimeter

Calculate each term approximately:

- $\sqrt{5} \approx 2.236$
- $\sqrt{29} \approx 5.385$
- $3\sqrt{2} \approx 3 \times 1.414 \approx 4.242$

Adding these:

$$
2.236 + 5.385 + 4.242 \approx 11.863
$$

Thus, the perimeter is approximately 11.86 units.

Final Result: Rounded Perimeter

Depending on the required precision, the perimeter rounded to two decimal places is 11.86 units.

Additional Insights and Tips

Handling Different Units and Precision

- Always specify the level of rounding based on context (e.g., nearest tenth, hundredth).
- For more precise calculations, keep the radical form until the final step.

Visualizing the Triangle

- Plotting the points on a coordinate plane can help visualize the shape.
- Tools like graph paper, graphing calculators, or software (GeoGebra, Desmos) enhance understanding.

Verifying Calculations

- Double-check each distance calculation.
- Confirm the correctness of the radical simplifications.

Summary

Calculating the perimeter of a triangle given its vertices involves:

1. Listing the vertices.
2. Applying the distance formula to each pair.
3. Simplifying radical expressions.
4. Summing the side lengths.
5. Rounding the final value as needed.

In our specific example with vertices at (1, 2), (3, 1), and (-2, -1), the perimeter is approximately 11.86 units when rounded to two decimal places. Mastery of these steps enables quick and accurate perimeter calculations for any set of coordinate points.

Practice Exercise

Try calculating the perimeter of a triangle with vertices at:

- (0, 0)
- (4, 0)
- (2, 3)

Use the same step-by-step process outlined above to find the perimeter, and compare your result with the approximate value.

Conclusion

Understanding how to compute the perimeter of a triangle with vertices in the coordinate plane is a crucial skill in mathematics. By mastering the distance formula, radical simplification, and careful addition, you can confidently analyze triangles in various contexts. Whether for academic purposes or practical applications, these fundamental techniques form the backbone of coordinate geometry problem-solving.

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