

In This Exercise We Use The Distance Formula. Which Of The Points A(9,8) Or B(-5,2) Is Closer To The

In This Exercise We Use The Distance Formula. Which Of The Points A(9,8) Or B(-5,2) Is Closer To The solution is a common question in coordinate geometry that helps students understand the practical application of the distance formula. Determining the proximity of points on a coordinate plane is fundamental in various fields such as mathematics, physics, engineering, and computer graphics. This article provides a comprehensive guide to understanding and applying the distance formula to compare distances between points, with a detailed walkthrough of the specific example involving points A(9,8) and B(-5,2).

Understanding the Distance Formula

What Is the Distance Formula?

The distance formula is a mathematical equation used to determine the straight-line distance between two points in a two-dimensional coordinate plane. It is derived from the Pythagorean theorem, which relates the lengths of the sides of a right triangle.

The formula is expressed as:

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

where:

- (x_1, y_1) are the coordinates of the first point,
- (x_2, y_2) are the coordinates of the second point,
- d is the distance between the two points.

Why Is the Distance Formula Important?

Understanding and applying the distance formula is essential because:

- It helps in calculating the shortest path between two locations.
- It is used in geometric proofs and problem-solving.
- It forms the basis for more complex concepts like the distance between points in space (3D).
- It underpins algorithms in computer science, such as those used in mapping and navigation.

Step-by-Step Guide to Comparing Distances of Points A and B

Given Points

Let's consider the two points provided:

- Point A: $(9, 8)$
- Point B: $(-5, 2)$

Objective

Determine which point, A or B, is closer to a specific reference point or to each other, depending on the context. Since the question is about which point is closer, and no specific reference point is given, a common interpretation is to compare the distances of points A and B from the origin $(0,0)$, or from each other.

In this guide, we will:

- Calculate the distance of each point from the origin.
- Calculate the distance between points A and B.
- Interpret the results to identify which point is closer.

Calculating Distance from the Origin

Distance from Point A to the Origin

Using the distance formula:

$$d_A = \sqrt{(0 - 9)^2 + (0 - 8)^2}$$

Calculations:

1. $(0 - 9)^2 = (-9)^2 = 81$
2. $(0 - 8)^2 = (-8)^2 = 64$
3. Sum: $81 + 64 = 145$
4. Square root: $d_A = \sqrt{145} \approx 12.04$

Distance from Point B to the Origin

Using the same approach:

$$d_B = \sqrt{(0 + 5)^2 + (0 - 2)^2}$$

\]

Calculations:

1. $\backslash (0 + 5)^2 = 5^2 = 25 \backslash$

2. $\backslash (0 - 2)^2 = (-2)^2 = 4 \backslash$

3. Sum: $\backslash (25 + 4 = 29 \backslash$

4. Square root: $\backslash (d_B = \sqrt{29} \approx 5.39 \backslash$

Result:

- Distance from A to origin ≈ 12.04 units

- Distance from B to origin ≈ 5.39 units

Conclusion:

Point B is closer to the origin than point A.

Calculating the Distance Between Points A and B

Applying the Distance Formula

Now, to compare the two points directly, calculate the distance between A and B:

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

\]

Substituting:

- $\backslash (x_1 = 9, y_1 = 8 \backslash$

- $\backslash (x_2 = -5, y_2 = 2 \backslash$

Calculations:

1. $\backslash (x_2 - x_1 = -5 - 9 = -14 \backslash$

2. $\backslash (y_2 - y_1 = 2 - 8 = -6 \backslash$

Square these:

- $\backslash (-14)^2 = 196 \backslash$

- $\backslash (-6)^2 = 36 \backslash$

Sum:

\[

$$196 + 36 = 232$$

\]

Square root:

\[

$$d_{AB} = \sqrt{232} \approx 15.23$$

\]

Result:

The distance between points A and B is approximately 15.23 units.

Interpreting the Results

Which Point Is Closer to the Origin?

- Point B (≈ 5.39 units)
- Point A (≈ 12.04 units)

Answer:

Point B is closer to the origin.

Which Point Is Closer to the Other?

- Distance from A to B: ≈ 15.23 units
- The distance between the points is greater than either individual distance from the origin, which makes sense given the positions.

Answer:

Point B is closer to point A than vice versa, but in absolute terms, the direct distance between them is about 15.23 units.

Additional Applications of the Distance Formula

Real-World Uses

The distance formula is used in numerous practical scenarios, including:

- Navigation and Mapping: Calculating the shortest route between two locations.
- Physics: Determining the separation between objects in space.
- Computer Graphics: Measuring distances between pixels or objects.
- Robotics: Navigating robots in a coordinate space.
- Data Analysis: Computing similarity or proximity between data points.

Advanced Topics

Building on the basic distance formula, students can explore:

- Distance in three dimensions ($\sqrt{(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2}$)
- Distance in higher-dimensional spaces

- The concept of Euclidean distance in machine learning algorithms
- Distance metrics like Manhattan or Chebyshev distances for different applications

Summary and Key Takeaways

- The distance formula is a vital tool for calculating the straight-line distance between two points in a plane.
- To find which point is closer to a reference point or to each other, compute their individual distances.
- The calculations for points A(9,8) and B(-5,2) reveal that:
 - B is closer to the origin than A.
 - The distance between A and B is approximately 15.23 units.
- Mastery of the distance formula enhances understanding of geometric concepts and supports applications across various disciplines.

Tips for Using the Distance Formula Effectively

- Always double-check your coordinate inputs.
- Simplify calculations by grouping terms.
- Use a calculator for square roots and squares to ensure accuracy.
- Practice with various points to become comfortable with the formula.
- Remember that the distance is always a non-negative value.

Conclusion

The distance formula is an essential component of coordinate geometry that allows us to quantify how far apart two points are in a plane. By systematically applying the formula, we can compare the proximity of points, analyze spatial relationships, and solve real-world problems efficiently. The example involving points A(9,8) and B(-5,2) illustrates how to perform these calculations and interpret the results, reinforcing the importance of understanding and mastering this fundamental mathematical tool.

Meta Description:

Learn how to use the distance formula to determine which point is closer—using the example points A(9,8) and B(-5,2). Step-by-step calculations and practical insights for mastering coordinate distance problems.

Keywords:

Distance formula, coordinate geometry, points A and B, calculating distance, which point is closer,

Frequently Asked Questions

How do you determine which point, A(9,8) or B(-5,2), is closer to a specific point using the distance formula?

You calculate the distance from each point to the specific point using the distance formula and compare the results; the smaller distance indicates the closer point.

What is the distance formula used in this exercise?

The distance formula is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, which computes the distance between two points (x_1, y_1) and (x_2, y_2) .

If you want to find which point is closer to the origin (0,0), how would you proceed?

Calculate the distance from each point to the origin using the distance formula and compare the results; the point with the smaller distance is closer.

Can you determine which point is closer without calculating the exact distance?

In some cases, you can estimate or compare squared distances to avoid square roots, since the smaller squared distance corresponds to the closer point.

What is the significance of using the distance formula in coordinate geometry?

It allows us to accurately measure the straight-line distance between points in a plane, which is fundamental for location-based problems and spatial analysis.

How do you apply the distance formula to points A(9,8) and B(-5,2) to compare their distances to a third point, say (x,y)?

Calculate $\sqrt{(x - 9)^2 + (y - 8)^2}$ for point A and $\sqrt{(x + 5)^2 + (y - 2)^2}$ for point B, then compare these distances.

What are common mistakes to avoid when using the distance formula?

Common mistakes include mixing up the order of coordinates, forgetting to square differences, or forgetting to take the square root at the end of the calculation.

How does understanding the distance formula help in real-world applications?

It helps in navigation, location planning, determining proximity of objects, and in various fields like GIS, urban planning, and robotics.

Additional Resources

In This Exercise We Use The Distance Formula. Which Of The Points A(9,8) Or B(-5,2) Is Closer To The

Understanding the spatial relationships between points on a coordinate plane is fundamental in many areas of mathematics, from geometry to real-world applications like navigation, engineering, and computer graphics. In this particular exercise, we are tasked with determining which of two points—A(9,8) or B(-5,2)—is closer to a specific reference point. While the reference point isn't explicitly specified here, the core technique involves applying the distance formula, a powerful tool that allows us to measure the straight-line distance between two points in a two-dimensional plane.

This article will explore the concept of the distance formula in depth, explain how to apply it step-by-step, and illustrate its importance through practical examples. Whether you're a student learning the fundamentals or a curious reader interested in the mathematical principles behind spatial measurements, this guide aims to make the process clear, accessible, and insightful.

Understanding the Distance Formula

The Coordinate Plane and Points

Before diving into the formula itself, it's essential to understand the basic components involved. The coordinate plane—also known as the Cartesian plane—is a two-dimensional surface defined by two perpendicular axes:

- The x-axis (horizontal)
- The y-axis (vertical)

Any point on this plane can be represented by an ordered pair of numbers, called coordinates, which indicate its position relative to the axes. For example:

- Point A(9,8): 9 units along the x-axis, 8 units along the y-axis
- Point B(-5,2): -5 units along the x-axis (to the left of the origin), 2 units along the y-axis (above the origin)

Knowing how to interpret these coordinates is fundamental before calculating distances.

The Distance Formula Derivation

The distance formula derives from the Pythagorean theorem, which relates the lengths of the sides of a right-angled triangle. Suppose you want to find the distance between two points, $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$. Visualize these points on the coordinate plane and draw a right triangle where:

- The horizontal leg has length $|x_2 - x_1|$
- The vertical leg has length $|y_2 - y_1|$
- The hypotenuse is the straight-line distance between the two points

Applying the Pythagorean theorem:

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

This formula allows us to compute the exact straight-line distance between any two points.

Applying the Distance Formula to Our Points

In our scenario, we want to determine which point—A(9,8) or B(-5,2)—is closer to a specific reference point. Although the reference point isn't specified in the initial prompt, a common approach is to compare each point's distance to a given point, say, the origin (0,0), or any other relevant point. For this illustration, let's assume the reference point is the origin, as it's a typical choice in many exercises.

Calculating Distance from the Origin to Point A(9,8)

Using the distance formula:

$$d_A = \sqrt{(9 - 0)^2 + (8 - 0)^2} = \sqrt{9^2 + 8^2} = \sqrt{81 + 64} = \sqrt{145}$$

Calculating the square root:

$$d_A \approx 12.04$$

So, point A is approximately 12.04 units away from the origin.

Calculating Distance from the Origin to Point B(-5,2)

Similarly:

$$d_B = \sqrt{(-5 - 0)^2 + (2 - 0)^2} = \sqrt{(-5)^2 + 2^2} = \sqrt{25 + 4} = \sqrt{29}$$

Calculating the square root:

$$d_B \approx 5.39$$

Thus, point B is approximately 5.39 units away from the origin.

Interpreting the Results

Based on these calculations:

- Distance from origin to A: approximately 12.04 units
- Distance from origin to B: approximately 5.39 units

Since 5.39 is less than 12.04, point B(-5,2) is closer to the origin than point A(9,8).

Broader Applications and Variations

While this example compares distances to a fixed point (the origin), the same principles apply when comparing distances to any other point in the plane. For instance, if the reference point is C(4,3), the process involves:

1. Computing the distance from each point to C using the same formula.
2. Comparing the resulting distances to determine which point is closer.

Practical applications of this process include:

- Navigation and GPS technology: Determining which location is nearer to a given point.
- Robotics: Calculating the closest obstacle or target.
- Urban planning: Assessing proximity of facilities or resources.
- Computer graphics: Measuring distances between objects to manage spatial relationships.

Step-by-Step Guide for Similar Problems

For those looking to solve comparable exercises, here's a step-by-step approach:

1. Identify the points involved: Know their coordinates.
2. Determine the reference point: The point to which distances are compared.
3. Apply the distance formula: For each point, plug in the coordinates into $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
4. Calculate the squared differences: Square the differences in x and y.
5. Sum the squared differences: Add the results.
6. Compute the square root: Find the square root of the sum to get the distance.
7. Compare the distances: The smaller value indicates the closer point.

Limitations and Considerations

While the distance formula is straightforward, some factors can influence its application:

- Accuracy of coordinates: Ensure the points are correctly identified.
- Coordinate system: The formula applies to Cartesian coordinates; other systems may require different methods.
- Multiple points: When dealing with many points, using programming or graphing tools can streamline calculations.
- Three-dimensional space: The formula extends naturally to 3D with an additional z-coordinate: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$.

Conclusion: The Power of the Distance Formula

In this exercise, by applying the distance formula, we determined that point B(-5,2) is closer to the origin than point A(9,8). This technique exemplifies how a simple algebraic formula can yield valuable insights into spatial relationships, with broad applications spanning various fields. Understanding and mastering the distance formula not only enhances your geometric intuition but also equips you with a practical skill for analyzing the world in terms of positions and distances. Whether solving academic problems or navigating real-world scenarios, this fundamental tool remains essential for precise and effective spatial reasoning.

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