

3. What Is The Distance From (0,0) To (24,10) On The coordinate Plane?

3. What Is The Distance From (0,0) To (24,10) On The Coordinate Plane?

Understanding how to determine the distance between two points on the coordinate plane is a fundamental skill in mathematics, especially in geometry and algebra. In this article, we will explore the process of calculating the distance from the origin point (0,0) to the point (24,10). Whether you're a student preparing for exams or simply interested in the practical application of coordinate geometry, this comprehensive guide will help you grasp the concepts and perform the calculations with confidence.

Understanding the Coordinate Plane

Before diving into the calculation process, it's essential to understand what the coordinate plane is and how points are represented.

What Is the Coordinate Plane?

The coordinate plane, also known as the Cartesian plane, is a two-dimensional surface defined by two perpendicular axes:

- The x-axis, which runs horizontally.
- The y-axis, which runs vertically.

The point where these axes intersect is called the origin, denoted as (0,0). Any point on the plane can be represented by an ordered pair (x, y), where:

- x is the horizontal distance from the origin.
- y is the vertical distance from the origin.

Plotting Points on the Coordinate Plane

For example:

- The point (0,0) is at the origin.
- The point (24,10) is 24 units to the right along the x-axis and 10 units up along the y-axis.

Understanding how to read and plot these points is critical for calculating distances between them.

Calculating the Distance Between Two Points

The key to finding the distance between two points in the coordinate plane lies in the use of the distance formula derived from the Pythagorean theorem.

The Distance Formula

Given two points, (x_1, y_1) and (x_2, y_2) , the distance d between them is calculated as:

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

This formula essentially computes the hypotenuse of a right-angled triangle where the differences in x and y are the legs.

Applying the Distance Formula to $(0,0)$ and $(24,10)$

In our case:

- First point: $(0,0)$
- Second point: $(24,10)$

Plugging these into the formula:

$$\begin{aligned} d &= \sqrt{(24 - 0)^2 + (10 - 0)^2} \\ d &= \sqrt{(24)^2 + (10)^2} \\ d &= \sqrt{576 + 100} \\ d &= \sqrt{676} \end{aligned}$$

The square root of 676 is 26, so:

$$d = 26$$

Therefore, the distance from $(0,0)$ to $(24,10)$ is 26 units.

Step-by-Step Breakdown of the Calculation

To better understand how this calculation works, here's a step-by-step guide:

1. Identify the coordinates:

- Point A: $(0,0)$
- Point B: $(24,10)$

2. Calculate the difference in x-coordinates:

$$\Delta x = x_2 - x_1 = 24 - 0 = 24$$

3. Calculate the difference in y-coordinates:

$$\Delta y = y_2 - y_1 = 10 - 0 = 10$$

4. Square both differences:

- $(\Delta x)^2 = 24^2 = 576$
- $(\Delta y)^2 = 10^2 = 100$

5. Sum the squares:

- $576 + 100 = 676$

6. Take the square root to find the distance:

- $\sqrt{676} = 26$

This straightforward process can be applied to find the distance between any two points on the coordinate plane.

Real-World Applications of Distance Calculation

Calculating distances between points is not just an academic exercise; it has many practical applications in various fields:

- Navigation and GPS: Determining the shortest distance between two locations.
- Computer Graphics: Calculating distances between objects or pixels.
- Robotics: Programming movement paths based on coordinate points.
- Architecture and Engineering: Measuring distances between structural points.
- Data Analysis: Evaluating the similarity or difference between data points in multivariate data.

Understanding the fundamental concept of distance on the coordinate plane is essential for these applications.

Additional Tips for Accurate Calculations

- Always double-check the coordinates before plugging them into the formula.
- Simplify calculations where possible; for example, recognizing perfect squares (like 576 and 100).
- Use a calculator for the square root to ensure accuracy.
- Remember that the distance is always a non-negative value.

Practice Problems to Reinforce Learning

To solidify your understanding, try solving these problems:

1. Find the distance between (0,0) and (3,4).
2. Calculate the distance from (0,0) to (-5,12).

3. Determine the distance between (2,3) and (10,8).
4. What's the distance from (0,0) to (-7,-24)?

Answers:

1. $\sqrt{(3-0)^2 + (4-0)^2} = \sqrt{9 + 16} = \sqrt{25} = 5$
2. $\sqrt{(-5 - 0)^2 + (12 - 0)^2} = \sqrt{25 + 144} = \sqrt{169} = 13$
3. $\sqrt{(10 - 2)^2 + (8 - 3)^2} = \sqrt{64 + 25} = \sqrt{89} \approx 9.43$
4. $\sqrt{(-7 - 0)^2 + (-24 - 0)^2} = \sqrt{49 + 576} = \sqrt{625} = 25$

Practicing these problems will help you become more comfortable with the distance formula and its applications.

Conclusion

Determining the distance between two points on the coordinate plane is a vital skill that combines understanding of the Cartesian coordinate system with algebraic calculation. By applying the distance formula, you can accurately find the straight-line distance between any two points, such as from (0,0) to (24,10). In our case, the distance is 26 units, illustrating the practical utility of the formula in real-world and academic contexts. Mastery of this concept is essential for progressing in mathematics and related fields, laying a solid foundation for more advanced topics like vector analysis, spatial reasoning, and geometric transformations.

Remember, practice makes perfect—so keep working through various problems to strengthen your understanding and confidence in calculating distances on the coordinate plane!

Frequently Asked Questions

How do I find the distance between the points (0,0) and (24,10) on the coordinate plane?

Use the distance formula: $\text{Distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Plugging in the values, $\text{Distance} = \sqrt{(24 - 0)^2 + (10 - 0)^2} = \sqrt{(24^2 + 10^2)} = \sqrt{(576 + 100)} = \sqrt{676} = 26$.

What is the distance from (0,0) to (24,10)?

The distance is 26 units.

Can I use the Pythagorean theorem to find the distance between (0,0) and (24,10)?

Yes, the distance formula is derived from the Pythagorean theorem. It calculates the hypotenuse of a right triangle with legs of lengths 24 and 10.

Why is the distance between (0,0) and (24,10) 26?

Because applying the distance formula yields $\sqrt{(24^2 + 10^2)} = \sqrt{676} = 26$, which is the straight-line distance between the points.

Is the distance from (0,0) to (24,10) the same as from (0,0) to (10,24)?

Yes, because the distance formula depends on the squares of the differences, so swapping the coordinates doesn't change the distance. Both distances are 26 units.

What are the steps to calculate the distance between two points on a coordinate plane?

1. Subtract the x-coordinates and square the result. 2. Subtract the y-coordinates and square the result. 3. Add these two squares. 4. Take the square root of the sum to find the distance.

Can I approximate the distance between (0,0) and (24,10)?

Yes, the exact distance is 26 units. If approximate, it remains 26 since the calculation yields an exact whole number.

Is the distance between (0,0) and (24,10) greater than 20?

Yes, since the distance is 26 units, which is greater than 20.

How would the distance change if the second point was (24,20) instead of (24,10)?

The distance would be $\sqrt{[(24-0)^2 + (20-0)^2]} = \sqrt{(576 + 400)} = \sqrt{976} \approx 31.24$ units, which is longer than 26.

Additional Resources

What Is The Distance From (0,0) To (24,10) On The Coordinate Plane?

In the realm of coordinate geometry, understanding how to determine the distance between two points is fundamental. Whether you're a student grappling with the basics or a seasoned mathematician revisiting core concepts, the question "What is the distance from $(0,0)$ to $(24,10)$ on the coordinate plane?" remains a cornerstone example illustrating the application of the distance formula. This article delves into the intricacies of this calculation, exploring the underlying principles, methods, and broader implications in mathematics and related fields.

Introduction to Distance in the Coordinate Plane

The coordinate plane, also known as the Cartesian plane, provides a two-dimensional framework where points are represented by ordered pairs (x, y) . The distance between any two points on this plane can be visualized as the length of the straight line segment connecting them. This measurement is crucial not only in pure mathematics but also in fields such as physics, engineering, computer graphics, and navigation systems.

Given two points, say, Point A at (x_1, y_1) and Point B at (x_2, y_2) , the core question is: How do we determine the precise length of the segment between them? The answer lies in the application of the Pythagorean theorem, which elegantly links the concepts of right triangles and Euclidean distance.

Understanding the Distance Formula

The Geometric Intuition

Imagine plotting the two points on the coordinate plane:

- Point A at $(0,0)$
- Point B at $(24,10)$

Draw a horizontal line from $(0,0)$ to $(24,0)$ and a vertical line from $(24,0)$ to $(24,10)$. These lines form a right triangle with the segment connecting the two points as the hypotenuse.

- The horizontal leg is the difference in the x-coordinates: $|24 - 0| = 24$
- The vertical leg is the difference in the y-coordinates: $|10 - 0| = 10$

Applying the Pythagorean theorem:

$$\text{Distance} = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

where

- $\Delta x = x_2 - x_1$
- $\Delta y = y_2 - y_1$

The Formal Distance Formula

For any two points, (x_1, y_1) and (x_2, y_2) , the distance (d) is given by:

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

This formula is derived directly from the Pythagorean theorem and reflects the Euclidean distance between the two points.

Calculating the Distance From (0,0) to (24,10)

Using our specific points:

- $x_1 = 0$, $y_1 = 0$
- $x_2 = 24$, $y_2 = 10$

Substituting into the formula:

$$\begin{aligned} d &= \sqrt{(24 - 0)^2 + (10 - 0)^2} \\ d &= \sqrt{(24)^2 + (10)^2} \\ d &= \sqrt{576 + 100} \\ d &= \sqrt{676} \end{aligned}$$

Since 676 is a perfect square:

$$d = \sqrt{676} = 26$$

Therefore, the distance from (0,0) to (24,10) is exactly 26 units.

Broader Implications and Applications

Understanding this calculation extends far beyond academic exercises. Precise

distance measurements underpin numerous practical applications across various disciplines.

Navigation and Geographic Information Systems (GIS)

In navigation, plotting the shortest path between two points—such as between two cities or waypoints—is essential. The Euclidean distance provides the straight-line or "as-the-crow-flies" distance, serving as a foundational metric before considering real-world constraints like roads and terrain.

Computer Graphics and Game Development

In digital rendering, determining the distance between objects on the screen influences collision detection, movement algorithms, and rendering decisions. Knowing the exact distance helps generate realistic interactions and spatial awareness.

Physics and Engineering

From calculating the displacement vector in physics to designing mechanical systems with precise spatial arrangements, accurate distance measurements are critical for ensuring safety, efficiency, and performance.

Mathematics Education and Problem Solving

Teaching students to compute distances fosters spatial reasoning, algebraic proficiency, and an appreciation for the interconnectedness of mathematical concepts.

Extending the Concept: Other Distance Metrics

While the Euclidean distance is the most common, alternative metrics exist, especially in more complex or abstract spaces:

- Manhattan Distance: Sum of the absolute differences of coordinates, applicable in grid-based pathfinding.
- Chebyshev Distance: Maximum of the absolute differences, useful in chess and other grid-based scenarios.
- Minkowski Distance: Generalization that encompasses various metrics

depending on a parameter "p."

Understanding these metrics enriches one's grasp of spatial analysis and broadens the toolkit for tackling diverse problems.

Conclusion

The question "What is the distance from (0,0) to (24,10) on the coordinate plane?" offers a straightforward yet profound illustration of fundamental principles in coordinate geometry. The application of the distance formula, derived from the Pythagorean theorem, confirms that the direct Euclidean distance between these points is 26 units.

This calculation exemplifies how abstract mathematical formulas translate into tangible, real-world insights. Whether in scientific research, engineering, or education, mastering the concept of distance calculation is essential for navigating the complexities of spatial relationships. As technology advances and data becomes increasingly spatially oriented, the importance of such foundational knowledge continues to grow, making it a cornerstone of mathematical literacy and practical problem-solving.

In summary:

- The distance from (0,0) to (24,10) is calculated via the distance formula.
- The precise length is 26 units.
- This example underscores the practical utility of coordinate geometry.
- Recognizing various distance metrics can enhance problem-solving in different contexts.

Understanding these concepts ensures a solid foundation for exploring more advanced topics in mathematics and its applications across multiple fields.

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