

Find The Distance Between The Points (5,2) And (7,7).Write Your Answer As A Whole Number Or A Fully Simplified

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Introduction

Understanding how to find the distance between two points on a coordinate plane is a fundamental skill in geometry and algebra. Whether you're a student preparing for exams, a teacher designing lesson plans, or someone interested in practical applications like navigation or engineering, grasping this concept is essential.

The distance formula, derived from the Pythagorean theorem, allows us to calculate the straight-line distance between any two points in a two-dimensional space. In this article, we will explore the step-by-step process of calculating the distance between the points (5, 2) and (7, 7), explaining the concept thoroughly and providing tips for ensuring your answer is in the simplest form or a whole number if possible.

Understanding the Coordinates

Before diving into the calculations, it's important to understand what the coordinates represent.

The Points (5, 2) and (7, 7)

- Point A: (5, 2)
- The x-coordinate is 5.
- The y-coordinate is 2.
- Point B: (7, 7)
- The x-coordinate is 7.
- The y-coordinate is 7.

These points are plotted on the Cartesian plane, where the x-axis runs horizontally and the y-axis runs vertically.

The Distance Formula

The distance d between two points (x_1, y_1) and (x_2, y_2) in a plane is given by the formula:

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

This formula is a direct application of the Pythagorean theorem, which

relates the lengths of the sides of a right triangle.

Why the Distance Formula Works

- When you plot two points, the difference in their x-coordinates $(x_2 - x_1)$ and y-coordinates $(y_2 - y_1)$ form the legs of a right triangle.
- The hypotenuse of this triangle represents the straight-line distance between the points.
- Applying the Pythagorean theorem:

$$\text{distance}^2 = (\text{horizontal difference})^2 + (\text{vertical difference})^2$$

Step-by-Step Calculation

Let's apply the formula to our specific points.

Step 1: Identify the differences in coordinates

- $x_2 - x_1 = 7 - 5 = 2$
- $y_2 - y_1 = 7 - 2 = 5$

Step 2: Square the differences

- $(x_2 - x_1)^2 = 2^2 = 4$
- $(y_2 - y_1)^2 = 5^2 = 25$

Step 3: Sum the squares

$$4 + 25 = 29$$

Step 4: Take the square root

$$d = \sqrt{29}$$

Step 5: Simplify the radical, if possible

- 29 is a prime number, so $\sqrt{29}$ cannot be simplified further.
- The approximate decimal value of $\sqrt{29}$ is approximately 5.385.

Final Answer: Expressing the Distance

Since the problem requests the answer as a whole number or a fully simplified radical, our final answer is:

$$\boxed{\sqrt{29}}$$

or approximately 5.385 if a decimal approximation is acceptable.

Additional Tips for Calculating Distance Between Points

When to Use the Exact Radical Form

- When the problem emphasizes exact answers, always leave the distance as $\sqrt{29}$.
- Simplify radicals only if possible; in this case, 29 is prime, so the radical is already simplified.

When to Use Approximate Values

- If a decimal approximation is acceptable, use a calculator to compute $\sqrt{29} \approx 5.385$.
- Round to the required decimal places based on the context of the problem.

Practice with Different Coordinates

- Practice calculating distances with various points to strengthen your understanding.
- For example, find the distance between (1, 1) and (4, 5), or between (0, 0) and (3, 4).

Real-World Applications of Distance Calculation

Understanding how to find the distance between points isn't just a theoretical exercise; it has many practical applications:

1. Navigation and GPS: Determining the shortest path between two locations.
2. Engineering: Designing mechanical parts where precise measurements are critical.
3. Computer Graphics: Calculating distances between objects on a screen.
4. Robotics: Programming robots to navigate environments efficiently.
5. Physics: Analyzing trajectories and motions.

Conclusion

Calculating the distance between two points is a foundational skill that combines geometric intuition with algebraic calculation. By following the step-by-step process outlined above, you can confidently determine the exact or approximate distance between any two points on the coordinate plane.

In our specific case, the distance between the points (5, 2) and (7, 7) is $\sqrt{29}$, which is approximately 5.385 when expressed as a decimal. Remember, always consider the context of the problem to decide whether to leave your answer in radical form or as a decimal approximation.

Mastering this skill will not only improve your understanding of geometry but also enhance your problem-solving capabilities across various fields that rely on spatial calculations.

Summary

- Use the distance formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
- Plug in the coordinates: $(5, 2)$ and $(7, 7)$.
- Calculate differences: 2 (x-direction), 5 (y-direction).
- Square differences: 4 and 25.
- Sum: 29.
- Take the square root: $\sqrt{29}$.
- Final answer: $\sqrt{29}$, approximately 5.385.

By understanding and practicing this process, you'll enhance your mathematical skills and be better prepared for more complex problems involving distance calculations.

Frequently Asked Questions

What is the formula to find the distance between two points (x_1, y_1) and (x_2, y_2) ?

The distance is found using the formula: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

How do you calculate the distance between the points $(5, 2)$ and $(7, 7)$?

Subtract the x-coordinates and y-coordinates, then apply the distance formula: $\sqrt{(7 - 5)^2 + (7 - 2)^2}$.

What is the step-by-step process to find the distance between $(5, 2)$ and $(7, 7)$?

Subtract x: $7 - 5 = 2$, subtract y: $7 - 2 = 5$, then compute $\sqrt{2^2 + 5^2} = \sqrt{4 + 25} = \sqrt{29}$.

Is the distance between $(5, 2)$ and $(7, 7)$ a whole number? Why or why not?

No, because $\sqrt{29}$ is an irrational number, approximately 5.39, which is not a whole number.

How can the distance between two points be expressed as a fully simplified radical?

By calculating $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ and simplifying the radical if possible; here, it remains $\sqrt{29}$ as it cannot be simplified further.

What is the approximate decimal value of the distance between $(5, 2)$ and $(7, 7)$?

Approximately 5.39, since $\sqrt{29} \approx 5.385$.

Can the distance between (5, 2) and (7, 7) be expressed as a whole number? Why or why not?

No, because the exact distance is $\sqrt{29}$, which is not a perfect square, so it cannot be expressed as a whole number.

Why is it important to write your answer as a fully simplified radical or a whole number?

Because it provides the most precise form of the distance, avoiding approximation errors and ensuring clarity.

What is the final simplified answer for the distance between (5, 2) and (7, 7)?

The distance is $\sqrt{29}$, which cannot be simplified further, so the exact answer is $\sqrt{29}$.

Additional Resources

Find The Distance Between The Points (5,2) And (7,7)

Understanding how to determine the distance between two points on a coordinate plane is a fundamental skill in mathematics, especially within the realm of geometry and algebra. Whether you are a student tackling a homework problem or a professional applying spatial analysis, grasping the method to find this distance accurately is essential. In this article, we will explore the comprehensive process of calculating the distance between the points (5, 2) and (7, 7), providing detailed explanations, step-by-step procedures, and analytical insights to deepen your understanding.

Introduction to the Coordinate Plane and Points

The coordinate plane, also known as the Cartesian plane, is a two-dimensional surface formed by two perpendicular axes: the x-axis (horizontal) and the y-axis (vertical). Each point on this plane is identified by an ordered pair (x, y), where:

- x-coordinate indicates the position along the horizontal axis.
- y-coordinate indicates the position along the vertical axis.

In our case, we are given two points:

- Point A: (5, 2)
- Point B: (7, 7)

These points can be visualized as specific locations on the plane, and our goal is to determine the straight-line distance between them.

Understanding the Distance Formula

The primary mathematical tool used to find the distance between two points in a plane is the Distance Formula, which is derived from the Pythagorean Theorem.

The Distance Formula

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

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

This formula essentially measures the length of the hypotenuse of a right triangle formed by the horizontal and vertical differences between the points.

Why the Formula Works

- The difference in x-coordinates, $(x_2 - x_1)$, represents the horizontal leg of the right triangle.
- The difference in y-coordinates, $(y_2 - y_1)$, represents the vertical leg.
- Applying the Pythagorean Theorem, the hypotenuse, which is the straight-line distance, combines these two legs.

Step-by-Step Calculation for (5, 2) and (7, 7)

Let's apply the distance formula to our specific points.

Step 1: Identify Coordinates

- $(x_1, y_1) = (5, 2)$
- $(x_2, y_2) = (7, 7)$

Step 2: Calculate the Differences

- Horizontal difference: $x_2 - x_1 = 7 - 5 = 2$
- Vertical difference: $y_2 - y_1 = 7 - 2 = 5$

Step 3: Square the Differences

- $(x_2 - x_1)^2 = 2^2 = 4$
- $(y_2 - y_1)^2 = 5^2 = 25$

Step 4: Sum the Squares

$$4 + 25 = 29$$

Step 5: Take the Square Root

```
\[
d = \sqrt{29}
\]
```

Step 6: Express the Final Answer

Since 29 is a prime number and not a perfect square, the square root remains in its simplest radical form:

```
\[
\boxed{\sqrt{29}}
\]
```

Note: The problem requests the answer as a whole number or a fully simplified radical. Since $\sqrt{29}$ cannot be simplified further, this is the most precise form.

Converting to a Decimal (Optional Approximation)

For practical purposes, sometimes it is helpful to approximate the square root:

```
\[
\sqrt{29} \approx 5.385
\]
```

But since the instruction emphasizes expressing the answer as a whole number or a fully simplified radical, sticking with $\sqrt{29}$ is appropriate.

Analytical Insights and Applications

Understanding how to compute the distance between points has profound implications across various fields, including physics, engineering, computer science, and geography. Let's explore some analytical perspectives:

Geometric Interpretation

- The distance represents the shortest path between the two points in Euclidean space.
- Visualizing the points and the right triangle formed can help in understanding the spatial relationship.

Practical Applications

- Navigation: Calculating the straight-line distance between two locations.
- Robotics: Determining the movement path between points.
- Data Analysis: Measuring similarity or difference between data points in two-dimensional datasets.
- Game Development: Calculating proximity between objects or characters.

Limitations and Extensions

- The formula applies to points in a 2D plane; in higher dimensions, the formula extends naturally by including additional coordinate differences.
- For non-Euclidean spaces, alternative distance measures, such as Manhattan or Minkowski distances, are used.

Common Pitfalls and Tips for Accurate Calculation

While the calculation process appears straightforward, several common mistakes can lead to inaccuracies:

- Incorrect coordinate differences: Always subtract the coordinates in the correct order; the difference's magnitude is what matters.
- Forgetting to square the differences: Remember to square both differences before summing.
- Neglecting the square root: The distance is the square root of the sum of squares; omitting this step yields the squared distance.
- Simplification errors: When radicals can be simplified, ensure to do so correctly.

Pro Tip: Always verify that the coordinates are correctly identified and substituted into the formula to avoid sign errors.

Summary and Final Remarks

In conclusion, determining the distance between the points (5, 2) and (7, 7) involves applying the fundamental distance formula rooted in the Pythagorean Theorem. The calculation reveals that the distance is $\sqrt{29}$, an irrational number that cannot be simplified further. This precise and elegant result underscores the power of basic geometric principles in solving real-world problems that require spatial measurement.

The ability to calculate distances accurately is not only a core mathematical skill but also a vital tool across disciplines. Whether navigating city streets, designing computer graphics, or analyzing data clusters, understanding how to find the shortest path between two points enriches one's analytical toolkit.

By mastering this process, you lay the groundwork for exploring more complex spatial relationships, extending into three-dimensional space, or applying distance metrics in unconventional contexts. As with many mathematical concepts, practice and familiarity lead to fluency, empowering you to tackle diverse problems with confidence.

In essence, the distance between (5, 2) and (7, 7) is $\sqrt{29}$, a fully simplified radical expression, representing the precise measure of the

straight-line gap separating these two points on the coordinate plane.

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