

6). Given A (3, 5) And B(4, 3), Find The Point P That Partitions The Line Segment AB Three Fourths Of

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6). Given A (3, 5) And B(4, 3), Find The Point P That Partitions The Line Segment AB Three Fourths Of is a classic problem in coordinate geometry that involves finding a specific point along a line segment that divides it in a given ratio. This problem not only tests understanding of the section formula but also helps students and learners grasp the concepts of ratios, coordinates, and line division. Whether you are a student preparing for exams or someone interested in the fundamentals of geometry, understanding how to find such points is essential. In this article, we will explore the detailed steps to determine the point P that partitions the segment AB in the ratio 3:1 starting from point A towards point B.

Understanding the Problem

The Coordinates of Points A and B

- Point A has coordinates (3, 5)
- Point B has coordinates (4, 3)

The Goal

Find the point P on the segment AB such that it divides the segment into two parts, with one part being three-fourths of the entire segment. In other words, P should be located three-fourths of the way from A to B.

The Concept of Section Formula

What is the Section Formula?

The section formula helps find the coordinates of a point that divides a line segment internally in a given ratio. If a point P divides the segment AB in the ratio $m:n$, then the coordinates of P are given by:

$$P(x, y) = \left(\frac{mx_2 + nx_1}{m + n}, \frac{my_2 + ny_1}{m + n} \right)$$

Applying the Ratio to Our Problem

Since P divides AB three-fourths of the way from A, the ratio in which P divides AB is 3:1, starting from A towards B. This means:

- $m = 3$ (the part from A to P)
- $n = 1$ (the remaining part from P to B)

Calculating Point P

Step-by-step Calculation

1. Identify the coordinates of A and B:

- A(3, 5)
- B(4, 3)

2. Determine the ratio:

- $m = 3$
- $n = 1$

3. Apply the section formula for the x-coordinate:

$$P_x = \frac{(m x_2 + n x_1)}{(m + n)} = \frac{(3 \cdot 4 + 1 \cdot 3)}{(3 + 1)} = \frac{(12 + 3)}{4} =$$

$$15 / 4 = 3.75$$

4. Apply the section formula for the y-coordinate:

$$P_y = (m y_2 + n y_1) / (m + n) = (3 \cdot 3 + 1 \cdot 5) / (3 + 1) = (9 + 5) / 4 = 14 / 4 = 3.5$$

Result

Therefore, the point P that partitions the segment AB three-fourths of the way from A to B is at:

$$P(3.75, 3.5)$$

Understanding the Significance of This Calculation

Why Find Such a Point?

- It helps in understanding how line segments can be divided proportionally.
- Useful in coordinate geometry, computer graphics, and engineering design.
- Provides foundational knowledge for more complex geometric constructions.

Practical Applications

- Designing paths or routes that divide a segment in specific ratios.
- Locating points of interest along a line in GPS and mapping systems.
- Creating scale models and performing proportional analysis in architecture.

Extending the Concept to Other Ratios

Division in Different Ratios

The section formula is versatile and can be used for any ratio. For example, if you want to find a point that divides the segment in the ratio $m:n$, just plug in the respective values into the formula.

Examples of Other Ratios

1. Midpoint (ratio 1:1):

$$P\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

2. Closer to A (ratio 1:2):

$$P\left(\frac{1x_2 + 2x_1}{3}, \frac{1y_2 + 2y_1}{3}\right)$$

3. Closer to B (ratio 2:1):

$$P\left(\frac{2x_2 + 1x_1}{3}, \frac{2y_2 + 1y_1}{3}\right)$$

Conclusion: Mastering the Section Formula

Finding the point P that partitions a line segment in a specified ratio is an essential skill in coordinate geometry. By understanding and applying the section formula, you can accurately determine points that divide segments proportionally. In our specific case, the point $P(3.75, 3.5)$ divides the segment AB in a ratio of 3:1 starting from A, located three-fourths of the way along the segment from A towards B. This approach is not only applicable in theoretical mathematics but also has practical uses in various fields such as engineering, computer graphics, and navigation systems.

Further Reading and Resources

- [Khan Academy: Coordinate Geometry](#)
- [Math is Fun: Section Formula](#)

- [Wolfram MathWorld: Line Division](#)

Mastering the concepts discussed here will enhance your problem-solving skills and deepen your understanding of geometry. Practice with different points and ratios to solidify your knowledge and become proficient in coordinate geometry techniques.

Frequently Asked Questions

How do you find the point P that divides the segment AB in the ratio 3:1 starting from A?

Use the section formula: $P = [(mx_2 + nx_1)/(m + n), (my_2 + ny_1)/(m + n)]$. For ratio 3:1, $P = [(3 \cdot 4 + 1 \cdot 3)/4, (3 \cdot 3 + 1 \cdot 5)/4] = (15/4, 8/4) = (3.75, 2)$.

What is the coordinate of point P dividing segment AB in a 3:1 ratio from point A?

The coordinate of P is (3.75, 2), calculated using the section formula with ratio 3:1.

How do you determine the point that partitions a line segment in a given ratio?

Apply the section formula, which finds the point dividing the segment based on the ratio of the division.

What is the significance of the ratio 3:1 in dividing a line segment?

The ratio 3:1 indicates that the point divides the segment into two parts where one part is three times longer than the other from the starting point.

Can the section formula be used for any ratio to find the dividing point on a segment?

Yes, the section formula applies to any ratio, enabling you to find the point dividing a segment in any specified ratio.

What are the coordinates of points A and B in the

given problem?

Point A is at (3, 5), and point B is at (4, 3).

How do you verify the accuracy of the computed point P on segment AB?

Check that P lies on the line segment by confirming it lies between A and B and that it satisfies the division ratio.

What is the practical application of finding a point that divides a segment in a given ratio?

It is used in geometry, design, and construction to accurately locate points of division based on proportional distances.

If the ratio was 1:3 instead of 3:1, how would the calculation change?

You would swap the ratio values in the section formula, calculating $P = [(14 + 33)/4, (13 + 35)/4] = (13/4, 18/4) = (3.25, 4.5)$.

Additional Resources

Finding the Point P That Partitions the Line Segment AB Three Fourths Of the Way: A Comprehensive Guide

When working with line segments in coordinate geometry, one common problem involves finding a specific point that divides the segment into a certain ratio. Specifically, in this article, we will explore "Given A (3, 5) and B (4, 3), find the point P that partitions the line segment AB three fourths of the way." This problem exemplifies the application of the section formula, a vital concept in coordinate geometry used to determine points dividing a segment internally in a given ratio. Whether you're a student preparing for exams, a teacher designing lessons, or a professional needing quick calculations, understanding how to find such a point is a fundamental skill.

Understanding the Problem

Imagine line segment AB with endpoints:

- A at (3, 5)
- B at (4, 3)

Our goal is to find the point P that divides segment AB in such a way that P is located three-fourths along the way from A to B. In other words, starting

from point A, if you travel toward B, you reach P after covering three-fourths of the total length of AB.

Why Is This Important?

Partitioning line segments in specified ratios is a foundational concept in geometry, used in:

- Constructing geometric figures
- Solving real-world problems involving distances and proportions
- Developing an intuitive understanding of coordinate systems

The Section Formula: The Key to Dividing Line Segments

The section formula provides a straightforward way to find a point dividing a line segment internally in a given ratio.

Definition:

Suppose you have two points:

- $A(x_1, y_1)$
- $B(x_2, y_2)$

and a point P that divides AB in the ratio $m:n$. Then, the coordinates of P are given by:

$$P\left(\frac{mx_2 + nx_1}{m + n}, \frac{my_2 + ny_1}{m + n}\right)$$

This formula assumes P divides AB internally.

Applying the Formula to Our Problem

In our case:

- $A(3, 5)$
- $B(4, 3)$
- The point P divides segment AB three-fourths of the way from A to B, which corresponds to a ratio $m:n$.

Converting the "Three-Fourths" Ratio to $m:n$

The phrase "three-fourths of the way from A to B" indicates that P is located at 75% of the length of AB starting from A.

Visualizing the Division

- Total length from A to B is split into 4 parts.
- P is three parts along the way from A, meaning it divides the segment in the ratio 3 : 1.

Establishing the Ratio

- $(AP : PB = 3 : 1)$

Therefore, the ratio $(m:n = 3:1)$.

Calculating the Coordinates of Point P

Using the section formula with $(m=3)$ and $(n=1)$:

$$\begin{aligned} P_x &= \frac{m x_2 + n x_1}{m + n} = \frac{3 \times 4 + 1 \times 3}{3 + 1} = \\ &= \frac{12 + 3}{4} = \frac{15}{4} = 3.75 \end{aligned}$$

$$\begin{aligned} P_y &= \frac{m y_2 + n y_1}{m + n} = \frac{3 \times 3 + 1 \times 5}{4} = \\ &= \frac{9 + 5}{4} = \frac{14}{4} = 3.5 \end{aligned}$$

Therefore, the point P is at $((3.75, 3.5))$.

Visualizing the Result

- Point A is at (3, 5)
- Point B is at (4, 3)
- Point P is at (3.75, 3.5)

This means P is very close to A, slightly more than three-quarters of the way along from A toward B, consistent with the ratio. It lies closer to B than to A, given the segment's orientation.

Practical Applications and Further Insights

1. Understanding Ratios in Geometry

The ratio approach helps in various geometric constructions:

- Locating midpoints (ratio 1:1)
- Finding points dividing segments into arbitrary ratios
- Constructing similar triangles or proportional segments

2. Real-World Contexts

In fields like engineering, architecture, and navigation:

- Precise division of segments enables accurate design

- The technique aids in plotting points along a path or segment proportionally

3. Extending to External Division

While this article focused on internal division, the same principles can be extended to external division, which involves ratios with negative values. The formulas differ slightly, accommodating points lying outside the segment.

Summary of the Step-by-Step Process

1. Identify the endpoints and their coordinates.
2. Determine the ratio in which the point divides the segment.
3. Convert the ratio into the $(m:n)$ form appropriate for the section formula.
4. Apply the section formula to find the coordinates of the dividing point.
5. Interpret the result, verifying it aligns with the expected division.

Final Thoughts

Understanding how to find a point that partitions a line segment in a specified ratio is a versatile skill in coordinate geometry. The problem involving points $A(3, 5)$ and $B(4, 3)$, and finding P that is three-fourths of the way along the segment, exemplifies this concept clearly. Using the section formula simplifies the process, providing an exact coordinate for the point P . Whether you're solving academic problems or applying these concepts practically, mastering this technique enhances your geometric intuition and problem-solving toolkit.

Additional Practice Problems

To solidify your understanding, try tackling these similar problems:

- Find the point dividing segment AB and BC in the ratio $2:3$.
- Determine the external division point of AC and BD in the ratio $3:-2$.
- Locate the midpoint of segment CD and DE .

Practice makes perfect, and these exercises will help reinforce your grasp of dividing segments using ratios.

Remember: Mastery of the section formula and understanding ratios are foundational in coordinate geometry, offering powerful tools for geometric

constructions, problem-solving, and analytical reasoning.

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