

Find The Slope Of The Line That Passes Through (4,2) And (2,1) Which Set Up In The Formula Is Correct?

Find The Slope Of The Line That Passes Through (4,2) And (2,1) Which Set Up In The Formula Is Correct? Understanding how to find the slope of a line passing through two points is a fundamental skill in coordinate geometry. Whether you're a student working on math homework, a teacher preparing lesson plans, or someone interested in applying mathematical concepts in real-world situations, mastering the formula for calculating the slope is essential. In this article, we will explore the correct way to set up the slope formula using the given points (4,2) and (2,1), discuss common mistakes to avoid, and provide a comprehensive guide to calculating the slope accurately.

Understanding the Concept of Slope

Before diving into the specific calculation, it's important to understand what the slope of a line represents. The slope indicates the steepness or incline of a line, showing how much the y-value changes for a unit change in the x-value.

Definition of Slope

The slope (often denoted as "m") is defined as the ratio of the change in y-values to the change in x-values between two points on the line:

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

This formula measures the rate at which y increases or decreases as x increases.

Importance of Correct Point Ordering

While the order of the points in the formula doesn't affect the magnitude of the slope (since subtraction order reverses the sign), consistency is crucial for clarity and correctness. Usually, we denote the points as $((x_1, y_1))$ and $((x_2, y_2))$, ensuring that the differences are computed with respect to these labels.

Set Up the Slope Formula Correctly

Given the points $((4, 2))$ and $((2, 1))$, our goal is to determine the correct setup of the slope formula.

Identify the Coordinates

Let's label the points:

- Point 1: $((x_1, y_1) = (4, 2))$
- Point 2: $((x_2, y_2) = (2, 1))$

Choosing the order depends on which point to consider first, but typically, you can pick either. For consistency, we'll proceed with the order as listed.

Apply the Slope Formula

Plugging in the values:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substituting the given points:

$$m = \frac{1 - 2}{2 - 4}$$

Calculating the numerator and denominator:

- Numerator: $(1 - 2 = -1)$
- Denominator: $(2 - 4 = -2)$

Therefore:

$$m = \frac{-1}{-2}$$

Simplify the fraction:

$$m = \frac{-1}{-2} = \frac{1}{2}$$

The slope of the line passing through the points $((4, 2))$ and $((2, 1))$ is $(\frac{1}{2})$.

Common Mistakes in Setting Up the Slope Formula

When calculating the slope, several common errors can lead to incorrect results. Recognizing and avoiding these mistakes ensures accuracy.

1. Swapping the Points

Swapping $((x_1, y_1))$ and $((x_2, y_2))$ doesn't change the slope's magnitude but can affect the sign if you're not consistent. Always be clear about which point is which.

2. Incorrect Subtraction Order

Using the wrong order when subtracting can lead to a negative slope when a positive one is

expected or vice versa. Remember:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

or

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

but never mix the two within the same calculation.

3. Forgetting to Simplify

Always simplify the resulting fraction to its lowest terms for clarity and correctness.

Alternative Setups for the Slope Formula

Depending on the context, you may set up the slope formula differently, but the principle remains the same.

Using Different Point Labels

Suppose you label the points differently:

$$- ((x_1, y_1) = (2, 1))$$

$$- ((x_2, y_2) = (4, 2))$$

Then, the slope becomes:

$$m = \frac{2 - 1}{4 - 2} = \frac{1}{2}$$

which yields the same result, illustrating that the order affects the sign but not the magnitude if the calculation is consistent.

Significance of Correct Setup

Ensuring your points are correctly labeled and the formula is set up properly is critical, especially when dealing with negative coordinates or when calculating the equation of the line afterward.

Step-by-Step Guide to Calculate the Slope

Here's a simple process to follow:

1. Identify the two points on the line.
2. Label the points as $((x_1, y_1))$ and $((x_2, y_2))$.

3. Substitute the coordinates into the slope formula: $\frac{y_2 - y_1}{x_2 - x_1}$.
4. Calculate the numerator and denominator separately.
5. Divide the numerator by the denominator to find the slope.
6. Simplify the resulting fraction, if possible.

Applying this to our points:

- $(4, 2)$

- $(2, 1)$

We get:

$$m = \frac{1 - 2}{2 - 4} = \frac{-1}{-2} = \frac{1}{2}$$

The line passing through these points has a slope of $\frac{1}{2}$.

Understanding the Equation of the Line

Once the slope is known, you may want to write the equation of the line passing through the points.

Point-Slope Form

Using the point-slope form:

$$y - y_1 = m(x - x_1)$$

Choose one point, for example, $(4, 2)$:

$$y - 2 = \frac{1}{2}(x - 4)$$

Convert to Slope-Intercept Form

Expanding:

$$y - 2 = \frac{1}{2}x - 2$$

Add 2 to both sides:

$$y = \frac{1}{2}x$$

This is the slope-intercept form, with a slope of $\frac{1}{2}$ and passing through the origin (since y-intercept is 0 in this case).

Real-World Applications of Finding Line Slopes

Understanding how to compute the slope has practical applications in various fields:

- **Physics:** Calculating the rate of change of velocity or acceleration.
- **Economics:** Determining the rate of profit or cost increase.
- **Engineering:** Analyzing the gradient of roads or slopes.
- **Data Analysis:** Finding the trend or correlation between variables.

In all these cases, accurately setting up and calculating the slope is crucial for meaningful analysis.

Conclusion

Calculating the slope of a line passing through two points is a straightforward process once you understand the correct setup of the formula. For the points $((4, 2))$ and $((2, 1))$, the correct setup involves identifying the coordinates, applying the formula $(m = \frac{y_2 - y_1}{x_2 - x_1})$, and carefully performing the subtraction and division. The resulting slope is $(\frac{1}{2})$, indicating a line that rises one unit vertically for every two units horizontally. Always double-check your point labels and calculations to avoid common errors, and you'll be well-equipped to handle more complex problems involving lines and their slopes.

Frequently Asked Questions

What is the formula to find the slope of a line passing through two points?

The formula for the slope (m) is $(y_2 - y_1) / (x_2 - x_1)$.

How do you determine which set up in the formula is correct for points (4,2) and (2,1)?

The correct setup assigns $(x_1, y_1) = (4, 2)$ and $(x_2, y_2) = (2, 1)$, then plugs these into the slope formula: $(1 - 2) / (2 - 4)$.

What is the correct calculation for the slope between (4,2) and (2,1)?

Using the formula $(y_2 - y_1)/(x_2 - x_1)$, we get $(1 - 2)/(2 - 4) = (-1)/(-2) = \frac{1}{2}$.

Why is it important to correctly identify which point is (x_1, y_1) and which is (x_2, y_2) ?

Correct identification ensures accurate calculation of the slope; swapping points can lead to incorrect signs or values, though the magnitude remains the same.

What is the significance of the slope value $\frac{1}{2}$ in context of the line passing through $(4,2)$ and $(2,1)$?

A slope of $\frac{1}{2}$ indicates the line rises $\frac{1}{2}$ unit vertically for every 1 unit it moves horizontally.

Can the slope be negative for these points, and if so, how?

Yes, if the points are reversed, the slope becomes negative: $(2 - 1)/(4 - 2) = 1/2$, but if calculated as $(1 - 2)/(2 - 4)$, it becomes $-1/2$, indicating a decreasing line.

What is the importance of setting up the formula correctly in coordinate geometry problems?

Proper setup ensures accurate calculation of line characteristics like slope, which is fundamental for graphing and understanding relationships between points.

Are there alternative methods to find the slope besides the standard formula?

Yes, you can use graphing methods, or if the line equation is known, derive the slope from the equation in slope-intercept form, but the basic formula remains the most straightforward for two points.

How does understanding the correct setup of the slope formula help in real-world applications?

It helps in accurately modeling and analyzing relationships between variables, such as speed over time, cost per unit, or rate of change in various fields.

Additional Resources

Find The Slope Of The Line That Passes Through $(4,2)$ And $(2,1)$ Which Set Up In The Formula Is Correct?

Understanding the concept of slope is fundamental in algebra and coordinate geometry, especially when analyzing the characteristics of lines on a Cartesian plane. When given two points, determining the slope involves applying a specific formula that quantifies the steepness of the line connecting those points. This article aims to explore how to find the slope of the line passing through the points $(4, 2)$ and $(2, 1)$, emphasizing which set-up of the formula is correct, and why.

The Significance of Slope in Coordinate Geometry

Before diving into calculations, it's essential to understand what slope represents and why it's an important concept:

- **Definition of Slope:** The slope of a line measures its inclination or steepness. Mathematically, it is the ratio of the vertical change to the horizontal change between two points on the line.
- **Symbol and Notation:** Usually denoted by the letter m , the slope indicates whether a line rises, falls, or remains flat as you move from left to right.
- **Applications:** Slope is used in various fields such as physics (to measure velocity), engineering (to analyze gradients), economics (to understand rates of change), and more.

The Slope Formula: Correct Set-Up and Its Components

The standard formula to find the slope (m) between two points $((x_1, y_1))$ and $((x_2, y_2))$ is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

This formula is derived from the concept of "rise over run," representing the change in the y-coordinates divided by the change in the x-coordinates.

Key Points to Remember:

- The order of points matters; swapping the points changes the sign of the slope but not its magnitude.
- The numerator $(y_2 - y_1)$ indicates the vertical change ("rise").
- The denominator $(x_2 - x_1)$ indicates the horizontal change ("run").
- If the denominator is zero, the line is vertical, and the slope is undefined.

Applying the Formula to the Points (4, 2) and (2, 1)

Given two points:

- $((x_1, y_1) = (4, 2))$
- $((x_2, y_2) = (2, 1))$

The question is: Which set-up in the formula is correct?

Step-by-step process:

1. Identify the points:

- Assign the points clearly to avoid confusion.

- Typically, you can choose which point to be $((x_1, y_1))$ and which to be $((x_2, y_2))$. The order determines the sign but not the magnitude of the slope.

2. Set up the formula:

- Option A: $m = \frac{y_2 - y_1}{x_2 - x_1}$

- Option B: $m = \frac{y_1 - y_2}{x_1 - x_2}$

3. Calculate using the standard set-up:

- Using Option A:

$$m = \frac{1 - 2}{2 - 4} = \frac{-1}{-2} = \frac{1}{2}$$

- Using Option B:

$$m = \frac{2 - 1}{4 - 2} = \frac{1}{2}$$

Both approaches yield the same positive slope, confirming the consistency of the formula regardless of point order, provided signs are correctly assigned.

Deep Dive: Which Set-Up Is Correct?

The critical examination here is understanding which set-up is correct, especially when presented with multiple options.

The universally accepted formula is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Why this set-up?

- It directly follows from the definition of slope as "rise over run."
- It maintains consistency and clarity, especially when dealing with multiple points.
- It ensures the correct calculation of vertical and horizontal changes.

Common pitfalls and misconceptions:

- Mixing up the order: Changing the order of points without adjusting signs can lead to incorrect interpretation of the slope's sign.
- Incorrect subtraction: Using the wrong coordinates in the numerator or denominator leads to errors.
- Dividing by zero: If $(x_2 - x_1 = 0)$, the line is vertical, and the slope is undefined.

Conclusion: The correct set-up in the formula is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

where (x_1, y_1) and (x_2, y_2) are the two points, assigned consistently.

Calculating the Slope for the Given Points

Applying the formula with the points (4, 2) and (2, 1):

- Choosing $(x_1, y_1) = (4, 2)$
- Choosing $(x_2, y_2) = (2, 1)$

The slope calculation:

$$m = \frac{1 - 2}{2 - 4} = \frac{-1}{-2} = \frac{1}{2}$$

This result indicates that the line ascends at a rate of 0.5 units vertically for every 1 unit horizontally moved to the right.

Visualizing the Line and Its Slope

Understanding the visual aspect helps reinforce the concept:

- Plot the points (4, 2) and (2, 1) on a coordinate plane.
- Draw a straight line connecting these points.
- Observe that as you move from (2, 1) to (4, 2):
 - The y-value increases from 1 to 2 (+1)
 - The x-value decreases from 4 to 2 (-2)
- The slope calculation confirms the line's inclination: positive, indicating an upward trend as you move from left to right.

Broader Implications and Variations

While the example here is straightforward, understanding the correct setup of the slope formula is crucial across various contexts:

- In physics: Calculating velocity as the slope of a position-time graph.
- In economics: Determining marginal rates of change.
- In engineering: Analyzing gradients and slopes of surfaces.

Additionally, the same principles extend to more complex applications like:

- Calculus: Derivatives as the slope of tangent lines.
- Data analysis: Regression lines and their slopes.

Summary: The Correct Formula Setup

To conclude, when asked, "Find the slope of the line passing through (4, 2) and (2, 1). Which set-up in the formula is correct?", the answer is:

- The standard, correct setup is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

- When applying this to the points:

$$m = \frac{1 - 2}{2 - 4} = \frac{-1}{-2} = \frac{1}{2}$$

- This calculation confirms the slope of the line is 0.5.

Remember, consistency in assigning points to (x_1, y_1) and (x_2, y_2) ensures accurate results. The simplicity of the formula belies its importance: a fundamental tool that helps us quantify and analyze the behavior of lines on the coordinate plane with clarity and precision.

Final Thoughts

Mastering the correct setup of the slope formula empowers students, educators, and professionals to interpret and analyze lines effectively. Whether plotting a graph, solving a geometric problem, or understanding real-world phenomena, the clarity in applying the slope formula remains a cornerstone of analytical reasoning in mathematics.

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