

This Graph Shows A Proportional Relationship. (2/3, 3/4) What Is The Constant Of Proportionality?

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Understanding proportional relationships is fundamental in algebra and everyday mathematics. When analyzing graphs that depict such relationships, identifying the constant of proportionality is crucial for interpreting the data accurately. This article explores the concept of proportional relationships through the specific example of the points (2/3, 3/4), explaining how to determine the constant of proportionality, and providing insights into their significance in mathematical and real-world contexts.

What Is a Proportional Relationship?

A proportional relationship exists between two quantities when their ratio remains constant. In mathematical terms, if x and y are two variables, the relationship is proportional if:

$$y = kx$$

where:

- k is the constant of proportionality.
- The ratio $\frac{y}{x}$ remains the same for all pairs of values.

Key Features of Proportional Relationships:

- The graph of a proportional relationship is a straight line passing through the origin (0,0).
- The slope of this line equals the constant of proportionality (k).
- The ratio $\frac{y}{x}$ is constant for all points on the line.

Understanding the Points (2/3, 3/4)

The points (2/3, 3/4) represent a specific pair of values on a graph illustrating a proportional relationship. To interpret these points:

- x-coordinate: $\frac{2}{3}$
- y-coordinate: $\frac{3}{4}$

These are fractions, indicating that the relationship may involve ratios or proportions rather than whole numbers. To analyze this, consider the following:

1. Plot the points on a graph to visualize their position.
2. Determine if the points lie on a straight line passing through the origin.
3. Calculate the ratio $\frac{y}{x}$ to see if it remains constant.

Calculating the Constant of Proportionality (k)

Given a point (x, y) on a proportional relationship, the constant of proportionality k can be found using:

$$k = \frac{y}{x}$$

Applying this to the point $(\frac{2}{3}, \frac{3}{4})$:

$$k = \frac{\frac{3}{4}}{\frac{2}{3}}$$

To compute this, follow these steps:

1. Express the division as a multiplication by the reciprocal:

$$k = \frac{3}{4} \times \frac{3}{2}$$

2. Multiply the numerators and denominators:

$$k = \frac{3 \times 3}{4 \times 2} = \frac{9}{8}$$

Result:

$$k = \frac{9}{8}$$

This means that the constant of proportionality for the relationship passing through the point $(\frac{2}{3}, \frac{3}{4})$ is $\frac{9}{8}$.

Verifying the Constant of Proportionality with

Additional Points

To confirm that $k = 9/8$ is consistent across the graph, check whether other points satisfy the relation:

$$y = \frac{9}{8} x$$

Suppose we have another point, say (x, y) . To verify:

- Calculate y using $y = \frac{9}{8} x$.
- Check if the actual y -value matches the computed value.

Example:

If $x = 1$:

$$y = \frac{9}{8} \times 1 = \frac{9}{8}$$

If the point $(1, 9/8)$ exists on the graph, then the proportionality holds.

Visualizing the Graph of the Proportional Relationship

The graph of the proportional relationship with $k = 9/8$:

- Is a straight line passing through the origin $(0,0)$.
- Has a slope of $9/8$, indicating the rate of change between y and x .
- For every increase of 1 unit in x , y increases by 1.125 units (since $9/8 = 1.125$).

Plotting Key Points:

x	$y = (9/8) x$	Coordinates
0	0	$(0, 0)$
1	$9/8 \approx 1.125$	$(1, 1.125)$
$2/3$	$9/8 \times 2/3 = (9/8) \times (2/3) = (9 \times 2) / (8 \times 3) = 18/24 = 3/4$	$(2/3, 3/4)$

This confirms that the point $(2/3, 3/4)$ lies on this line, reinforcing the calculated constant of proportionality.

Importance of the Constant of Proportionality in Real-Life Contexts

The concept of a constant of proportionality extends beyond pure mathematics into various practical applications:

- Speed and Distance: Speed is proportional to distance over time; the constant of proportionality could represent speed.
- Cost Calculations: Price per item remains constant; the total cost is proportional to the number of items.
- Physics: Ohm's law states voltage is proportional to current with resistance as the constant.
- Cooking: Recipes often involve proportional relationships between ingredients.

Understanding the constant of proportionality enables accurate predictions, conversions, and decision-making across industries.

Common Mistakes and Misconceptions

While working with proportional relationships and constants, students often encounter errors such as:

- Confusing proportionality with other relationships: Not all relationships are proportional; some are nonlinear.
- Forgetting to verify the line passes through the origin: A key feature of proportional graphs.
- Miscomputing the constant: Especially when working with fractions, ensure proper fraction operations.
- Assuming all points on the line have the same ratio: Only true if the relationship is truly proportional.

Practice Problems for Mastery

1. Given the point $(\frac{3}{4}, \frac{27}{32})$, find the constant of proportionality.
2. Plot the proportional relationship with $(k = \frac{5}{2})$. What is the y-coordinate when $x = 4$?
3. Determine whether the point $(\frac{1}{2}, \frac{3}{4})$ lies on the proportional line with $(k = 2)$.

Conclusion

Understanding the proportional relationship between two quantities and accurately calculating the constant of proportionality is essential in both academic and real-world contexts. In the specific case of the point $(\frac{2}{3}, \frac{3}{4})$, we found that the constant of proportionality is $\frac{9}{8}$. Recognizing this constant enables us to write the equation of the line, predict other values, and interpret the relationship visually and analytically. Mastery of these concepts lays the foundation for more advanced topics in algebra, geometry, physics, economics, and various applied sciences.

Remember: The key to identifying a proportional relationship is to verify that the ratio $\frac{y}{x}$ remains constant across all points. The constant of proportionality is this ratio, serving as a bridge between the variables and their real-world interpretations.

Frequently Asked Questions

What does it mean when a graph shows a proportional relationship?

A graph shows a proportional relationship when the line passes through the origin and the ratio between the two variables remains constant across all points.

How do you find the constant of proportionality from a graph?

The constant of proportionality is found by calculating the ratio of y to x for any point on the graph. For example, if a point is (x, y) , then $k = y / x$.

Given the points $(\frac{2}{3}, \frac{3}{4})$, how do I determine the constant of proportionality?

You compute the ratio y / x for either point: $(\frac{3}{4})$ divided by $(\frac{2}{3})$, which simplifies to $(\frac{3}{4}) (\frac{3}{2}) = \frac{9}{8}$. So, the constant of proportionality is $\frac{9}{8}$.

Why is the constant of proportionality important in graphs showing proportional relationships?

It indicates the rate at which one variable changes in relation to the other and helps in making predictions or understanding the relationship between the variables.

Can the constant of proportionality be a negative number?

Yes, if the relationship between the variables is negative (one increases while the other decreases), the constant of proportionality would be negative.

What does it mean if a graph does not pass through the origin?

If a graph does not pass through the origin, the relationship is not proportional but possibly linear with an intercept other than zero.

How can I verify if a graph represents a proportional relationship using points?

Check if all points satisfy the same ratio y / x . If they do, the relationship is proportional, and the ratio is the constant of proportionality.

Is the constant of proportionality always the same for all points on the graph?

Yes, in a proportional relationship, the constant of proportionality remains constant for all points on the graph.

Additional Resources

This Graph Shows A Proportional Relationship. $(2/3, 3/4)$ What Is The Constant Of Proportionality?

Understanding the essence of proportional relationships is fundamental in mathematics, especially when analyzing graphs that depict such relationships. Among the core concepts in this domain is the constant of proportionality, a value that succinctly encapsulates the connection between two variables. This article embarks on an in-depth exploration of the proportional relationship exemplified by the points $(2/3, 3/4)$, aiming to elucidate the underlying principles, interpret the graphical representations, and clarify the computation of the constant of proportionality.

Introduction to Proportional Relationships in Graphs

Proportional relationships are a cornerstone concept in mathematics, underpinning numerous real-world applications—from physics and economics to data science and engineering. When two quantities are directly proportional, their ratio remains constant; graphically, such a relationship manifests as a straight line passing through the origin with a constant slope.

Key characteristics of proportional relationships:

- The graph is a straight line through the origin $(0,0)$.
- The ratio of the dependent variable to the independent variable is constant.
- The slope of the line corresponds to the constant of proportionality, often denoted as (k) .

Mathematically, a proportional relationship between variables (x) and (y) can be expressed as:

$$\begin{aligned} &[\\ y &= kx \\ &] \end{aligned}$$

where (k) is the constant of proportionality.

Deciphering the Data Points: $(\frac{2}{3}, \frac{3}{4})$

The points $(\frac{2}{3}, \frac{3}{4})$ are intriguing because they suggest a relationship between two quantities, possibly within a proportional context. To interpret this, we must analyze the meaning of each coordinate.

Analyzing the points:

- The first coordinate, $(x = \frac{2}{3})$
- The second coordinate, $(y = \frac{3}{4})$

If these points lie on a proportional relationship line, then the ratio $(\frac{y}{x})$ should be constant across the relationship.

Calculating the ratio:

$$\frac{y}{x} = \frac{\frac{3}{4}}{\frac{2}{3}} = \frac{3/4}{2/3}$$

Dividing fractions:

$$\frac{3/4}{2/3} = \frac{3}{4} \times \frac{3}{2} = \frac{3 \times 3}{4 \times 2} = \frac{9}{8}$$

This ratio, $\left(\frac{9}{8} \right)$, suggests that the relationship between (y) and (x) is characterized by this constant.

Implication:

Since the ratio $(y/x = 9/8)$ is consistent for these points, the line passing through the origin that contains these points is proportional with a constant of proportionality:

$$k = \frac{9}{8}$$

Determining the Constant of Proportionality

The constant of proportionality, (k) , is the key value that links two variables in a proportional relationship. It defines the rate at which one variable changes concerning the other.

Methodology to compute (k) :

1. Identify a point on the graph: For a proportional relationship, any point (x, y) on the line should satisfy $(y = kx)$.
2. Calculate the ratio (y/x) : Since the line passes through the origin, the ratio is constant for all points.
3. Verify with multiple points: To ensure accuracy, verify that other points on the graph maintain the same (y/x) ratio.

Applying to $(2/3, 3/4)$:

$$k = \frac{y}{x} = \frac{\frac{3}{4}}{\frac{2}{3}} = \frac{9}{8}$$

Thus, the constant of proportionality is $(\boxed{\frac{9}{8}})$.

Significance of the Constant of Proportionality

The constant (k) has multiple interpretations depending on the context:

- Rate of change: It indicates how much (y) increases per unit increase in (x) .
- Scaling factor: It acts as a scaling factor transforming (x) into (y) .
- Slope of the graph: In the coordinate plane, the slope of the line is (k) .

In this case, $(y = \frac{9}{8}x)$, meaning for every unit increase in (x) , (y) increases by $(\frac{9}{8})$.

Graphical Representation and Validation

Plotting the points $(\frac{2}{3}, \frac{3}{4})$ and considering the proportionality:

- The line should pass through the origin $(0,0)$.
- The slope of the line should be $(\frac{9}{8})$.

Constructing the line:

Using the point $(0,0)$ and the slope $(k = \frac{9}{8})$, the equation of the line is:

$$\begin{aligned} &[\\ y &= \frac{9}{8}x \\ &] \end{aligned}$$

Verification:

- Plugging in $(x = \frac{2}{3})$:

$$\begin{aligned} &[\\ y &= \frac{9}{8} \times \frac{2}{3} = \frac{9 \times 2}{8 \times 3} = \\ &\frac{18}{24} = \frac{3}{4} \\ &] \end{aligned}$$

which matches the point $(\frac{2}{3}, \frac{3}{4})$.

- Plugging in other points similarly confirms the proportionality.

Real-World Context and Applications

Understanding proportional relationships and their constants is essential across various fields:

- Physics: Force and acceleration in Newton's second law ($F = ma$), where the force is proportional to mass.
- Economics: Cost per item remains constant in linear pricing models.
- Chemistry: Concentration ratios and reaction rates often involve proportional relationships.
- Statistics: Scaling data points for normalization.

In practical scenarios, identifying the constant of proportionality aids in:

- Predicting values outside the given data.
- Simplifying complex relationships into manageable linear models.
- Establishing proportionality constraints in data fitting.

Limitations and Considerations

While the analysis confirms a proportional relationship between x and y with $k = \frac{9}{8}$, several considerations are essential:

- Data accuracy: The points analyzed should be verified for measurement precision.
- Linearity: The relationship must be linear; non-linear proportionalities require different models.
- Origin passage: The line should pass through $(0,0)$ for pure proportionality; deviations suggest other relationships.

Conclusion

The investigation into the graph represented by the points $(\frac{2}{3}, \frac{3}{4})$ reveals that the relationship is indeed proportional, characterized by a constant of proportionality $\boxed{\frac{9}{8}}$. This value encapsulates the rate at which y changes with respect to x , offering vital insights into the underlying relationship. Recognizing and calculating the constant of proportionality is fundamental in translating graphical data into meaningful

mathematical models, facilitating analysis, prediction, and application across diverse scientific and practical domains.

In sum, this exploration underscores the importance of understanding proportional relationships, the role of the constant of proportionality, and the power of graphing in revealing these fundamental connections.

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