What Is The Image Point Of (7,-5) After A Translation Right 3 Units And Down 1 Unit

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Understanding how points move on the coordinate plane is fundamental in geometry, especially when dealing with transformations such as translations. A translation shifts every point of a figure or a coordinate point by a specific distance in a given direction. In this detailed guide, we will explore how to determine the image point of a specific coordinate—(7, -5)—after it undergoes a translation, specifically moving right 3 units and down 1 unit. By the end of this article, you will have a clear understanding of how to apply translations and find the resulting coordinate with confidence.

Understanding Coordinates and Translations

What Are Coordinates?

Coordinates are numerical values that specify the position of a point in the two-dimensional plane. They are written as an ordered pair (x, y), where:

- x-coordinate: Indicates the point’s position along the horizontal axis (the x-axis).
- y-coordinate: Indicates the point’s position along the vertical axis (the y-axis).

For example, in the point (7, -5):
- The x-coordinate is 7.
- The y-coordinate is -5.

What Is a Translation?

A translation is a type of geometric transformation that slides every point of a figure or coordinate system by a fixed distance in a specified direction. It does not alter the size, shape, or orientation of the figure.

Key aspects of translation:
- It involves shifting points horizontally and/or vertically.
- The amount and direction of the shift are specified by translation vectors or instructions (e.g., "right 3 units and down 1 unit").

Deciphering the Translation: Moving Right 3 Units and Down 1 Unit

Breaking Down the Translation

The instruction is to move the point right 3 units and down 1 unit. This can be interpreted as:

- Moving right 3 units: Increases the x-coordinate by 3.
- Moving down 1 unit: Decreases the y-coordinate by 1.

Important note: Moving right increases the x-value, while moving left decreases it. Moving down decreases the y-value, and moving up increases it.

Representing the Translation as a Vector

The translation can be represented as a vector:

$$
\vec{v} = (\text{horizontal shift}, \text{vertical shift}) = (3, -1)
$$

This vector indicates that to find the image point, you add 3 to the x-coordinate and subtract 1 from the y-coordinate of the original point.

Calculating the Image Point

Step-by-Step Calculation

Given:
- Original point: (7, -5)
- Translation vector: (3, -1)

To find the image point, perform the following operations:

1. Add the horizontal component:
$$
x_{image} = x_{original} + \text{horizontal shift} = 7 + 3 = 10
$$
2. Add the vertical component:
$$
y_{image} = y_{original} + \text{vertical shift} = -5 + (-1) = -6
$$

Result:
$$
\boxed{(10, -6)}
$$

The point (7, -5), after moving right 3 units and down 1 unit, becomes (10, -6).

Understanding the Significance of the Coordinates

Why Do Coordinates Change This Way?

The logic behind adding and subtracting values during a translation stems from the coordinate plane's grid system:

- Moving right increases the x-coordinate because it shifts along the positive x-axis.
- Moving left would decrease the x-coordinate.
- Moving up increases the y-coordinate.
- Moving down decreases the y-coordinate.

In this case, the translation instructions specify moving right 3 units, so we increase x by 3, and moving down 1 unit, so we decrease y by 1.

Visualizing the Translation

Visualizing the shift can help solidify understanding:

- The original point is at (7, -5), located 7 units to the right of the y-axis and 5 units below the x-axis.
- Moving right 3 units shifts the point to 10 units to the right.
- Moving down 1 unit shifts the point further below the x-axis to -6 in the y-coordinate.

This visualization confirms the calculated image point at (10, -6).

Practical Applications of Translations

In Geometry and Art

Translations are fundamental in creating symmetrical figures, tessellations, and managing geometric transformations in design and art.

In Computer Graphics

Moving objects on the screen involves translation operations, often represented by coordinate adjustments similar to the process described above.

In Navigation and Mapping

GPS and mapping systems use translations to shift geographic data points based on user movements or coordinate system adjustments.

Additional Examples and Practice Problems

Example 1: Moving a Different Point

Suppose you have the point (4, 2). What is its image after moving left 2 units and up 3 units?

Solution:
- Moving left 2 units: subtract 2 from x → 4 - 2 = 2
- Moving up 3 units: add 3 to y → 2 + 3 = 5

Image point: (2, 5)

Example 2: General Translation Formula

Given an original point (x, y) and translation vector (a, b):

$$
\text{Image point} = (x + a, y + b)
$$

Using this formula makes it straightforward to handle any translation.

Summary and Key Takeaways

- Coordinates specify the position of points on the plane.
- Translations move points by adding the translation vector components to the original coordinates.
- Moving right increases x; moving left decreases x.
- Moving up increases y; moving down decreases y.
- To find the image point after a translation, apply the formula:

\[
(x_{original} + \text{horizontal shift}, y_{original} + \text{vertical shift})
\]
- For the point (7, -5) after moving right 3 units and down 1 unit, the new point is (10, -6).

Conclusion

Understanding how to perform and interpret translations is an essential skill in geometry, computer graphics, and various fields involving spatial reasoning. By breaking down the translation into horizontal and vertical components, calculating the new point becomes straightforward. Remember, the key is to identify the direction and magnitude of movement and then adjust the original coordinates accordingly. The process demonstrated with the point (7, -5) can be applied universally to any coordinate point undergoing translation.

Whether you're solving academic problems or working on real-world applications, mastering coordinate translations will enhance your spatial understanding and problem-solving capabilities.

Frequently Asked Questions

What is the new image point of (7, -5) after translating right 3 units and down 1 unit?

The image point is (10, -6).

How do you find the new coordinates after translating a point right 3 units and down 1 unit?

Add 3 to the x-coordinate and subtract 1 from the y-coordinate of the original point.

What is the process to translate a point (7, -5) right 3 units and down 1 unit?

Increase the x-coordinate by 3 and decrease the y-coordinate by 1, resulting in (10, -6).

If a point is moved right 3 units and down 1 unit, how do you calculate its new position?

Add 3 to the original x-value and subtract 1 from the original y-value.

Can you give an example of translating a point (7, -5) right 3 and down 1?

Yes, the translated point is (10, -6).

What is the formula for translating a point (x, y) right 3 units and down 1 unit?

The new point is (x + 3, y - 1).

After translating (7, -5) right 3 units and down 1 unit, what are the resulting coordinates?

The resulting coordinates are (10, -6).

Additional Resources

What Is The Image Point Of (7, -5) After A Translation Right 3 Units And Down 1 Unit

In the realm of coordinate geometry, transformations such as translations are foundational concepts that help us understand how figures move within the coordinate plane. When dealing with specific points, these transformations can be systematically analyzed to determine new positions, or "images," of points after certain shifts. This article explores in detail what is the image point of (7, -5) after a translation right 3 units and down 1 unit, providing a comprehensive review of the underlying principles, step-by-step calculations, and practical implications.

Understanding Translations in Coordinate Geometry

A translation is a type of rigid motion that shifts every point of a figure or coordinate point by the same distance in a specified direction. Unlike rotations or reflections, translations do not alter the size, shape, or orientation of the figure; they only change its position.

Key features of translations:
- The movement is uniform, meaning each point moves the same distance.
- It is specified by a translation vector, which indicates the direction and magnitude of the shift.
- The translation vector is often written in component form, such as (Δx, Δy).

Components of the Given Transformation

In this specific scenario, the transformation involves moving the point (7, -5) to the right by 3 units and down by 1 unit. To analyze this, we need to understand what these instructions imply in terms of shifts along the x- and y-axes.

Breakdown:
- Moving right 3 units corresponds to increasing the x-coordinate by 3.
- Moving down 1 unit corresponds to decreasing the y-coordinate by 1.

This can be represented as a translation vector:
- Translation vector (Δx, Δy) = (3, -1)

Step-by-Step Calculation of the Image Point

Given:
- Original point: (7, -5)
- Translation vector: (3, -1)

To find the image point, apply the translation vector to each coordinate:

1. Calculate the new x-coordinate:

$x' = x + \Delta x = 7 + 3 = 10$

2. Calculate the new y-coordinate:

$y' = y + \Delta y = -5 + (-1) = -6$

Result:
- Image point: (10, -6)

Graphical Interpretation and Visualization

Visualizing the translation process aids in comprehending the movement:

- The original point (7, -5) is located in the fourth quadrant, given that x is positive and y is negative.
- Moving right 3 units shifts the point horizontally to the right, from x=7 to x=10.
- Moving down 1 unit shifts the point vertically downward, from y=-5 to y=-6.
- The new position (10, -6) is also in the fourth quadrant, but shifted right and down relative to the original.

Visualization Tips:
- Plot the original point on graph paper or a coordinate plane.
- From that point, move horizontally to the right by 3 units.
- Then, move vertically downward by 1 unit.
- Mark the resulting point; this confirms the calculated image.

Implications and Applications of Translations

Understanding how to find the image point after translations has numerous applications beyond pure mathematics:

Practical Uses:
- Navigation and GPS: Adjusting positions based on directional shifts.
- Computer Graphics: Moving images or objects across screens.
- Robotics: Programming movement commands that translate positions in a coordinate space.
- Engineering Design: Positioning components within a coordinate framework.

Mathematical Significance:
- Serves as a fundamental tool for understanding more complex geometric transformations.
- Forms the basis for vector operations and affine transformations.
- Facilitates the study of congruence and similarity in geometric figures.

Summary and Key Takeaways

To summarize, the process of finding the image point of (7, -5) after a translation right 3 units and down 1 unit involves:

- Recognizing the translation as a vector (3, -1),
- Applying the vector to the original point by adding the respective components,
- Calculating the new point, which results in (10, -6).

Key points:
- Translations move points uniformly.
- Moving right increases x; moving left decreases x.
- Moving up increases y; moving down decreases y.
- The translation vector encapsulates all movement information.

Additional Considerations and Variations

While this example involves a straightforward translation, variations may include:

- Diagonal translations (e.g., right 3 units and up 2 units).
- Multiple consecutive translations.
- Translations combined with other transformations like rotations or reflections.

Understanding the foundational principles in this example prepares students and practitioners to handle more complex scenarios involving multiple transformations.

Conclusion

The question, what is the image point of (7, -5) after a translation right 3 units and down 1 unit, underscores the importance of vector addition in coordinate geometry. By translating the original point (7, -5) with the vector (3, -1), we precisely determine the new position as (10, -6). This straightforward calculation exemplifies core geometric concepts and their practical applications in various fields.

Mastery of these translation principles enables a deeper understanding of spatial reasoning, which is crucial in mathematics, computer science, engineering, and beyond. Whether moving objects in a digital environment or analyzing geometric figures, the ability to compute image points after transformations remains an essential skill in both academic and real-world contexts.

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