

A Rectangle Is Translated By The Rule $(x,y) \rightarrow (x-3, y+6)$. What Will Be The Measure Of Each Interior

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Understanding geometric transformations is fundamental in geometry, especially when analyzing how figures change position and orientation within a coordinate plane. One common transformation is translation, which shifts a figure from one location to another without altering its size or shape. In this article, we will explore what happens when a rectangle is translated using the rule $(x, y) \rightarrow (x - 3, y + 6)$. Specifically, we will examine how this translation affects the rectangle's interior angles and what the measures of these angles will be after the transformation.

Understanding the Translation Rule $(x, y) \rightarrow (x - 3, y + 6)$

What Is a Translation in Geometry?

In geometry, translation is a type of rigid motion that moves every point of a figure a fixed distance in a specified direction. The key characteristics of translation include:

- Preservation of Size and Shape: The figure does not stretch, shrink, or rotate.
- Parallel Shift: Every point moves the same distance in the same direction.
- Copy of the Original: The translated figure is congruent to the original.

Decoding the Translation Rule

The translation rule $(x, y) \rightarrow (x - 3, y + 6)$ indicates that:

- Horizontal Shift: Each point moves 3 units to the left (because of $x - 3$).
- Vertical Shift: Each point moves 6 units upward (because of $y + 6$).

This rule effectively shifts the entire rectangle 3 units to the left and 6 units up on the coordinate plane.

Effects of Translation on a Rectangle's Interior Angles

Are Interior Angles Affected by Translation?

One of the fundamental properties of translation is that it does not alter the size, shape, or internal angles of a figure. Instead, it only changes the figure's position within the coordinate plane.

Therefore:

- The measure of each interior angle of the rectangle remains unchanged.
- The rectangle maintains its shape and size.
- The only difference is the figure's location after the translation.

Interior Angles of a Rectangle

Before considering the translation, recall the properties of a rectangle's interior angles:

- All four angles are right angles.
- Each interior angle measures 90 degrees.
- Sum of interior angles: 360 degrees.

Since translation does not modify these properties, the measures of the interior angles after the translation are still 90 degrees each.

Calculating the Coordinates of the Translated Rectangle

Original Coordinates of the Rectangle

Suppose the rectangle is defined by its four vertices in the coordinate plane:

Vertex	Coordinates (x, y)
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A	(x_1, y_1)
B	(x_2, y_2)
C	(x_3, y_3)
D	(x_4, y_4)

The exact coordinates depend on the original rectangle's position.

Applying the Translation Rule

To find the new coordinates after translation, apply the rule to each vertex:

- New x-coordinate = original x - 3
- New y-coordinate = original y + 6

Example:

If the original vertices are:

- A (2, 3)
- B (6, 3)
- C (6, 5)
- D (2, 5)

then the translated vertices become:

Vertex	Original Coordinates	Translated Coordinates (x - 3, y + 6)
A	(2, 3)	(2 - 3, 3 + 6) → (-1, 9)
B	(6, 3)	(6 - 3, 3 + 6) → (3, 9)
C	(6, 5)	(6 - 3, 5 + 6) → (3, 11)
D	(2, 5)	(2 - 3, 5 + 6) → (-1, 11)

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Implications for the Interior Angles of the Translated Rectangle

What Changes and What Remains Constant?

- Size and Shape: The rectangle retains its original dimensions because translation is a rigid motion.
- Angles: Each interior angle remains at 90 degrees.
- Position: The rectangle is shifted left by 3 units and upward by 6 units.

Conclusion:

The measure of each interior angle of the rectangle remains exactly the same after translation, confirming that the translation rule does not affect the angles' measures.

Summary of Key Points

- Translation moves a figure without altering its size, shape, or internal angles.
- The rule $(x, y) \rightarrow (x - 3, y + 6)$ shifts the rectangle 3 units left and 6 units up.
- Interior angles of a rectangle are always 90 degrees, regardless of translation.
- The translated rectangle has identical interior angle measures as the original.

Practical Applications of Translation in Geometry

Design and Engineering

- Moving components in a design without changing their dimensions.
- Shifting architectural plans or blueprints for better visualization.

Computer Graphics and Animation

- Moving objects across the screen while maintaining their shape and size.
- Implementing movement in animations through translation.

Educational Tools

- Teaching students about transformations and congruence.
- Visualizing how figures move in the coordinate plane.

Conclusion: The Measure of Each Interior Angle Remains Constant

In summary, translating a rectangle using the rule $(x, y) \rightarrow (x - 3, y + 6)$ does not affect the measure of its interior angles. Since the original rectangle's interior angles are all right angles, each measuring 90 degrees, they remain the same after the translation. This demonstrates a fundamental property of translation in geometry: it preserves size, shape, and internal angles but changes the figure's position within the plane.

Understanding this concept is essential for students and professionals working in fields that involve geometric transformations, ensuring accurate modeling and analysis of figures regardless of their position in space.

Frequently Asked Questions

What is the translation rule applied to the rectangle?

The rule is $(x, y) \rightarrow (x - 3, y + 6)$.

How does the translation affect the position of the rectangle?

It shifts the rectangle 3 units left and 6 units up.

Does the translation change the size of the rectangle?

No, translation moves the rectangle without altering its size or shape.

What is the significance of the translation rule in coordinate geometry?

It describes how a figure is moved in the plane without changing its dimensions or angles.

Will the measure of each interior angle of the rectangle change after translation?

No, the interior angles remain the same because translation preserves shape and size.

Are the side lengths of the rectangle affected by the translation?

No, side lengths remain unchanged; only the position shifts.

What is the measure of each interior angle of a rectangle?

Each interior angle of a rectangle measures 90 degrees.

Does the translation rule affect the perimeter of the rectangle?

No, the perimeter stays the same because the shape and size do not change.

How can you find the new coordinates of the rectangle after translation?

Apply the rule $(x, y) \rightarrow (x - 3, y + 6)$ to each vertex of the rectangle.

Is the measure of each interior angle of the rectangle affected by the translation?

No, the interior angles remain 90 degrees after translation.

Additional Resources

A Rectangle Is Translated By The Rule $(x, y) \rightarrow (x - 3, y + 6)$. What Will Be The Measure Of Each Interior?

Understanding how transformations affect geometric figures is fundamental in geometry, especially when dealing with translations. In this article, we will explore the concept of translating a rectangle using the rule $(x, y) \rightarrow (x - 3, y + 6)$ and analyze what happens to the measures of each interior. This comprehensive guide will help you grasp the principles behind translation transformations, their impact on geometric figures, and the specifics of how interior measures are preserved or altered during such transformations.

Introduction to Translations in Geometry

What Is a Translation?

In geometry, a translation is a type of transformation that slides a figure from one position to another without changing its size, shape, or orientation. Think of it as "pushing" or "shifting" a figure along a plane.

The key characteristic of translations is that they preserve the shape and size of the figure, meaning the figure is congruent to its original.

The Translation Rule: $(x, y) \rightarrow (x - 3, y + 6)$

The rule $(x, y) \rightarrow (x - 3, y + 6)$ describes a specific translation:

- Horizontal shift: Moving every point 3 units to the left (since subtracting 3 decreases the x-coordinate).
- Vertical shift: Moving every point 6 units up (since adding 6 increases the y-coordinate).

This rule applies to every point of the rectangle, ensuring the entire figure moves uniformly without distortion.

Understanding the Impact of the Translation Rule on a Rectangle

Coordinates and Original Position

Suppose you have a rectangle with vertices labeled:

- A (x_1, y_1)
- B (x_2, y_2)
- C (x_3, y_3)
- D (x_4, y_4)

These points define the original rectangle's position and size.

Applying the Translation Rule

Applying the rule $(x, y) \rightarrow (x - 3, y + 6)$ to each vertex:

- A' $(x_1 - 3, y_1 + 6)$
- B' $(x_2 - 3, y_2 + 6)$
- C' $(x_3 - 3, y_3 + 6)$
- D' $(x_4 - 3, y_4 + 6)$

The new image, A'B'C'D', is congruent to the original rectangle and located 3 units to the left and 6 units up from the original.

Effect of the Translation on the Measures of the Interior

Preservation of Lengths and Angles

One of the fundamental properties of translations is that they preserve the measures of lengths and angles within the figure. Since the translation simply shifts the rectangle without stretching, shrinking, or rotating it,

the following are invariant:

- Side lengths
- Interior angles
- Area
- Perimeter

Why Are Measures Preserved?

Because translation is an isometry (a distance-preserving transformation), all distances between points remain the same. The shape's size and angles do not change, only its position in the plane.

Interior Measures of a Rectangle

For a rectangle, the measures of interior angles are always 90 degrees. The length of each side depends on the coordinates of its vertices but remains unchanged after translation.

In summary:

- The measure of each interior angle remains 90 degrees.
- The lengths of the sides remain the same.
- The area remains unchanged.

Step-by-Step Example: Calculating Interior Measures Before and After Translation

Original Rectangle Coordinates

Let's assume the rectangle has the following vertices:

- A (2, 3)
- B (6, 3)
- C (6, 7)
- D (2, 7)

This rectangle has:

- Width: $|6 - 2| = 4$ units
- Height: $|7 - 3| = 4$ units
- Area: $4 \times 4 = 16$ square units
- Interior angles: all 90 degrees

Applying the Translation

Using $(x, y) \rightarrow (x - 3, y + 6)$:

- A' $(2 - 3, 3 + 6) = (-1, 9)$

- B' $(6 - 3, 3 + 6) = (3, 9)$
- C' $(6 - 3, 7 + 6) = (3, 13)$
- D' $(2 - 3, 7 + 6) = (-1, 13)$

Coordinates of the Translated Rectangle

- A' $(-1, 9)$
- B' $(3, 9)$
- C' $(3, 13)$
- D' $(-1, 13)$

Measures After Translation

- Width: $|3 - (-1)| = 4$ units
- Height: $|13 - 9| = 4$ units
- Area: $4 \times 4 = 16$ square units
- Interior angles: all 90 degrees

The measures are identical to the original rectangle, confirming that translation preserves interior measures.

Summary of Key Concepts

What Remains Unchanged?

- Side lengths
- Interior angles
- Area and perimeter
- Shape and size of the rectangle

What Changes?

- Position in the coordinate plane

The rectangle is simply shifted, not distorted or resized.

Practical Implications and Applications

Understanding how translation affects a rectangle's interior measures is fundamental in various fields:

- Computer Graphics: Moving objects within a scene without altering their shape or size.
- Engineering Design: Shifting parts while maintaining their dimensions.
- Mathematics Education: Teaching the properties of geometric transformations.
- Robotics and Navigation: Calculating movements that preserve object

dimensions.

Common Mistakes to Avoid

- Assuming translation alters size: Remember, it does not.
- Confusing translation with other transformations: Rotation, reflection, and scaling change measures differently.
- Misapplying the rule: Always ensure that the translation rule is applied to all vertices for accurate results.

Final Thoughts

The translation rule $(x, y) \rightarrow (x - 3, y + 6)$ illustrates a fundamental concept in geometry: that translations shift figures without altering their internal measurements. For a rectangle, this means that all interior measures—angles, side lengths, area—remain constant despite the figure's new position in the coordinate plane. Recognizing this property is essential for deeper understanding of geometric transformations and their applications across various scientific and engineering disciplines.

In conclusion, when a rectangle is translated by the rule $(x, y) \rightarrow (x - 3, y + 6)$, the measure of each interior remains exactly the same as before the translation. The figure's size, shape, and internal angles are preserved, reaffirming the fundamental property of translations as isometric transformations.

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