Polygon JKLM Is Drawn With Vertices J(4, 3), K(4, 6), L(1, 6), M(1, 3). Determine The Image Coordinates

Polygon JKLM Is Drawn With Vertices J(4, 3), K(4, 6), L(1, 6), M(1, 3). Determine The Image Coordinates

Understanding how to analyze and transform polygons is a fundamental skill in geometry, computer graphics, and various engineering applications. In this article, we will explore the process of determining the image coordinates of a polygon, specifically focusing on Polygon JKLM with vertices at J(4, 3), K(4, 6), L(1, 6), and M(1, 3). We will examine the steps involved in transforming these coordinates through different geometric operations, including translation, rotation, scaling, and reflection. By the end of this guide, you will have a comprehensive understanding of how to manipulate and find image coordinates for complex polygons.

Understanding the Polygon JKLM and Its Coordinates

Before diving into transformations, it's essential to understand the initial positioning of the polygon.

Vertices of Polygon JKLM

- J(4, 3): The starting point at x=4, y=3.
- K(4, 6): Vertically aligned with J, at x=4, y=6.
- L(1, 6): Positioned to the left of K, at x=1, y=6.
- M(1, 3): Vertically aligned with L and to the left of J, at x=1, y=3.

This configuration suggests that Polygon JKLM is a quadrilateral with the following properties:

- It forms a rectangle or a parallelogram depending on specific side lengths.
- The vertices are aligned such that J and M are on the line y=3, and K and L are on y=6.
- The sides are vertical and horizontal, indicating the polygon is a rectangle.

Analyzing the Shape and Coordinates

Shape Type

Given the coordinates, Polygon JKLM is a rectangle with sides parallel to the axes. The vertices are:

Vertex	Coordinates	Description
J	(4, 3)	Bottom right corner
K	(4, 6)	Top right corner
L	(1, 6)	Top left corner
M	(1, 3)	Bottom left corner

Side Lengths

- Vertical sides:
- JK and M L: length = |6 - 3| = 3 units.
- Horizontal sides:
- J M and K L: length = |4 - 1| = 3 units.

Thus, the polygon is a rectangle measuring 3 units by 3 units.

Transformations and Their Impact on Coordinates

Transformations are operations that change the position, size, or orientation of a figure. Common transformations include translation, rotation, scaling, and reflection.

Types of Transformations

- Translation: Moving every point of the polygon by the same distance in a given direction.
- Rotation: Turning the polygon around a point (usually the origin or a vertex) by a certain angle.
- Scaling: Increasing or decreasing the size of the polygon proportionally with respect to a point.
- Reflection: Flipping the polygon over a line (such as the x-axis, y-axis, or any other line).

Determining New Coordinates After Transformation

Let's explore how to find image coordinates after applying specific transformations.

1. Translation

Suppose we want to translate the polygon by vector (a, b). The new coordinates (x', y') are given by:

$x' = x + a$
$y' = y + b$

Example: Moving the polygon 2 units right and 1 unit up:

- J(4,3) → J'(4+2, 3+1) = (6, 4)
- K(4,6) → (6, 7)
- L(1,6) → (3, 7)
- M(1,3) → (3, 4)

Resulting vertices after translation:

Vertex	New Coordinates	Description
J	(6, 4)	Translated bottom right
K	(6, 7)	Translated top right
L	(3, 7)	Translated top left
M	(3, 4)	Translated bottom left

2. Rotation

Rotating a point around the origin by an angle θ (degrees) involves:

$x' = x \cos \theta - y \sin \theta$
$y' = x \sin \theta + y \cos \theta$

Example: Rotate the original polygon 90° clockwise around the origin.

- $\cos 90° = 0$
- $\sin 90° = 1$

Calculations:

- J(4,3):

x' = 40 - 31 = -3
y' = 41 + 30 = 4

- K(4,6):

x' = -6
y' = 4

- L(1,6):

x' = -6
y' = 1

- M(1,3):

x' = -3
y' = 1

Rotated vertices:

Vertex	Coordinates after rotation	Description
J	(-3, 4)	Rotated J
K	(-6, 4)	Rotated K
L	(-6, 1)	Rotated L
M	(-3, 1)	Rotated M

3. Scaling

Scaling involves multiplying coordinates by a scale factor s with respect to a point, usually the origin.

Suppose s=2 (doubling size):

New coordinates:

x' = s x
y' = s y

Applying to original vertices:

- J(4,3) → (8, 6)
- K(4,6) → (8, 12)
- L(1,6) → (2, 12)
- M(1,3) → (2, 6)

4. Reflection

Reflections over axes:

- About x-axis: $(x, y) \rightarrow (x, -y)$
- About y-axis: $(x, y) \rightarrow (-x, y)$
- About the line $y = x$: $(x, y) \rightarrow (y, x)$

Reflection over y-axis:

- J(4,3) → (-4, 3)
- K(4,6) → (-4, 6)
- L(1,6) → (-1, 6)
- M(1,3) → (-1, 3)

Reflection over x-axis:

- J(4,3) → (4, -3)
- K(4,6) → (4, -6)
- L(1,6) → (1, -6)
- M(1,3) → (1, -3)

Applications of Coordinate Transformations in Real-World Scenarios

Transformations of polygons are vital in numerous fields. Here are some practical applications:

Computer Graphics and Animation

- Moving and rotating objects within a scene.
- Scaling characters or objects to different sizes.
- Reflecting images for symmetry effects.

Engineering and Design

- Adjusting component positions in CAD models.
- Simulating physical movements or deformations.
- Creating precise drawings and blueprints.

Mathematics Education

- Visualizing geometric transformations.
- Teaching concepts of symmetry, congruence, and similarity.
- Developing spatial reasoning skills.

Step-by-Step Method to Determine Image Coordinates

To systematically find the image coordinates after any transformation, follow these steps:

1. Identify Original Coordinates: Clearly list the vertices of the original polygon.
2. Select Transformation Type: Decide whether you will translate, rotate, scale, or reflect.
3. Determine Parameters: Establish the parameters for the transformation (e.g., translation vector, rotation angle, scale factor).
4. Apply Transformation Formula: Use the appropriate formulas to calculate new coordinates.
5. Plot or Visualize: Sketch the original and transformed polygons to verify accuracy.
6. Analyze Results: Confirm the shape, size, and position align with expectations.

Conclusion: Mastering Coordinate Transformations for Polygon JKLM

Understanding how to determine the image coordinates of polygons like JKLM is essential for both academic and practical purposes. By mastering translation, rotation, scaling, and reflection, you can manipulate polygons to suit various design needs and analytical tasks. Remember to carefully apply the transformation formulas and verify your results through visualization. Whether you're working on geometrical proofs, computer graphics, or engineering designs, these skills will enable you to confidently analyze and transform polygons in a coordinate plane.

In summary:

- The original polygon JKLM is a rectangle with

Frequently Asked Questions

What are the given vertices of polygon JKLM?

The vertices are J(4, 3), K(4, 6), L(1, 6), and M(1, 3).

How do you determine the image coordinates of polygon JKLM after a translation?

Add the translation vector components to each vertex's coordinates to find the new image coordinates.

What is the translation vector if the polygon is shifted 2 units right and 1 unit up?

The translation vector is (2, 1).

What are the image coordinates of vertex J after a translation of (2, 1)?

J'(6, 4).

What are the image coordinates of vertex K after the same translation?

K'(6, 7).

What are the image coordinates of vertex L after the translation?

L'(3, 7).

What are the image coordinates of vertex M after the translation?

M'(3, 4).

How can you verify that the shape of polygon JKLM remains unchanged after translation?

Check that the distances between vertices and the shape's angles remain the same, confirming it's a congruent translation.

What is the general formula for translating a point (x, y) by a vector (a, b)?

The translated point is (x + a, y + b).

Additional Resources

Polygon JKLM Is Drawn With Vertices J(4, 3), K(4, 6), L(1, 6), M(1, 3). Determine The Image Coordinates

Understanding the spatial properties of geometric figures is fundamental in fields ranging from computer graphics to engineering design. When dealing with polygons on the coordinate plane, a common problem involves transforming these figures—through translation, rotation, scaling, or other transformations—and determining the new coordinates of their vertices. In this article, we delve into a specific case: a quadrilateral with vertices J(4, 3), K(4, 6), L(1, 6), and M(1, 3). We'll explore how to analyze its properties, perform transformations, and accurately determine the image coordinates after such operations.

The Basic Geometry of Polygon JKLM

Coordinates and Shape Description

The initial step in analyzing any polygon is to understand its shape and position based on the given vertices. The vertices of polygon JKLM are:

- J(4, 3)
- K(4, 6)
- L(1, 6)
- M(1, 3)

Plotting these points on the Cartesian plane reveals a rectangle aligned along the axes, with the following characteristics:

- The rectangle's sides are parallel to the axes.
- Vertices J and K share the same x-coordinate (x=4), indicating a vertical side.
- Vertices L and M share the same x-coordinate (x=1), indicating another vertical side.
- Vertices J and M share the same y-coordinate (y=3), indicating a horizontal side.
- Vertices K and L share the same y-coordinate (y=6), indicating the opposite horizontal side.

Visual Representation and Dimensions

Plotting these points, the rectangle appears as follows:

- Left side: from M(1, 3) to L(1, 6)
- Right side: from J(4, 3) to K(4, 6)
- Top side: from L(1, 6) to K(4, 6)
- Bottom side: from M(1, 3) to J(4, 3)

The width of the rectangle is calculated as the difference between the x-coordinates:

- Width = 4 - 1 = 3 units

The height of the rectangle is the difference between the y-coordinates:

- Height = 6 - 3 = 3 units

This confirms that the figure is a square with side length 3 units, aligned with the axes, positioned in the coordinate plane.

Analyzing the Transformation: What Does "Determine The Image Coordinates" Imply?

Clarifying the Transformation

The phrase "Determine The Image Coordinates" suggests applying a certain transformation to the polygon and calculating the new positions of the vertices. Common transformations include:

- Translation: Moving the figure without rotating or resizing.
- Rotation: Turning the figure around a point.
- Scaling: Resizing the figure proportionally from a specific point.
- Reflection: Flipping the figure across a line.

Since the problem statement does not specify which transformation to perform, a typical approach involves considering a common transformation such as translation, rotation, or scaling. For this article, we'll analyze three typical transformations:

1. Translation by a specific vector
2. Rotation about a point
3. Scaling with respect to a point

Assumption for Demonstration

To illustrate the process, let's assume the following transformations:

- Translation: move the polygon 2 units right and 1 unit up.
- Rotation: rotate the polygon 90 degrees clockwise about the origin.
- Scaling: enlarge the polygon by a factor of 2 with respect to the origin.

We'll detail each transformation step-by-step and compute the new coordinates accordingly.

Performing the Transformations Step-by-Step

1. Translation: Moving the Polygon

Objective: Shift every vertex by a vector $\vec{v} = (2, 1)$.

Method:
- For each vertex (x, y), the translated vertex (x', y') is:

$$
x' = x + \Delta x
$$
$$
y' = y + \Delta y
$$

where $\Delta x = 2$ and $\Delta y = 1$.

Calculations:

- J(4, 3) becomes J' (4 + 2, 3 + 1) = (6, 4)
- K(4, 6) becomes K' (4 + 2, 6 + 1) = (6, 7)
- L(1, 6) becomes L' (1 + 2, 6 + 1) = (3, 7)
- M(1, 3) becomes M' (1 + 2, 3 + 1) = (3, 4)

Resulting vertices after translation:

- J'(6, 4)
- K'(6, 7)
- L'(3, 7)
- M'(3, 4)

The translated polygon is now shifted 2 units right and 1 unit up on the coordinate plane.

---

2. Rotation: Rotating 90 Degrees Clockwise About the Origin

Objective: Rotate each vertex 90° clockwise around the origin (0,0).

Rotation rule:

For a point (x, y), the image after rotating 90° clockwise is:

$$
(x', y') = (y, -x)
$$

Calculations for translated vertices:

- J'(6, 4):

$$
x' = 4,\quad y' = -6 \Rightarrow (4, -6)
$$

- K'(6, 7):

$$
x' = 7,\quad y' = -6 \Rightarrow (7, -6)
$$

- L'(3, 7):

$$
x' = 7,\quad y' = -3 \Rightarrow (7, -3)
$$

- M'(3, 4):

$$
x' = 4,\quad y' = -3 \Rightarrow (4, -3)
$$

Resulting vertices after rotation:

- J'' (4, -6)
- K'' (7, -6)
- L'' (7, -3)
- M'' (4, -3)

The figure has been rotated in the plane, now occupying a different quadrant.

---

3. Scaling: Enlarging by a Factor of 2 With Respect to the Origin

Objective: Increase the size of the polygon by a factor of 2, centered at the origin.

Scaling rule:

For each point (x, y), the scaled point (x', y') is:

$$
x' = s \times x
$$
$$
y' = s \times y
$$

where $s = 2$.

Calculations:

- J'' (4, -6):

$$
x' = 2 \times 4 = 8,\quad y' = 2 \times -6 = -12
$$

- K'' (7, -6):

$$
x' = 2 \times 7 = 14,\quad y' = 2 \times -6 = -12
$$

- L'' (7, -3):

$$
x' = 2 \times 7 = 14,\quad y' = 2 \times -3 = -6
$$

- M'' (4, -3):

$$
x' = 2 \times 4 = 8,\quad y' = 2 \times -3 = -6
$$

Final image coordinates after all three transformations:

- J''' (8, -12)
- K''' (14, -12)
- L''' (14, -6)
- M''' (8, -6)

This sequence of transformations demonstrates how a polygon's vertices can be systematically manipulated and how their coordinates are computed at each step.

Practical Applications and Significance

Understanding how to determine the image coordinates of a polygon after transformations is essential in numerous practical applications:

- Computer Graphics: Rendering scenes requires transforming object coordinates to simulate movement, rotation, or scaling.
- Engineering Design: CAD software relies on coordinate transformations to modify parts and assemblies.
- Robotics: Path planning involves transforming coordinate frames.
- Geographic Information Systems (GIS): Map features are often translated, rotated, or scaled to fit different coordinate systems.

By mastering these transformation techniques, professionals can accurately manipulate and analyze geometric figures in various contexts.

Summary and Key Takeaways

- The initial polygon JKLM is a square with vertices at (4, 3), (4, 6), (1, 6), and (1, 3).
- Transformations like translation, rotation, and scaling alter the position and size of the polygon, and their effects on coordinates can be precisely computed using well-established formulas.
- Applying sequential transformations involves a step-by-step approach: transform the vertices, then examine the resulting coordinates.
- Understanding coordinate transformations enhances skills in graphical programming, CAD design, and spatial analysis.

Final Thoughts

Determining the image coordinates of a polygon after various transformations is a fundamental skill that bridges geometric theory and practical application. Whether you're designing complex models, programming computer graphics, or analyzing spatial data, a clear grasp of how to manipulate and compute coordinate changes is invaluable.

Polygon Jklm Is Drawn With Vertices J 4 3 K 4 6 L 1 6 M 1 3 Determine The Image Coordinates

Polygon Jklm Is Drawn With Vertices J 4 3 K 4 6 L 1 6 M 1 3 Determine The Image Coordinates

Related Articles

- On June 1, Button Co. Borrowed $1,000 Cash From National Bank By Signing A 120-day, 6% Interest-bearing
- Rebecca's Score On The Stats Midterm Was 66 Points. The Class Average Was 76 And The Standard Deviation
- Nobel Prize Winner Milton Friedman Said That A Bad Central Banker Is Like A ""fool In The Shower."" How

Back to Home