Enlarge The Triangle By Scale Factor 1.5 Using (4,4) As The Centre Of Enlargement.

Enlarge The Triangle By Scale Factor 1.5 Using (4,4) As The Centre Of Enlargement.

Understanding geometric transformations is fundamental in both mathematics and practical applications such as engineering, computer graphics, and design. One such transformation is enlargement, which involves resizing a figure while maintaining its shape and proportions. In this article, we will explore how to enlarge a triangle by a scale factor of 1.5, using the point (4,4) as the centre of enlargement. This process involves precise calculations and a clear understanding of the concepts of scale factors and centres of enlargement.

Understanding Enlargement and Scale Factors

What Is Enlargement in Geometry?

Enlargement, also known as dilation or scaling, is a transformation that changes the size of a geometric figure without altering its shape. When a figure is enlarged:

- The shape remains similar to the original.
- All distances from the centre of enlargement are scaled by a specific factor.
- The figure's size increases or decreases proportionally based on the scale factor.

Enlargement can be performed about any point in the plane, but the most common centre is a specific coordinate point.

Defining the Scale Factor

The scale factor determines how much larger or smaller the enlarged figure will be relative to the original:

- A scale factor greater than 1 (>1) results in an enlargement.
- A scale factor less than 1 (<1) results in a reduction.
- A scale factor of exactly 1 means the figure remains unchanged.

In our case, the scale factor is 1.5, indicating that the triangle's dimensions will increase by 50%.

Using (4,4) as the Centre of Enlargement

Why Choose a Specific Centre?

The centre of enlargement is the fixed point about which the figure is scaled. All points of the figure are moved along lines passing through this centre, and the distances from the centre are scaled by the chosen factor.

Choosing (4,4) as the centre means:

- The point (4,4) remains unchanged during the transformation.
- The other vertices of the triangle are moved along straight lines passing through (4,4).

Steps to Enlarge the Triangle

Suppose we are given the vertices of the original triangle and need to perform the enlargement:

1. Identify the vertices of the original triangle.
2. For each vertex, determine its position relative to the centre of enlargement.
3. Calculate the new position of each vertex by scaling the distance from the centre by 1.5.
4. Plot or connect the new vertices to form the enlarged triangle.

Let's explore these steps in detail.

Step-by-Step Process for Enlarging the Triangle

1. Original Coordinates of the Triangle

Assuming the triangle has vertices at:

- A (x1, y1)
- B (x2, y2)
- C (x3, y3)

For demonstration, let's suppose the vertices are:

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

These points form a triangle in the coordinate plane.

2. Identify the Centre of Enlargement

Given centre point:

- O (4, 4)

This point stays fixed during the transformation.

3. Calculate the New Coordinates of Each Vertex

For each vertex, perform the following:

- Determine the vector from the centre to the vertex:

$$
\Delta x = x_{vertex} - x_{centre}
$$

$$
\Delta y = y_{vertex} - y_{centre}
$$

- Scale this vector by the scale factor (1.5):

$$
\Delta x_{new} = \Delta x \times 1.5
$$

$$
\Delta y_{new} = \Delta y \times 1.5
$$

- Find the new vertex coordinates:

$$
x_{new} = x_{centre} + \Delta x_{new}
$$

$$
y_{new} = y_{centre} + \Delta y_{new}
$$

Applying this process to each vertex:

Vertex A (2,3):
- $\Delta x = 2 - 4 = -2$
- $\Delta y = 3 - 4 = -1$

Scaled vectors:
- $\Delta x_{A} = -2 \times 1.5 = -3$
- $\Delta y_{A} = -1 \times 1.5 = -1.5$

New vertex:
- $x_{A'} = 4 + (-3) = 1$
- $y_{A'} = 4 + (-1.5) = 2.5$

Vertex B (6,2):
- $\Delta x = 6 - 4 = 2$
- $\Delta y = 2 - 4 = -2$

Scaled vectors:
- $2 \times 1.5 = 3$
- $-2 \times 1.5 = -3$

New vertex:
- $x_{B'} = 4 + 3 = 7$
- $y_{B'} = 4 + (-3) = 1$

Vertex C (3,7):
- $\Delta x = 3 - 4 = -1$
- $\Delta y = 7 - 4 = 3$

Scaled vectors:
- $-1 \times 1.5 = -1.5$
- $3 \times 1.5 = 4.5$

New vertex:
- $x_{C'} = 4 + (-1.5) = 2.5$
- $y_{C'} = 4 + 4.5 = 8.5$

4. Plotting and Connecting the Enlarged Triangle

The enlarged triangle's vertices are:

- A' (1, 2.5)
- B' (7, 1)
- C' (2.5, 8.5)

Connecting these points in order forms the enlarged triangle. The process preserves the shape while increasing its size by 50%.

Visualizing the Enlargement Process

Visual aids are essential for understanding the transformation:

- Plot the original triangle with vertices A, B, and C.
- Mark the centre of enlargement at (4, 4).
- Draw lines from each original vertex through the centre.
- Mark the scaled points A', B', and C' along these lines.
- Connect the new points to visualize the enlarged triangle.

Applications of Enlargement in Various Fields

Understanding how to enlarge figures using a scale factor and a specific centre has practical applications:

1. Computer Graphics and Design

- Scaling images or figures while maintaining proportions.
- Creating enlargements or reductions of objects in digital environments.

2. Engineering and Architecture

- Producing scale models of structures.
- Enlarging blueprint sections for detailed analysis.

3. Mathematics Education

- Teaching concepts of similarity, scale, and transformations.
- Developing spatial reasoning skills.

Summary and Key Takeaways

- Enlargement is a transformation that scales a figure proportionally about a fixed point called the centre.
- The scale factor determines the degree of enlargement or reduction.
- To enlarge a triangle by a scale factor of 1.5 using (4, 4) as the centre, calculate the vectors from the centre to each vertex, scale these vectors, and then add them back to the centre to find the new vertices.
- This process preserves the shape's similarity while increasing its size by 50%.

Tips for Accurate Enlargement

- Always double-check calculations of the vectors and scaled coordinates.

- Use graph paper or plotting software for precise visualization.
- Remember that the centre point remains unchanged.

Conclusion

Enlarging a triangle by a scale factor of 1.5 using (4,4) as the centre of enlargement is a straightforward yet powerful geometric transformation. It demonstrates the principles of similarity and proportionality, essential concepts in both theoretical and applied mathematics. By mastering this process, students and professionals can better understand how figures change size relative to a fixed point, enabling accurate scaling in various practical contexts.

Whether for academic purposes, design projects, or engineering models, understanding and applying the concept of enlargement enhances spatial reasoning and mathematical proficiency. Practice with different figures and centres of enlargement will deepen your grasp of this versatile transformation.

Keywords: enlarge triangle, scale factor 1.5, centre of enlargement, coordinate geometry, geometric transformation, similarity, dilation, scaling, coordinate calculation, enlargement process

Frequently Asked Questions

What is the process to enlarge a triangle by a scale factor of 1.5 using (4,4) as the center?

To enlarge a triangle by a scale factor of 1.5 using (4,4) as the center, you draw lines from the center (4,4) to each vertex of the triangle, measure 1.5 times the original distance along each line from the center, and mark the new vertices at these points. Connecting these new points creates the enlarged triangle.

How do you find the new coordinates of the vertices after enlarging a triangle with center (4,4) and scale factor 1.5?

You use the formula: New Vertex = Center + scale factor × (Original Vertex - Center). For each vertex, subtract the center coordinates, multiply by 1.5, then add back the center coordinates to find the new position.

Why is the point (4,4) used as the center of enlargement

in this problem?

The point (4,4) is chosen as the center because it remains fixed during the enlargement process. All other points are scaled relative to this fixed point, making it the reference point for the transformation.

What are the benefits of enlarging a triangle using a scale factor and a fixed center of enlargement?

Using a scale factor and a fixed center allows precise control over the size of the shape while maintaining its proportions and orientation. It also helps in creating similar figures in geometric constructions.

Can the method of enlarging a triangle by a scale factor of 1.5 be applied to any shape?

Yes, the method can be applied to any shape, as long as the center of enlargement and the scale factor are specified. The process involves scaling all points relative to the fixed center.

What are common mistakes to avoid when enlarging a triangle using this method?

Common mistakes include not measuring the correct distances from the center, forgetting to multiply by the scale factor, or mislabeling the new vertices. Ensuring accurate measurements and calculations is essential for a correct enlargement.

Additional Resources

Enlarging a Triangle by a Scale Factor of 1.5 Using (4,4) as the Centre of Enlargement

Enlarging geometric figures is a fundamental concept in coordinate geometry, often encountered in mathematics curricula ranging from middle school to advanced levels. Among the various transformations, enlargement (or dilation) stands out as a pivotal operation that not only enhances understanding of similarity but also deepens insight into the properties of geometric figures in the coordinate plane. In this detailed exploration, we will focus on enlarging a specific triangle by a scale factor of 1.5, with (4,4) serving as the centre of enlargement. This process involves multiple steps, from understanding the initial setup to executing the transformation precisely, and analyzing the resulting figure.

Understanding the Concept of Enlargement in

Coordinate Geometry

Enlargement, also known as dilation, refers to a transformation that produces a similar figure to the original, scaled uniformly from a fixed point called the centre of enlargement. The key properties include:

- Centre of Enlargement: The fixed point in the plane about which the figure is scaled.
- Scale Factor (k): The ratio of any length in the enlarged figure to the corresponding length in the original figure. A scale factor of 1.5 indicates the figure will be 1.5 times larger than the original.
- Resulting Image: The new figure, similar to the original, scaled uniformly with respect to the centre.

Mathematically, the coordinates of a point (x, y) after enlargement with centre (x_c, y_c) and scale factor k are given by:

$$
(x', y') = (x_c + k \times (x - x_c), \quad y_c + k \times (y - y_c))
$$

This formula ensures that each point moves along the line connecting it to the centre, scaled by the factor k.

Setting Up the Problem: Details and Assumptions

To proceed with the enlargement, we need:

1. The initial triangle's vertices.
2. The centre of enlargement — given as (4,4).
3. The scale factor — specified as 1.5.

Assumption of Triangle Coordinates:

Suppose the original triangle has vertices:

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

These coordinates are chosen to illustrate the process clearly; in an actual problem, the vertices would be specified explicitly.

Step-by-Step Process of Enlarging the Triangle

1. Applying the Enlargement Formula to Each Vertex

Using the general formula:

$$
(x', y') = (x_c + k \times (x - x_c), \quad y_c + k \times (y - y_c))
$$

with $(x_c, y_c) = (4, 4)$ and $k = 1.5$, we calculate the new positions:

---

2. Calculating New Coordinates for Each Vertex

Vertex A (2, 3):

$$
x'_A = 4 + 1.5 \times (2 - 4) = 4 + 1.5 \times (-2) = 4 - 3 = 1
$$
$$
y'_A = 4 + 1.5 \times (3 - 4) = 4 + 1.5 \times (-1) = 4 - 1.5 = 2.5
$$

A' (Enlarged A): (1, 2.5)

Vertex B (6, 2):

$$
x'_B = 4 + 1.5 \times (6 - 4) = 4 + 1.5 \times 2 = 4 + 3 = 7
$$
$$
y'_B = 4 + 1.5 \times (2 - 4) = 4 + 1.5 \times (-2) = 4 - 3 = 1
$$

B' (Enlarged B): (7, 1)

Vertex C (3, 7):

$$
x'_C = 4 + 1.5 \times (3 - 4) = 4 + 1.5 \times (-1) = 4 - 1.5 = 2.5

\]

$$
y'_C = 4 + 1.5 \times (7 - 4) = 4 + 1.5 \times 3 = 4 + 4.5 = 8.5
$$

C' (Enlarged C): (2.5, 8.5)

---

3. Visualizing the Transformation

With the original vertices:

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

and the enlarged vertices:

- A'(1, 2.5)
- B'(7, 1)
- C'(2.5, 8.5)

we can plot both triangles to observe the change. The enlarged triangle is scaled uniformly, maintaining the shape but increased in size proportionally from the centre (4,4).

Properties and Analysis of the Enlarged Triangle

1. Similarity and Scale

The enlarged triangle A'B'C' is similar to the original ABC, with all corresponding angles equal and side lengths scaled by 1.5. The similarity ratio directly corresponds to the scale factor.

Side Lengths (original):

Calculate the lengths of sides AB, BC, and CA:

$$
AB = \sqrt{(6-2)^2 + (2-3)^2} = \sqrt{4^2 + (-1)^2} = \sqrt{16 + 1} = \sqrt{17} \approx 4.123
$$

$$
BC = \sqrt{(3-6)^2 + (7-2)^2} = \sqrt{(-3)^2 + 5^2} = \sqrt{9 + 25} = \sqrt{34} \approx 5.831
$$

$$
CA = \sqrt{(3-2)^2 + (7-3)^2} = \sqrt{1^2 + 4^2} = \sqrt{1 + 16} = \sqrt{17} \approx 4.123
$$

Enlarged side lengths:

- For A'B':

$$
A'B' = \sqrt{(7-1)^2 + (1-2.5)^2} = \sqrt{6^2 + (-1.5)^2} = \sqrt{36 + 2.25} = \sqrt{38.25} \approx 6.185
$$

- For B'C':

$$
B'C' = \sqrt{(2.5-7)^2 + (8.5-1)^2} = \sqrt{(-4.5)^2 + 7.5^2} = \sqrt{20.25 + 56.25} = \sqrt{76.5} \approx 8.75
$$

- For C'A':

$$
C'A' = \sqrt{(2.5-1)^2 + (8.5-2.5)^2} = \sqrt{1.5^2 + 6^2} = \sqrt{2.25 + 36} = \sqrt{38.25} \approx 6.185
$$

These lengths are approximately 1.5 times the original lengths, confirming the scale factor.

---

2. Preservation of Shape and Orientation

The transformation preserves the shape's angles and orientation, a hallmark of similarity transformations. The enlarged triangle maintains the same internal angles as the original, just scaled uniformly.

3. Location of the Image Relative to the Centre

Each vertex moves along a straight line passing through the centre (4,4):

- Points closer to the centre move less than those farther away.
- The direction from the centre to each point remains the same; only the distance changes.

This property emphasizes the radial nature of dilation: points are scaled along lines radiating from the centre.

Practical Applications and Significance

Enlargements using coordinate geometry are not merely academic exercises; they have real-world applications:

- Design and Engineering: Scaling blueprints and models.
- Computer Graphics: Transforming images or shapes proportionally.
- Urban Planning: Enlarging maps or layouts from a small scale.
- Art and Illustration: Creating larger versions maintaining proportions.

Understanding how to perform such transformations accurately is crucial in these fields.

Additional Considerations and Variations

a. Different Scale Factors:

- Scale factors greater than 1 produce enlargements.
- Scale factors between 0 and 1 produce reductions.
- Negative scale factors can invert the figure, producing a reflection combined with

Enlarge The Triangle By Scale Factor 1 5 Using 4 4 As The Centre Of Enlargement

Enlarge The Triangle By Scale Factor 1 5 Using 4 4 As The Centre Of Enlargement

Related Articles

- What Are The Five Marketing Management Functions Used To Manage The Marketing Process?
- Help..!! Right Answers Will Be Marked As Brainliest..! Answer All The Questions..!
- From Which Location Could You Observe All Of The Stars During The Course Of A Year?

Back to Home