7 1 additional practice dilations

7 1 additional practice dilations are a vital concept in the field of geometry that helps students understand transformations, particularly scaling figures. Dilation is a transformation that alters the size of a figure but keeps its shape intact. It is one of the four primary transformations in geometry, along with translation, rotation, and reflection. This article will delve into the concept of dilations, how to perform them, and provide additional practice problems to reinforce the learning process.

Understanding Dilations

Dilation involves resizing a figure based on a scale factor and a center of dilation. The scale factor determines how much larger or smaller the figure will become. If the scale factor is greater than 1, the figure enlarges; if it is between 0 and 1, the figure shrinks. The center of dilation is the fixed point in the plane about which the figure is enlarged or reduced.

Key Terms

- Center of Dilation: The point from which the figure is enlarged or reduced.
- Scale Factor: A number that scales, or multiplies, the dimensions of the figure. It can be represented as k.
- Pre-image: The original figure before dilation.
- Image: The resulting figure after dilation has been applied.

How Dilation Works

To perform a dilation, follow these steps:

1. Identify the Center of Dilation: Choose a point in the plane that will serve as the center for your transformation.

2. Determine the Scale Factor: Decide on a scale factor (k). For example:
- If k = 2, the figure will double in size.
- If k = 0.5, the figure will reduce to half its original size.

3. Calculate the Coordinates of the Image: For each point of the pre-image, apply the dilation formula. If (x, y) are the coordinates of a point in the pre-image, the coordinates (x', y') in the image can be calculated using:

$$
x' = k(x - h) + h
$$

$$
y' = k(y - k) + k
$$

where (h, k) is the center of dilation.

4. Plot the Image: Finally, plot the new points on the coordinate plane to visualize the dilated figure.

Examples of Dilations

To better understand how dilations work, let's look at a couple of examples.

Example 1: Enlarging a Triangle

Suppose we have a triangle with vertices A(1, 2), B(3, 4), and C(5, 2). We want to dilate this triangle using a center of dilation at the origin (0, 0) and a scale factor of 3.

- Step 1: Identify the pre-image points:
- A(1, 2)
- B(3, 4)
- C(5, 2)

- Step 2: Apply the dilation formula:
- A': (31, 32) = (3, 6)
- B': (33, 34) = (9, 12)
- C': (35, 32) = (15, 6)

- Step 3: The new vertices of the dilated triangle are A'(3, 6), B'(9, 12), and C'(15, 6).

Example 2: Reducing a Square

Consider a square with vertices W(2, 2), X(2, 4), Y(4, 4), and Z(4, 2). We will reduce it using a center at (3, 3) and a scale factor of 0.5.

- Step 1: Identify the pre-image points:
- W(2, 2)
- X(2, 4)
- Y(4, 4)
- Z(4, 2)

- Step 2: Apply the dilation formula:
- W': (0.5(2 - 3) + 3, 0.5(2 - 3) + 3) = (2.5, 2.5)
- X': (0.5(2 - 3) + 3, 0.5(4 - 3) + 3) = (2.5, 3.5)
- Y': (0.5(4 - 3) + 3, 0.5(4 - 3) + 3) = (3.5, 3.5)
- Z': (0.5(4 - 3) + 3, 0.5(2 - 3) + 3) = (3.5, 2.5)

- Step 3: The new vertices of the reduced square are W'(2.5, 2.5), X'(2.5, 3.5), Y'(3.5, 3.5), and Z'(3.5, 2.5).

Practice Problems

Now that we have covered the basics and examples, it's time to practice dilations. Here are some problems with a variety of scale factors and centers of dilation.

Problem Set

1. Dilation of a Rectangle: Given a rectangle with vertices A(1, 1), B(1, 3), C(4, 3), and D(4, 1), dilate the rectangle using a center of dilation at (2, 2) and a scale factor of 2.

2. Dilation of a Circle: Consider a circle centered at (0, 0) with a radius of 4. Dilate the circle using a center at (0, 0) and a scale factor of 0.25. What will be the new radius?

3. Dilation of a Parallelogram: A parallelogram has vertices P(0, 0), Q(2, 3), R(5, 3), and S(3, 0). Dilate this shape using a center of dilation at (2, 1) and a scale factor of 1.5.

4. Dilation of a Hexagon: A hexagon has vertices A(1, 0), B(2, 2), C(1, 3), D(0, 2), E(0, 1), and F(1, 1). Dilate this hexagon with a center at (1, 1) and a scale factor of 3.

5. Dilation and Reflection Combined: A triangle with vertices A(0, 0), B(1, 1), and C(0, 2) is dilated with a center at the origin and a scale factor of 2. Then reflect the resulting triangle across the y-axis. What are the new vertices?

Conclusion

In summary, 7 1 additional practice dilations is an essential topic for students studying geometry. Understanding how to perform dilations helps in grasping more advanced concepts such as similarity, congruence, and geometric transformations. Through examples and practice problems, learners can build their confidence and proficiency in executing dilations, providing a strong foundation in the principles of geometry. As students practice these problems, they not only enhance their skills but also gain a deeper appreciation for the beauty of geometric transformations.

Frequently Asked Questions

What is a dilation in geometry?

A dilation is a transformation that alters the size of a figure while maintaining its shape. It involves scaling the figure by a certain factor from a specific center point.

How do you determine the scale factor in dilations?

The scale factor is determined by the ratio of the distance from the center of dilation to a point on the image to the distance from the center of dilation to the corresponding point on the original figure.

What is the formula for performing a dilation?

The formula for dilating a point (x, y) from a center point (h, k) with a scale factor of 'r' is given by: $(x', y') = (h + r(x - h), k + r(y - k))$.

Can dilations create negative scale factors?

Yes, a negative scale factor will not only resize the figure but also reflect it across the center of dilation, resulting in an inverted image.

How do you perform a dilation on a triangle?

To dilate a triangle, locate the center of dilation, apply the scale factor to each vertex of the triangle using the dilation formula, and connect the new vertices to form the dilated triangle.

What are some real-world applications of dilations?

Dilations are used in various fields, including architecture for scaling designs, computer graphics for resizing images, and cartography for map scaling.

What happens to the angles of a shape during a dilation?

During a dilation, the angles of a shape remain unchanged; only the size of the shape is affected.

How can dilations be represented on a coordinate plane?

Dilations can be represented on a coordinate plane by plotting the original figure, identifying the center of dilation, and applying the dilation formula to find the coordinates of the new figure.

What is the difference between a dilation and a translation?

A dilation changes the size of a figure while preserving its shape, whereas a translation shifts a figure from one location to another without changing its size or orientation.

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