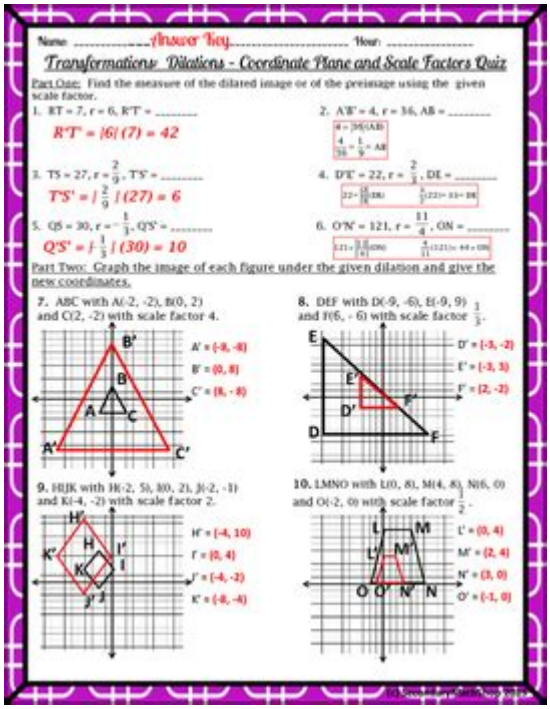
Scale Factor And Dilations Answer Key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Transformations: Dilations - Coordinate Plane and Scale Factors Quiz

Part One: Find the measure of the dilated image or of the preimage using the given scale factor.

1. $RT = 7$, $r = 6$, $R'T' =$ .....
$R'T' = |6|\,(7) = 42$

2. $A'B' = 4$, $r = 16$, $AB =$ .....
$4 = |16|(AB)$
$\frac{4}{16} = \frac{1}{4} = AB$

3. $TS = 27$, $r = \frac{2}{9}$, $T'S' =$ .....
$T'S' = |\frac{2}{9}|\,(27) = 6$

4. $D'E' = 22$, $r = \frac{2}{1}$, $DE =$ .....
$22 = \frac{2}{1}(DE)$ $\quad \frac{1}{2}(22) = 11 = DE$

5. $QS = 30$, $r = -\frac{1}{3}$, $Q'S' =$ .....
$Q'S' = |-\frac{1}{3}|\,(30) = 10$

6. $O'N' = 121$, $r = \frac{11}{4}$, $ON =$ .....
$121 = \frac{11}{4}(ON)$ $\quad \frac{4}{11}(121) = 44 = ON$

Part Two: Graph the image of each figure under the given dilation and give the new coordinates.

7. ABC with A(-2, -2), B(0, 2) and C(2, -2) with scale factor 4.
A' = (-8, -8)
B' = (0, 8)
C' = (8, -8)

8. DEF with D(-9, -6), E(-9, 9) and F(6, - 6) with scale factor $\frac{1}{3}$.
D' = (-3, -2)
E' = (-3, 3)
F' = (2, -2)

9. HIJK with H(-2, 5), I(0, 2), J(-2, -1) and K(-4, -2) with scale factor 2.
H' = (-4, 10)
I' = (0, 4)
J' = (-4, -2)
K' = (-8, -4)

10. LMNO with L(0, 8), M(4, 8), N(6, 0) and O(-2, 0) with scale factor $\frac{1}{2}$.
L' = (0, 4)
M' = (2, 4)
N' = (3, 0)
O' = (-1, 0)

Scale factor and dilations answer key is a crucial concept in geometry, particularly in the study of transformations. Understanding scale factors and dilations allows students to manipulate and analyze shapes effectively. This article will delve into the definitions, properties, and applications of scale factors and dilations, providing a thorough answer key for common problems associated with these concepts.

Understanding Scale Factor

Definition of Scale Factor

A scale factor is a number that describes how much a figure is enlarged or reduced in a dilation transformation. It is a ratio that indicates the relationship between the dimensions of the original figure and the dimensions of the new figure. If the scale factor is greater than 1, the figure enlarges; if it is less than 1, the figure reduces.

Notation and Calculation

Scale factors are usually expressed as a fraction or a decimal. For example, a scale factor of 2 means that every dimension of the original figure will be multiplied by 2, making it twice as large. Conversely, a scale factor of 0.5 would mean that every dimension is halved.

To calculate the scale factor between two similar figures, use the formula:

\[

$$
\text{Scale Factor} = \frac{\text{Dimension of the new figure}}{\text{Dimension of the original figure}}
$$

For instance, if a triangle has sides measuring 3 cm, 4 cm, and 5 cm, and a similar triangle has sides measuring 6 cm, 8 cm, and 10 cm, the scale factor can be determined as follows:

- For the side measuring 3 cm:
$$
\text{Scale Factor} = \frac{6}{3} = 2
$$
- For the side measuring 4 cm:
$$
\text{Scale Factor} = \frac{8}{4} = 2
$$
- For the side measuring 5 cm:
$$
\text{Scale Factor} = \frac{10}{5} = 2
$$

In this case, the scale factor is consistently 2.

Dilations in Geometry

Definition of Dilation

Dilation is a transformation that alters the size of a figure but maintains its shape. During a dilation, every point on the original figure is moved along a line that passes through a fixed point known as the center of dilation. The distance from each point to the center is multiplied by the scale factor.

Characteristics of Dilations

- Center of Dilation: This is the fixed point in the plane about which the figure is enlarged or reduced.
- Scale Factor: Determines the degree of enlargement or reduction.
- Similar Figures: Dilated figures remain similar to their original figures, meaning they have the same shape but different sizes.

Properties of Dilations

Key Properties

1. Proportionality: Corresponding sides of dilated figures are proportional to the scale factor.
2. Angle Preservation: Angles remain unchanged during dilation.
3. Distance from Center: The distance from the center to any point on the figure is multiplied by the

scale factor.

Example of Dilation

Consider a square with vertices at A(1, 1), B(1, 3), C(3, 3), and D(3, 1). To dilate this square with a center at (0, 0) and a scale factor of 2:

- New coordinates for A will be:
$$
A' = (1 \cdot 2, 1 \cdot 2) = (2, 2)
$$
- New coordinates for B:
$$
B' = (1 \cdot 2, 3 \cdot 2) = (2, 6)
$$
- New coordinates for C:
$$
C' = (3 \cdot 2, 3 \cdot 2) = (6, 6)
$$
- New coordinates for D:
$$
D' = (3 \cdot 2, 1 \cdot 2) = (6, 2)
$$

The dilated square has vertices at A'(2, 2), B'(2, 6), C'(6, 6), and D'(6, 2).

Applications of Scale Factor and Dilations

Real-World Applications

1. Architecture: Architects use scale factors to create blueprints that represent buildings at a smaller size.
2. Cartography: Maps use scale factors to represent large areas on a smaller scale, ensuring that distances are proportional.
3. Graphic Design: Designers utilize dilations to resize images while maintaining their proportions.

Mathematical Applications

1. Similar Triangles: The concept of dilations is crucial in proving the similarity of triangles, which is fundamental in geometry.
2. Scaling Models: In science and engineering, scale factors apply when creating models, such as in physics experiments or simulations.

Practice Problems

Example Problems

1. Find the scale factor:
A rectangle has dimensions 4 cm by 6 cm, and a similar rectangle has dimensions 8 cm by 12 cm. What is the scale factor?
- Scale Factor = 8/4 = 2 (or 12/6 = 2)

2. Determine new coordinates after dilation:
A triangle has vertices at (2, 3), (4, 5), and (6, 1). If the triangle is dilated with a center at the origin (0,0) and a scale factor of 3, what are the new coordinates?
- New coordinates:
- A'(23, 33) = (6, 9)
- B'(43, 53) = (12, 15)
- C'(63, 13) = (18, 3)

3. Identify the center of dilation:
If a figure is dilated to a new figure and the scale factor is 0.5, what does this say about the location of the center of dilation?
- The center of dilation is inside the figure, as the new figure is smaller than the original.

Conclusion

Understanding the concepts of scale factors and dilations is fundamental in geometry. These principles not only aid in solving mathematical problems but also have practical applications in various fields such as architecture, map-making, and design. By mastering these concepts, students can enhance their problem-solving skills and better comprehend the relationships between geometric figures.

Through practice and application, the relationship between scale factors and dilations becomes clearer, empowering students to tackle more complex geometric challenges with confidence.

Frequently Asked Questions

What is a scale factor in geometry?

A scale factor is a number that scales, or multiplies, the dimensions of a geometric figure. It determines how much larger or smaller the figure will become during a dilation.

How do you find the scale factor when dilating a shape?

To find the scale factor, divide the length of a side of the dilated shape by the corresponding side length of the original shape. If the resulting value is greater than 1, the shape has been enlarged; if it's less than 1, the shape has been reduced.

What is the effect of a scale factor greater than 1 on a figure?

A scale factor greater than 1 enlarges the figure, meaning all dimensions of the shape are increased proportionally, resulting in a larger image.

What happens to a figure when the scale factor is between 0 and 1?

When the scale factor is between 0 and 1, the figure is reduced in size, meaning all dimensions are scaled down proportionally, resulting in a smaller image.

Can the scale factor be negative, and what would that mean?

Yes, a negative scale factor reflects the figure across the origin and also scales it. For example, a scale factor of -2 would double the size of the figure and flip it to the opposite side of the origin.

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