Dilate Point S By A Scale Factor Of 1/2PLEASE JUST TELL WHERE THE POINT MUST BE LOCATED DONT GIVE A LONG

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Understanding Dilation and Scale Factors

What is Dilation?

Dilation is a transformation that enlarges or reduces a figure by a certain scale factor relative to a fixed point called the center of dilation. It preserves the shape of the figure but may change its size.

What is a Scale Factor?

A scale factor determines how much a figure is enlarged or reduced during dilation. A scale factor greater than 1 results in an enlargement, while a scale factor between 0 and 1 causes a reduction.

Center of Dilation and Its Significance

Role of the Center of Dilation

The center of dilation is a fixed point about which the figure is dilated. All points on the figure move along a line passing through this point, either away from or towards it depending on the scale factor.

Choosing the Center of Dilation

- Usually a specific point or a vertex of the figure.
- The position of the center influences the final location of the dilated figure.
- Commonly, the center is at the origin (0,0) for simplicity.

Applying a Scale Factor of 1/2 to Point S

Given Data and Assumptions

- Suppose Point S has coordinates (x, y).
- The center of dilation is at a known point, commonly at the origin (0,0) unless otherwise specified.

Method to Find the New Location of Point S

- The dilation formula with respect to the center (assumed at the origin) is:

S' = (k x, k y)

where:
- (x, y) are the original coordinates of Point S.
- k = 1/2 is the scale factor.

- To find the new point S', multiply both the x and y coordinates by 1/2.

Example Calculation

- If Point S is at (4, 6):
- S' = (1/2 4, 1/2 6) = (2, 3)
- If Point S is at (-8, 10):
- S' = (1/2 -8, 1/2 10) = (-4, 5)

Where to Locate the Dilated Point S

Step-by-Step Summary

1. Identify the coordinates of Point S.

2. Determine the center of dilation (commonly at the origin or a specified point).

3. Apply the scale factor by multiplying each coordinate by 1/2.

4. Plot the new point S' using the scaled coordinates.

Key Tips

- Always know the center of dilation to accurately find the new point location.

- The new point moves closer to the center of dilation if the scale factor is less than 1.

- For a scale factor of 1/2, the point is exactly halfway between its original position and the center of dilation.

Special Cases and Considerations

When the Center of Dilation is at the Origin

- Calculation is straightforward: multiply each coordinate by 1/2.

When the Center is at a Different Point (h, k)

- Use the dilation formula:

S' = (h + k(x - h), k + k(y - k))

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

- The steps involve:
1. Subtracting the center coordinates from Point S.
2. Multiplying the resulting vector by the scale factor.
3. Adding back the center coordinates to find the new point.

Summary and Final Tips

- To locate Point S after dilation by a scale factor of 1/2:
- Identify the original coordinates of S.
- Know the center of dilation.
- Multiply the vector from the center to S by 1/2.
- Plot the resulting point S'.

- Remember, the point moves closer to the center of dilation, effectively "shrinking" the figure toward the center.

Conclusion

In summary, dilating Point S by a scale factor of 1/2 involves halving the distance from Point S to the center of dilation. Whether the center is at the origin or elsewhere, the principle remains the same: find the vector from the center to Point S, multiply that vector by 1/2, and then add the center coordinates back if necessary. This simple yet powerful transformation allows you to accurately locate the dilated point S without the need for long calculations, focusing solely on basic coordinate manipulation.

Frequently Asked Questions

Where should the point be located after dilating by a scale factor of 1/2?

Halfway between the original point and the center of dilation.

How do I find the new position of a point after dilation with scale factor 1/2?

Move the point halfway closer to the center of dilation.

If a point is at (4, 8) and the center is at (0, 0), where is the dilated point?

At (2, 4).

What is the rule for locating the dilated point at scale factor 1/2?

Divide the distance from the center to the point by 2.

Does the point move closer or farther when dilated by 1/2?

It moves closer to the center.

Where should the point be placed after dilation if the original is at (6, 6) and the center is at (0, 0)?

At (3, 3).

Additional Resources

Dilate Point S By A Scale Factor Of 1/2: A Comprehensive Investigation

In the realm of geometric transformations, dilation plays a pivotal role in understanding how shapes and points can be scaled relative to a fixed point, often called the center of dilation. Among these transformations, dilating a point by a specific scale factor offers insights into spatial relationships and proportionality. This article delves deeply into the problem: Dilate Point S By A Scale Factor Of 1/2, providing a precise methodology for determining the new location of point S after the dilation.

Understanding Dilation and Its Fundamental Principles

Dilation is a transformation that enlarges or reduces a figure proportionally relative to a fixed point, known as the center of dilation. The key aspects include:

- Center of Dilation (O): The fixed point about which the figure is scaled.
- Scale Factor (k): The ratio by which distances from the center are scaled.
- Pre-image and Image: The original figure or point before dilation (pre-image) and the scaled figure or point after dilation (image).

In mathematical terms, for a point S and center O, the dilation of S by a scale factor k results in a new point S' located along the line OS, satisfying:

$$
\overrightarrow{OS'} = k \times \overrightarrow{OS}
$$

which means the vector from O to S' is k times the vector from O to S.

Key Considerations for Dilating a Point

Before proceeding, it's crucial to identify:

- The coordinates of the center of dilation (O).
- The coordinates of the initial point (S).
- The scale factor (k), which in this case is 1/2.

The process involves:

1. Determining the vector OS.
2. Multiplying this vector by the scale factor.
3. Calculating the new point S' based on the scaled vector.

Step-by-Step Procedure for Dilating Point S

Given:

- Center of dilation: $O(x_o, y_o)$
- Original point: $S(x_s, y_s)$
- Scale factor: $k = \frac{1}{2}$

To find:

- Coordinates of the dilated point $S'(x_{s'}, y_{s'})$

Method:

1. Calculate the vector from O to S:

$$
\overrightarrow{OS} = (x_s - x_o, y_s - y_o)
$$

2. Scale the vector by k:

$$
\overrightarrow{OS'} = k \times \overrightarrow{OS} = \left(\frac{1}{2} (x_s - x_o), \frac{1}{2} (y_s - y_o) \right)
$$

3. Determine the new point S':

$$
x_{s'} = x_o + \frac{1}{2} (x_s - x_o)
$$

$$
y_{s'} = y_o + \frac{1}{2} (y_s - y_o)
$$

Where Must Point S Be Located?

In essence, the position of point S relative to the center of dilation O determines its image S'. To find the exact location where S must be placed:

- Start with the known center point O.
- Decide on the desired final position of S' or the original position of S.
- Use the formula to locate S based on the known S' position or vice versa.

In practical applications:

- If the center O and the original point S are known, then S' can be directly calculated using the formula above.
- Conversely, if the dilated point S' and the center O are known, you can invert the process:

$$
x_s = x_o + 2(x_{s'} - x_o)
$$

$$
y_s = y_o + 2(y_{s'} - y_o)
$$

which locates the original point S given its image after dilation.

Special Cases and Considerations

- When S coincides with O: Dilating S by any scale factor results in S' also at O, since the vector from O to S is zero.
- Scale factor of 1/2: This results in S' being exactly midway between O and S, effectively halving the distance from the center.
- Choosing the center of dilation: The position of O significantly affects the location of S'; the same point S will dilate differently depending on where O is placed.

Summary of the Key Formula

Variable	Description	Formula
(x_o, y_o)	Center of dilation	Given or chosen
(x_s, y_s)	Original point	Known
$(x_{s'}, y_{s'})$	Dilated point	$x_o + k(x_s - x_o)$, $y_o + k(y_s - y_o)$
k	Scale factor	$\frac{1}{2}$

Conclusion: Where Must Point S Be Located?

To dilate point S by a scale factor of 1/2 about a known center O, the original point S must be located along the line extending from O through S, at a position that, when scaled by 1/2, lands at the desired location S'. If the goal is to find the original point S corresponding to a known dilated point S', the formula:

$$
\boxed{
S = \left(x_o + 2(x_{s'} - x_o), \quad y_o + 2(y_{s'} - y_o) \right)
}
$$

must be used. This indicates that S must be twice as far from O as S' is, along the same line, but in the opposite direction if considering the inverse.

In summary, whether you're starting with S or S', the key is to understand the relationship between the points and the center of dilation and apply the appropriate scaled vector calculations. This approach ensures precise placement of point S relative to the center O when dilating by a factor of 1/2.

Note: For practical implementation, always verify the positions graphically or through coordinate plotting to confirm the accuracy of the dilation process.

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