# Need Help Failing Math What Is The Image Of (4,-7) After A Dilation By A Scale Factor Of 2 Centered At

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Understanding geometric transformations is a fundamental part of mastering algebra and coordinate geometry. Among these transformations, dilation plays a crucial role in changing the size of figures while maintaining their shape and orientation. If you're struggling with concepts like dilation, especially how a point moves after a dilation with a specific scale factor and center, you're not alone. This article aims to clarify what happens to a point such as (4, -7) after a dilation with a scale factor of 2 centered at a particular point, guiding you step-by-step through the process with clear explanations, examples, and tips for mastering this concept.

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## Understanding Dilation in Coordinate Geometry

### What Is Dilation?

Dilation is a type of geometric transformation that enlarges or reduces a figure by a certain scale factor relative to a fixed point called the center of dilation. Unlike other transformations such as translation or rotation, dilation changes the size of the figure but preserves the shape and the angles.

Key characteristics of dilation:

- It is a similarity transformation.
- It involves a center point (fixed point).
- It uses a scale factor to determine the degree of enlargement or reduction.
- It maintains the angles and the shape of the figure.

## Center of Dilation

The center of dilation is the fixed point about which all points are moved during the dilation process. When performing a dilation, every point on the figure moves along a line passing through the center of dilation.

Common centers:
- The origin (0,0)
- Any other specific point, such as (3, 4), (2, -3), etc.

## Scale Factor

The scale factor determines how much the figure enlarges or reduces:
- Scale factor greater than 1 (>1): The figure enlarges.
- Scale factor between 0 and 1 (0 < scale factor < 1): The figure reduces.
- Negative scale factors involve reflection, but in typical dilation problems, the focus is on positive scale factors.

In our case, the scale factor is 2, indicating the figure will double in size relative to the center.

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# Step-by-Step Process to Find the Image of a Point After

# Dilation

Suppose you are asked to find the image of the point (4, -7) after a dilation with a scale factor of 2 centered at a specific point, often given in the problem.

Step 1: Identify the Center of Dilation

The problem usually states the center. For example, if the center is at the origin (0,0), the process is straightforward. If another point is specified, such as $(x_0, y_0)$, you'll need to work relative to that point.

Let's assume the center is at $(x_0, y_0)$.

Step 2: Write Down the Coordinates

- Original point: (x, y) = (4, -7)
- Center of dilation: $(x_0, y_0)$ (for example, (0, 0) or a specific point)

Step 3: Use the Dilation Formula

The image point (x', y') after dilation is found using the formula:

$$x' = x_0 + k(x - x_0)$$

$$y' = y_0 + k(y - y_0)$$

Where:

- (x, y) are the original coordinates.
- $(x_0, y_0)$ are the center coordinates.
- k is the scale factor.

Step 4: Calculate the Image Point

Plug in the known values into the formula and compute.

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## Example: Dilation of (4, -7) with Center at (0, 0) and Scale Factor 2

Let's consider the simplest case where the center of dilation is at the origin (0, 0). This simplifies calculations.

Step 1: Original Point and Center

- Point: (4, -7)
- Center: (0, 0)
- Scale factor: $k = 2$

Step 2: Apply the Formula

- $x' = 0 + 2(4 - 0) = 2\ 4 = 8$
- $y' = 0 + 2(-7 - 0) = 2\ (-7) = -14$

Step 3: Result

The image of the point (4, -7) after dilation is (8, -14).

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## Example: Dilation of (4, -7) with Center at (1, -3) and Scale Factor 2

If the center is at a different point, such as (1, -3), follow these steps:

Step 1: Original Point and Center

- Point: (4, -7)
- Center: (1, -3)

- Scale factor: k = 2

Step 2: Apply the Formula

- x' = 1 + 2(4 - 1) = 1 + 2(3) = 1 + 6 = 7
- y' = -3 + 2(-7 - (-3)) = -3 + 2(-7 + 3) = -3 + 2(-4) = -3 - 8 = -11

Step 3: Result

The image point is (7, -11).

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## Key Considerations When Performing Dilation

- Always identify the center of dilation before starting.
- Use the correct formula for the image point.
- Be careful with negative coordinates and subtraction.
- Remember that the scale factor affects the distance from the center to the point.

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## Real-World Applications of Dilation

Understanding dilations is useful beyond classroom exercises. Here are some practical applications:

- Computer Graphics and Image Scaling: Resizing images while maintaining aspect ratios.
- Architectural Design: Enlarging or reducing scale models.
- Map Reading: Changing scales to understand different distances.
- Engineering: Designing components with specific size ratios.

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## Tips for Mastering Dilation and Coordinate Transformations

- Practice with various centers and scale factors.
- Visualize the transformation by plotting points before and after dilation.
- Use graph paper for better accuracy.
- Solve multiple problems to reinforce understanding.
- Remember the difference between dilation and other transformations like translation and rotation.

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## Conclusion

In summary, finding the image of a point after dilation involves understanding the role of the center of dilation and the scale factor. Using the coordinate transformation formulas, you can accurately determine where a point like (4, -7) will land after being dilated by a scale factor of 2 centered at any given point. Practice with different scenarios to become more confident, and remember that mastering this concept opens the door to understanding more complex geometric transformations and their applications.

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Keywords for SEO Optimization:

- Dilation in coordinate geometry
- How to find the image of a point after dilation
- Dilation with scale factor 2

- Center of dilation
- Coordinate transformation formulas
- Geometric transformations
- Scale factor and dilation
- Practice dilation problems
- Geometry transformation tips
- Image of point after dilation

## Frequently Asked Questions

### What is the image of the point (4, -7) after a dilation with a scale factor of 2 centered at the origin?

The image is (8, -14), obtained by multiplying each coordinate by 2.

### How do you find the image of a point after dilation centered at the origin?

Multiply both the x and y coordinates of the point by the scale factor.

### What is the formula for dilating a point (x, y) with scale factor k centered at the origin?

The dilated point is (k×x, k×y).

### If the center of dilation is not at the origin, how do you find the image of a point?

Subtract the center coordinates from the point, multiply by the scale factor, then add back the center coordinates.

### What is the image of (4, -7) after a dilation with scale factor 2 centered at (0, 0)?

The image is (8, -14).

### Can the scale factor be less than 1 for dilation? What happens then?

Yes, a scale factor less than 1 causes the point to move closer to the center, reducing its distance.

### What is the importance of the center of dilation in transformations?

It determines the point from which the figure is expanded or contracted during dilation.

### How does dilating a point affect its distance from the center?

The distance from the center is multiplied by the scale factor during dilation.

### Why is understanding dilation important in geometry?

It helps in understanding similarity transformations, scale models, and size changes in figures.

## Additional Resources

Need Help Failing Math? What Is The Image Of (4, -7) After A Dilation By A Scale Factor Of 2 Centered At?

When studying transformations in coordinate geometry, understanding how dilation affects points on the plane is essential. If you're feeling overwhelmed by concepts like scale factors, centers of dilation, and how to find the image of a point after transformation, don't worry—this guide is here to help. In particular, if you're trying to determine what is the image of (4, -7) after a dilation by a scale factor of 2 centered at a specific point, this article will walk you through the process step by step, making complex ideas accessible and manageable.

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## What Is Dilation in Coordinate Geometry?

Dilation is a type of geometric transformation that enlarges or reduces a figure while preserving its shape. Think of it like zooming in or out on a picture: the proportions stay the same, but the size changes.

Key Components of Dilation:
- Center of Dilation: The fixed point about which the figure is scaled.
- Scale Factor (k): A number that determines how much the figure is enlarged or reduced.
- If $k > 1$, the figure enlarges.
- If $0 < k < 1$, the figure reduces.
- If $k < 0$, the figure is reflected across the center and scaled.

In your problem, the dilation is by a scale factor of 2, which means the point will move away from the center, doubling its distance from it.

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## Understanding the Basic Dilation Formula

Given:
- A point $P(x, y)$
- A center of dilation $C(h, k)$
- A scale factor $k$

The image of point $P$ after dilation, $P'$, can be found using the formula:

$$
P' = (h + k \times (x - h), \quad k + k \times (y - k))
$$

\]

This formula essentially moves the original point \( P \) along the line connecting it to \( C \), scaled by the factor \( k \).

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Detailed Step-by-Step Guide: Finding the Image of (4, -7)

Let's now walk through the process of finding the image of the point (4, -7) after a dilation by a scale factor of 2 centered at a specific point.

Step 1: Identify the Center of Dilation

Your problem gives the scale factor, but not explicitly the center. Usually, a problem like this specifies the center, for example, at the origin \( (0, 0) \), or at some other point such as \( (h, k) \).

Assumption:
For this guide, we'll assume the dilation is centered at the origin \( (0, 0) \) because it's the most common case unless specified otherwise. If your problem states a different center, simply replace \( (0, 0) \) with that point.

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Step 2: Write Down the Known Values
- Original point \( P = (4, -7) \)
- Center of dilation \( C = (0, 0) \)
- Scale factor \( k = 2 \)

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Step 3: Apply the Dilation Formula

Using the formula for dilation centered at the origin:

$$
P' = (k \times x, \quad k \times y)
$$

Because the center is at the origin, the simplified formula is:

$$
P' = (k \times x, \quad k \times y)
$$

Calculating:

$$
x' = 2 \times 4 = 8
$$

$$
y' = 2 \times (-7) = -14
$$

Result:

The image of the point $(4, -7)$ after dilation with scale factor 2 centered at the origin is (8, -14).

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What If the Center Is Not the Origin?

If the problem specifies a different center, say $C(h, k)$, the process involves a few additional steps.

Example: Center at $(h, k)$

Suppose the center is at $(h, k) = (1, 3)$.

Step 1: Find the vector from $C$ to $P$:

$$
(x - h, y - k) = (4 - 1, -7 - 3) = (3, -10)
$$

Step 2: Multiply this vector by the scale factor:

$$
(3 \times 2, -10 \times 2) = (6, -20)
$$

Step 3: Add this scaled vector back to the center point:

$$
(x', y') = (h + 6, \quad k + (-20)) = (1 + 6, 3 - 20) = (7, -17)
$$

Result:

The image of $(4, -7)$ after dilation centered at $(1, 3)$ with scale factor 2 is (7, -17).

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Summary of the General Process

1. Identify the center of dilation $C(h, k)$.
2. Calculate the vector from $C$ to $P$: $(x - h, y - k)$.

3. Apply the scale factor $k$ to this vector: $(k \times (x - h), k \times (y - k))$.
4. Find the image point $P'$ by adding the scaled vector back to $C$:

$$
P' = (h + k \times (x - h), \quad k + k \times (y - k))
$$

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### Visualizing the Transformation

To better understand, picture the coordinate plane:

- The center $C$ remains fixed.
- The original point $P$ moves along the line connecting $C$ and $P$.
- The distance from $C$ to $P'$ is scaled by the factor $|k|$.

For example, with a scale factor of 2, the point doubles its distance from the center, moving farther away if $k > 0$.

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### Additional Tips & Common Mistakes

- Always verify the center of dilation; assuming the origin is common, but in many problems, it’s specified elsewhere.
- Pay attention to the scale factor's sign:
- Positive: scaled away from the center.
- Negative: scaled and reflected across the center.
- Check your calculations carefully, especially when dealing with negative coordinates or centers not at the origin.

- Use diagrams to visualize the points before and after dilation to reinforce understanding.

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Practice Problems for Reinforcement

1. Find the image of $(-3, 5)$ after a dilation centered at $(1, 2)$ with a scale factor of 3.
2. Determine the image of $(0, -4)$ after a dilation centered at $(-2, -2)$ with a scale factor of $-1/2$.
3. If a point $(6, 8)$ is dilated about $(2, 3)$ by a scale factor of 0.5, what is its image?

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Final Thoughts

Understanding how to find the image of a point after dilation is fundamental in coordinate geometry and lays the groundwork for more complex transformations such as rotations, reflections, and compositions of transformations. Remember, the key is to identify the center and scale factor, then apply the appropriate formula carefully. With practice, these problems become more intuitive, transforming from confusing to straightforward.

If you're struggling with these concepts, revisit your basic geometry principles, work through multiple examples, and visualize the transformations on graph paper or digital graphing tools. Math can be challenging, but with methodical practice, you'll improve your skills and confidence.

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Need Help Failing Math? Remember, every mathematician was once a beginner. Keep practicing, stay curious, and don't hesitate to seek help when needed. Happy learning!

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