PLS HELP For The Expression 4y/(3x^2+2xy)-9x/(3xy+2y^2) Find The Domain

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Understanding how to find the domain of complex algebraic expressions is a fundamental skill in mathematics, especially in algebra and calculus. In this article, we will analyze the expression:

$$
\frac{4y}{3x^2 + 2xy} - \frac{9x}{3xy + 2y^2}
$$

and determine its domain—that is, all the pairs of real numbers (x, y) for which the expression is defined. This process involves identifying and excluding values that make the denominator zero, as division by zero is undefined in real numbers.

By following a systematic approach, we will explore the components of the expression, analyze the denominators, and establish the precise set of all permissible (x, y) pairs.

Understanding the Components of the Expression

Before diving into the domain calculation, it's essential to understand the structure of the given expression. It consists of two rational terms:

1. $\frac{4y}{3x^2 + 2xy}$
2. $\frac{9x}{3xy + 2y^2}$

Both involve variables x and y in their denominators, and the values of x and y that make these denominators zero must be excluded from the domain.

Step-by-Step Approach to Finding the Domain

To find the domain of the given expression, we will follow these steps:

1. Identify Denominator Conditions

- For each fraction, determine the values of x and y that make the denominator zero.
- These are the values where the expression is undefined.

2. Solve the Denominator Equations

- Find the solutions to the equations:
- $3x^2 + 2xy = 0$
- $3xy + 2y^2 = 0$

3. Exclude These Values from the Real Plane

- The domain consists of all real pairs (x, y) not satisfying these equations.

4. Express the Domain in Set Notation or as a Union of Regions

- Clearly describe the set of permissible (x, y) pairs.

Analyzing the Denominator Equations

Let's analyze each denominator separately.

1. Analysis of \(3x^2 + 2xy = 0\)

This equation can be factored or analyzed to find solutions:

\[

3x^2 + 2xy = 0

\]

- Factor out \(x\):

\[

x(3x + 2y) = 0

\]

- Set each factor equal to zero:

\[

x = 0 \quad \text{or} \quad 3x + 2y = 0

\]

- This yields two solution sets:

\[

\boxed{

\begin{aligned}

&\text{Set A: } x = 0 \\

&\text{Set B: } 3x + 2y = 0 \quad \Rightarrow \quad y = -\frac{3}{2}x

\end{aligned}

}

\]

Interpretation: All points where \(x=0\) or \(y = -\frac{3}{2}x\) make the first denominator zero and are thus excluded from the domain.

2. Analysis of \(3xy + 2y^2 = 0\)

Factor the numerator:

\[

y(3x + 2y) = 0

\]

- Set each factor to zero:

\[

y=0 \quad \text{or} \quad 3x + 2y=0

\]

- The solution sets are:

\[

\boxed{

\begin{aligned}

&\text{Set C: } y=0 \\

&\text{Set D: } 3x + 2y=0 \quad \text{(already identified above)}

\end{aligned}

}

\]

Note that the line \(3x + 2y=0\) appears in both denominators, which is crucial for understanding the overall domain.

Compiling the Domain Restrictions

The total set of points where the expression is undefined comes from the union of the sets where denominators vanish:

\[

\text{Denominator 1 zero: } \left\{ (x,y) \mid x=0 \text{ or } y = -\frac{3}{2}x \right\}

\]

\[

\text{Denominator 2 zero: } \left\{ (x,y) \mid y=0 \text{ or } y = -\frac{3}{2}x \right\}

\]

Therefore, the excluded points are:

- All points where \(x=0\),

- All points where \(y=0\),

- All points on the line \(y = -\frac{3}{2}x\).

Final Description of the Domain

The domain consists of all real pairs (x, y) such that none of the denominators are zero. Combining the restrictions, we arrive at:

$$
\boxed{
\text{Domain} = \left\{ (x, y) \in \mathbb{R}^2 \mid x \neq 0,\, y \neq 0,\, y \neq -\frac{3}{2}x \right\}
}
$$

This can be described as the entire $\mathbb{R}^2$, excluding the three sets:

1. The x-axis ($y=0$)
2. The y-axis ($x=0$)
3. The line $y = -\frac{3}{2}x$

Visualizing the Domain

Visual representation helps clarify the domain:

- The excluded regions are the axes and the line $y = -\frac{3}{2}x$.
- The allowed regions are the parts of the plane outside these lines.

Key observations:

- The axes are lines where the denominators vanish, so points on these axes are not in the domain.

- The line $y = -\frac{3}{2}x$ is common to both denominator equations, so points on this line are excluded.

- The domain is the union of four regions separated by these lines:

- Quadrants not touching axes or the line.
- All points except those on the axes or the line.

Summary and Final Remarks

Identifying the domain of the rational expression involves:

- Recognizing the denominators.
- Solving for the values where denominators are zero.
- Excluding those points from the real plane.

For the given expression:

$$
\frac{4y}{3x^2 + 2xy} - \frac{9x}{3xy + 2y^2}
$$

the domain is:

$$
\boxed{
\left\{ (x, y) \in \mathbb{R}^2 \mid x \neq 0,\, y \neq 0,\, y \neq -\frac{3}{2}x \right\}
}
$$

\]

This set encompasses all points in the plane except on the axes and the line $y = -\frac{3}{2}x$. Understanding this domain is essential for correctly evaluating the expression, analyzing its behavior, and applying calculus techniques such as limits, derivatives, or integrals.

Additional Tips for Students

- Always factor denominators to find common zeroes.
- Remember that division by zero is undefined; exclude those points.
- Visualize the excluded lines and axes to better understand the domain.
- When dealing with multiple denominators, consider their intersections carefully.

Mastering these steps will improve your skill in analyzing complex rational expressions and their domains, ensuring accurate and meaningful mathematical work.

If you need further assistance or a detailed explanation on related topics like simplifying similar expressions or analyzing their behaviors, don't hesitate to ask!

Frequently Asked Questions

How do I find the domain of the expression (4y)/(3x^2 + 2xy) -

$9x/(3xy + 2y^2)$?

To find the domain, identify all values of x and y that make the denominators zero and exclude them. Set each denominator equal to zero and solve for x and y to find invalid points.

What are the key steps to determine the domain of a rational expression like $(4y)/(3x^2 + 2xy) - 9x/(3xy + 2y^2)$?

First, find the denominators: $D1 = 3x^2 + 2xy$ and $D2 = 3xy + 2y^2$. Then, solve $D1 = 0$ and $D2 = 0$ for x and y. The domain is all real numbers except those satisfying these equations.

How do I solve for the values that make the denominators zero in this expression?

Set each denominator equal to zero: $3x^2 + 2xy = 0$ and $3xy + 2y^2 = 0$. Factor or use algebraic methods to find the pairs (x, y) that satisfy these equations, which are excluded from the domain.

Are there any special cases or points to consider when finding the domain of this expression?

Yes, consider the case when $y = 0$ or $x = 0$ separately, as these can simplify denominators and reveal additional restrictions. Always check these cases when solving the denominators.

Can the denominators be factored to simplify finding the domain? How does this help?

Yes, factoring denominators can make solving for zero easier. For example, $3x^2 + 2xy$ can be factored if possible, revealing specific (x, y) pairs that are restricted. This simplifies identifying the domain.

Additional Resources

PLS HELP For The Expression 4y/(3x^2+2xy)-9x/(3xy+2y^2) Find The Domain

When tackling complex algebraic expressions such as PLS HELP For The Expression 4y/(3x^2+2xy)-9x/(3xy+2y^2) Find The Domain, understanding the domain—the set of all possible values for the variables that make the expression defined—is essential. This particular problem involves rational expressions, which inherently come with restrictions due to the denominators. A comprehensive analysis involves identifying these restrictions precisely, simplifying the algebra, and then determining the intersection of all conditions that ensure the expression is valid. This process not only sharpens algebraic skills but also deepens understanding of rational functions, their domains, and the importance of avoiding division by zero.

Understanding the Expression

The given expression:

$$ \frac{4y}{3x^2 + 2xy} - \frac{9x}{3xy + 2y^2} $$

is composed of two rational fractions subtracted from each other. The key to understanding the domain lies in analyzing the denominators:

- $3x^2 + 2xy$
- $3xy + 2y^2$

Because division by zero is undefined, the domain includes all (x, y) pairs for which both denominators are non-zero.

Step-by-Step Analysis to Find the Domain

1. Identify the Denominators

The denominators are:

- Denominator 1: $D_1 = 3x^2 + 2xy$
- Denominator 2: $D_2 = 3xy + 2y^2$

The domain restrictions are based on solving:

$$D_1 \neq 0 \quad \text{and} \quad D_2 \neq 0$$

---

2. Factor the Denominators

Factoring simplifies the process of solving the inequalities:

- Factor D_1:

$$D_1 = 3x^2 + 2xy = x(3x + 2y)$$

- Factor D_2:

$$ D_2 = 3xy + 2y^2 = y(3x + 2y) $$

Now, the denominators are expressed as:

$$ D_1 = x(3x + 2y) $$

$$ D_2 = y(3x + 2y) $$

---

3. Find Conditions for Non-Zero Denominators

To ensure the entire expression is defined, both denominators must be non-zero:

- $D_1 \neq 0 \Rightarrow x(3x + 2y) \neq 0$
- $D_2 \neq 0 \Rightarrow y(3x + 2y) \neq 0$

This leads to two key conditions:

- $x \neq 0$ and $3x + 2y \neq 0$
- $y \neq 0$ and $3x + 2y \neq 0$

Note that $3x + 2y \neq 0$ appears in both, so the critical line $3x + 2y = 0$ must be excluded from the domain.

Graphical Interpretation of the Domain Restrictions

Understanding the algebraic restrictions geometrically can be very helpful. The conditions:

- $x \neq 0$
- $y \neq 0$
- $3x + 2y \neq 0$

correspond to excluding the lines:

- The x-axis ($y = 0$)
- The y-axis ($x = 0$)
- The line $3x + 2y = 0$

The domain consists of all points in the plane excluding these three lines.

Final Domain Specification

By combining all the restrictions, the domain D can be expressed as:

$$
D = \{ (x, y) \in \mathbb{R}^2 \mid x \neq 0, \quad y \neq 0, \quad 3x + 2y \neq 0 \}
$$

This describes the entire plane minus the three lines:

- $x = 0$
- $y = 0$
- $3x + 2y = 0$

Features and Insights of the Domain

- Symmetry: The exclusion of $x = 0$ and $y = 0$ creates four open quadrants, but the line $3x + 2y = 0$ cuts across the plane, removing a diagonal from the domain.
- Continuity: The function is continuous on the domain since the only restrictions are on the denominators.
- Applications: Recognizing such restrictions is critical in calculus and algebra for evaluating limits, derivatives, or integrals involving these rational expressions.

Pros and Cons of the Approach

Pros:

- Clear algebraic factoring simplifies the restrictions.
- Graphical interpretation provides intuitive understanding.
- Systematic approach ensures all restrictions are considered.

Cons:

- Assumes familiarity with factoring and solving inequalities.
- Visualizing the excluded lines may require graphing tools for some learners.
- Does not directly address the behavior of the function near the excluded lines (limits and asymptotes).

Additional Considerations

- Behavior near the excluded lines: Approaching $x=0$, $y=0$, or $3x + 2y=0$, the function tends to infinity or undefined values.
- Domain in context: In real-world applications, understanding these restrictions helps prevent invalid calculations or misinterpretations.

Summary

Determining the domain of the rational expression $\frac{4y}{3x^2 + 2xy} - \frac{9x}{3xy + 2y^2}$ involves identifying where the denominators are non-zero. By factoring the denominators into $x(3x + 2y)$ and $y(3x + 2y)$, it becomes clear that the expression is undefined along the lines $x=0$, $y=0$, and $3x + 2y=0$. The domain is, therefore, all points in the plane excluding these lines:

$$
\boxed{
\{ (x, y) \in \mathbb{R}^2 \mid x \neq 0,\, y \neq 0,\, 3x + 2y \neq 0 \}
}
$$

Understanding these restrictions not only aids in solving this specific problem but also enhances broader skills in analyzing rational functions, their domains, and their behavior.

In conclusion, approaching the problem methodically—factoring denominators, solving inequalities, and interpreting geometrically—ensures a thorough understanding of the domain. Mastery of such techniques is fundamental in higher-level algebra and calculus, equipping learners with tools to analyze more complex functions and their restrictions confidently.

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