For Which Value(s) Of Xwill The Rational Expression Below Equal Zero? Checkall That Apply.(x - 3)(x +

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Understanding when a rational expression equals zero is a fundamental concept in algebra that helps students and mathematicians analyze the behavior of functions. In particular, determining the values of x that make the expression *(x - 3)(x + ...)* equal to zero involves exploring the roots of the numerator and understanding restrictions imposed by the denominator. This article will guide you through the process of identifying the value(s) of x for which the given rational expression equals zero, highlighting key steps, common pitfalls, and strategies for solving these types of problems.

What Is a Rational Expression?

A rational expression is a ratio of two polynomials, typically written as $\frac{P(x)}{Q(x)}$, where $P(x)$ and $Q(x)$ are polynomials. The key characteristic of these expressions is that they are undefined whenever the denominator $Q(x)$ is zero, which means the domain excludes those values.

For example, in the expression $\frac{(x - 3)(x + 2)}{x - 5}$, the numerator is $(x - 3)(x + 2)$, and the denominator is $x - 5$. To find when this expression equals zero, we focus on the numerator since a fraction is zero when its numerator is zero (excluding points where the denominator is zero).

How To Find When a Rational Expression Equals Zero

Determining the values of x that make a rational expression equal to zero involves a straightforward process:

Step 1: Set the Numerator Equal to Zero

Since a fraction equals zero when its numerator equals zero (and the denominator is not zero), begin by solving the equation:

$$
\text{Numerator} = 0
$$

For the expression $(x - 3)(x + ...)$, this involves solving the equation:

$$
(x - 3)(x + ...) = 0
$$

which means solving for the roots of each factor.

Step 2: Solve Each Factor for Zero

Apply the zero product property: if $A \times B = 0$, then either $A = 0$ or $B = 0$. Therefore:

- Solve $x - 3 = 0$ to find the first root.
- Solve $x + ... = 0$ to find the second root.

Step 3: Check for Restrictions

While the numerator might be zero at certain values of x, you must verify these values do not make the denominator zero, as the rational expression would then be undefined.

Example:
Suppose the rational expression is:

$$
\frac{(x - 3)(x + 4)}{x - 2}
$$

To find the x-values where this equals zero:

1. Set numerator equal to zero:

$$
(x - 3)(x + 4) = 0
$$

2. Solve for x:

$$
x - 3 = 0 \Rightarrow x = 3
$$
$$
x + 4 = 0 \Rightarrow x = -4
$$

3. Check the denominator:

$$

$$
x - 2 \neq 0 \Rightarrow x \neq 2
$$

Since neither 3 nor -4 makes the denominator zero, both are valid solutions where the expression equals zero.

Understanding the Expression *(x - 3)(x + ...)*

The expression in question appears incomplete, but generally, if you have an expression like $(x - 3)(x + a)$, where a is a constant, the process remains the same:

- Find roots by setting each factor equal to zero.
- Verify that these roots do not coincide with values that make the denominator zero if the expression is a rational function.

Common Variations:
- The expression could include additional factors, such as $\frac{(x - 3)(x + 4)}{x - 2}$.
- It may involve more complex factors, requiring factoring quadratics or applying quadratic formulas.

Key Points to Remember When Solving for Zeroes of Rational Expressions

- Set the numerator equal to zero to find potential solutions.
- Exclude values that make the denominator zero, since the expression is undefined there.
- Verify all roots to ensure they are within the domain of the expression.
- Factor carefully; sometimes, factors are quadratic or higher degree, requiring factoring techniques or quadratic formulas.
- Check all solutions in the original expression to confirm they do not violate domain restrictions.

Practice Problems and Solutions

To solidify your understanding, review these practice problems:

Problem 1:

Find the value(s) of x for which:

$$
\frac{(x - 3)(x + 2)}{x - 4} = 0
$$

Solution:

- Set numerator equal to zero:

$$
(x - 3)(x + 2) = 0
$$

$$
x - 3 = 0 \Rightarrow x = 3
$$

$$
x + 2 = 0 \Rightarrow x = -2
$$

- Check denominator:

$$
x - 4 \neq 0 \Rightarrow x \neq 4
$$

- Both solutions are valid since neither equals 4.

Answer: The values of x are x = 3 and x = -2.

Problem 2:

Determine the x-values where:

$$
\frac{(x + 1)(x - 5)}{x + 1} = 0
$$

Solution:

- The numerator:

$$
(x + 1)(x - 5) = 0
$$

$$
x + 1 = 0 \Rightarrow x = -1
$$

$$
x - 5 = 0 \Rightarrow x = 5
$$

- Denominator:

$$
x + 1 \neq 0 \Rightarrow x \neq -1
$$

\]

- Since \(x = -1\) makes the denominator zero, it is not in the domain.

- The other solution, \(x=5\), is valid.

Answer: The only solution is x = 5.

Summary and Final Tips

- Always start by setting the numerator equal to zero.
- Solve for x by factoring or using algebraic methods.
- Remember to exclude any solutions that make the denominator zero.
- Be cautious with factors that cancel out; they may cancel but introduce restrictions.
- Practice with different types of rational expressions to build confidence.

By following these steps, you can confidently determine for which value(s) of x a rational expression equals zero and understand the importance of considering domain restrictions. Whether you're solving simple linear factors or more complex quadratic expressions, these strategies will help enhance your algebra skills and ensure accurate solutions.

In conclusion, to find the value(s) of x for which \((x - 3)(x + ...)\) equals zero, focus on the roots of the numerator, check for restrictions, and verify your solutions. Mastery of this process is essential for solving a wide range of algebraic problems involving rational expressions.

Frequently Asked Questions

For which value of x does the rational expression (x - 3)(x + 5) equal zero?

The expression equals zero when either (x - 3) = 0 or (x + 5) = 0, so x = 3 or x = -5.

Does the rational expression (x - 3)(x + 2) equal zero at x = 3?

Yes, because substituting x = 3 makes (x - 3) = 0, resulting in the entire expression being zero.

Are there any values of x for which (x - 3)(x + 4)

does not equal zero?

Yes, for any x other than 3 and -4, the expression does not equal zero.

What are the solutions for when (x - 3)(x + 1) equals zero?

The solutions are x = 3 and x = -1.

Can (x - 3)(x + 2) equal zero when x = -2?

Yes, because plugging in x = -2 makes (x + 2) = 0, so the entire expression equals zero.

Is x = 0 a solution for (x - 3)(x + 2) = 0?

No, because substituting x = 0 yields (0 - 3)(0 + 2) = (-3)(2) = -6, which is not zero.

If the expression is (x - 3)(x + 7), for which x values is it zero?

It is zero when x = 3 or x = -7.

Why can't x = 3 or x = -4 be valid solutions if the expression is a rational expression?

Because if the original rational expression has denominators that become zero at these x values, then these are excluded from the domain, even if the numerator is zero.

Additional Resources

For Which Value(s) Of X will The Rational Expression Below Equal Zero? Check all That Apply. (x - 3)(x + ...)

Understanding when a rational expression equals zero is fundamental in algebra, especially when solving equations involving fractions, polynomials, and rational functions. The expression (x - 3)(x + ...) hints at a product of factors, and the question asks us to determine the value(s) of x that make this expression equal to zero. This is a common type of problem that tests your grasp of the Zero Product Property and the nature of rational expressions. In this guide, we will explore the process step-by-step, clarifying key concepts, and providing a comprehensive approach to solving such problems.

Introduction: The Importance of Zeroes in Rational Expressions

In algebra, identifying the values of x that make an expression equal to zero is essential because these values, known as roots or solutions, often tell us where the graph of the function crosses the x-axis. For rational expressions, the process involves understanding both the numerator and the denominator, since the expression is undefined where the denominator equals zero.

The specific expression (x - 3)(x + ...) suggests a product of factors, which simplifies the process of finding zeros. The core principle is the Zero Product Property, which states that if the product of two factors equals zero, then at least one of the factors must be zero.

Step 1: Understanding the Expression

Let's analyze the given expression:

$(x - 3)(x + ...)$

- The first factor: $(x - 3)$

- The second factor: $(x + ...)$ — the ellipsis indicates missing information, but typically, this would be a term like $(x + k)$, where k is a constant.

Suppose the complete expression is:

$(x - 3)(x + a)$

where a is some real number.

Step 2: Applying the Zero Product Property

The Zero Product Property states:

> If $A \times B = 0$, then $A = 0$ or $B = 0$.

Applying this to our expression:

$(x - 3)(x + a) = 0$

This implies:

- $x - 3 = 0 \rightarrow x = 3$

- $x + a = 0 \rightarrow x = -a$

Thus, the potential solutions are $x = 3$ and $x = -a$.

Step 3: Considering the Rational Expression

In many cases, the expression is part of a rational function, such as:

f(x) = [(x - 3)(x + a)] / [some denominator]

To determine when f(x) = 0, we need to analyze:

- When the numerator equals zero (since a zero numerator yields zero)

- When the denominator is zero (since the function is undefined there, not equal to zero)

Important note: The zeros of the numerator give potential solutions, but any value that makes the denominator zero must be excluded from the solution set.

Step 4: Addressing the Denominator

Suppose the full rational expression is:

f(x) = [(x - 3)(x + a)] / [(x - b)]

where b is a constant.

- The function f(x) equals zero if and only if the numerator equals zero and the denominator is not zero at that point.

- If x = b, the function is undefined, so x = b cannot be a solution, even if the numerator is zero there.

Step 5: Final Solution Set

To find all x values where the rational expression equals zero:

1. Find solutions to (x - 3)(x + a) = 0.

2. Exclude any solutions where x = b, because the function is undefined at those points.

3. Confirm that the remaining solutions are valid zeros of the rational expression.

Practical Example: Solving a Specific Expression

Suppose the expression is:

f(x) = (x - 3)(x + 2) / (x - 5)

Let's follow the steps:

Step 1: Find zeros of numerator

- x - 3 = 0 → x = 3

- x + 2 = 0 → x = -2

Step 2: Check the denominator

- x - 5 = 0 → x = 5

Since x = 5 makes the denominator zero, x = 5 is not an acceptable solution.

Step 3: Final solutions

- x = 3 and x = -2 are potential zeros

- Neither of these makes the denominator zero, so both are valid solutions

Answer: The expression equals zero when x = 3 or x = -2

Additional Considerations

1. Domain Restrictions

Always remember to check the domain of the rational expression:

- Exclude values that make the denominator zero.

- Include only the solutions that satisfy the original equation and are in the domain.

2. Graphical Interpretation

Graphing the rational function can provide visual confirmation of where the function crosses the x-axis (zeros) and where it is undefined (vertical asymptotes).

Summary: Key Takeaways on When a Rational Expression Equal Zero

- The numerator's factors determine potential zeros.

- Set each factor equal to zero and solve for x.

- Exclude any solutions that make the denominator zero, as the function is undefined there.

- Verify solutions within the context of the original rational expression.

Practice Problem

Given the expression:

$f(x) = (x - 3)(x + 4) / (x - 2)$

Question: For which value(s) of x does $f(x) = 0$? Check all that apply.

Solution:

- Zeros of numerator:

- $x - 3 = 0 \rightarrow x = 3$

- $x + 4 = 0 \rightarrow x = -4$

- Denominator:

- $x - 2 = 0 \rightarrow x = 2$ (excluded)

- Final answer:

- $x = 3$ and $x = -4$ are solutions

- $x = 2$ is excluded because the function is undefined there

Therefore, the values of x for which $f(x) = 0$ are $x = 3$ and $x = -4$.

Conclusion

Determining for which value(s) of x a rational expression equals zero is a straightforward process once the core principles are understood. The key steps involve factoring the numerator, solving for zeros, and checking the denominator to exclude any values that make the expression undefined. Mastery of these steps allows for accurate and efficient solutions to a wide range of algebraic problems involving rational expressions.

Remember: Always analyze both the numerator and denominator, keep track of

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domain restrictions, and verify your solutions within the context of the
original expression. Happy solving!
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