MATHEMATICS · GRADES 10-12

Finding excluded values

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you spot the values that would break a calculation. A recipe that divides by the number of servings makes no sense when that number is zero, and a formula with a fraction in it breaks the same way. Finding the excluded values tells you which inputs to stay away from. It stops you from trusting an answer that comes from a calculation that was never allowed.



Rule

Excluded values: a fraction is undefined when its denominator is zero, so the excluded values are the numbers that make the denominator zero.

Set the denominator equal to zero and solve.

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Worked examples

EXAMPLE 1

Q Find the excluded values of $\frac{1}{(x - 5)}$

SOLUTION

Make the denominator zero: $x - 5 = 0$

Solve: $x = 5$

So the excluded value is $x = 5$

EXAMPLE 2

Q Find the excluded values of $\frac{(x + 1)}{(x^2 - 4)}$

SOLUTION

Factor the denominator: $(x - 2)(x + 2)$

Set each bracket to zero: $x = 2$ or $x = -2$

So the excluded values are $x = 2$ and $x = -2$

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Practice questions

1 When is $\frac{1}{(x - 7)}$ undefined? Find the excluded value.

- **A** x = -7
- **B** x = 0
- **C** x = 7
- **D** x = 1

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2 A recipe uses $\frac{1}{(x^2 + 1)}$ cups. How many excluded values does it have?

- **A** 0
- **B** 1
- **C** 2
- **D** 3

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3 A machine divides by $x^2 - 9$ in $\frac{(x + 2)}{x^2 - 9}$. For which x values is it undefined?

- **A** x = 3 only
- **B** x = 9 and x = -9
- **C** x = 3 and x = -3
- **D** x = 0 and x = 3

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4 A tank fills at $\frac{3}{2x}$ litres per minute. For which x is the rate undefined?

- **A** x = 0
- **B** x = 2
- **C** x = 3
- **D** x = -2

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5 The denominator of a fraction is $(x - 2)(x + 3)$. For which x values is the fraction undefined?

- **A** $x = 2$ and $x = -3$
- **B** $x = 2$ and $x = 3$
- **C** $x = -2$ and $x = 3$
- **D** $x = -1$ only

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6 **For the fraction $\frac{(x - 3)}{(x + 2)}$, $x = 3$ makes the top zero. Is $x = 3$ an excluded value?**

A Yes, because the top is zero

B No, because only the bottom can make it undefined

C Yes, because 3 makes the fraction zero

D No, because the top and bottom cancel

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7 A calculator divides 2 by $x^2 + 3x$. For which x values does it fail? Find the excluded values.

- **A** x = 0 and x = 3
- **B** x = 3 only
- **C** x = 0 only
- **D** x = 0 and x = -3

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8 When is $\frac{1}{(x^2 - 2x + 1)}$ undefined? Find the excluded value.

- **A** x = 1
- **B** x = -1
- **C** x = 1 and x = -1
- **D** x = 0

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9 A fraction has denominator $(x - 1)(x - 2)(x - 3)$. How many excluded values does it have?

- **A** 1
- **B** 2
- **C** 3
- **D** 0

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10 For which x is $\frac{1}{(x^2 - 5x + 6)}$ undefined? Find the excluded values.

- **A** $x = 2$ and $x = 3$
- **B** $x = 2$ and $x = -3$
- **C** $x = -2$ and $x = -3$
- **D** $x = 2$ only

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ANSWER KEY

1. $x = 7$

2. 0

3. $x = 3$ and $x = -3$

4. $x = 0$

5. $x = 2$ and $x = -3$

6. No, because only the bottom can make it undefined

7. $x = 0$ and $x = -3$

8. $x = 1$

9. 3

10. $x = 2$ and $x = 3$

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