MATHEMATICS · GRADES 10-12

Subtracting rational expressions

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you subtract fractions that contain letters, like comparing two rates or two shares of a job, where the minus sign has to reach every part of the second piece. These fractions stand for rates and shares that change, so the letters matter as much as the numbers. Before you can subtract them, they need a common denominator, and then the minus sign applies to the whole second fraction, not just its first term. Getting that right is how you compare two rates fairly, or work out how much of a shared job is left.



Rule

Subtracting rational expressions: rewrite both fractions with a common denominator, then subtract the numerators and keep the denominator.

Remember the values that would make any denominator zero are not allowed.

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Worked examples

EXAMPLE 1

Q Subtract $\frac{5}{(x - 2)} - \frac{3}{(x - 2)}$

SOLUTION

The denominators are already the same, so subtract the numerators: 5 - 3 = 2

Keep the denominator: $\frac{2}{(x - 2)}$.

Note the excluded value: x is not 2.

EXAMPLE 2

Q Subtract $\frac{2}{x} - \frac{1}{(x + 2)}$

SOLUTION

Common denominator: $x \times (x + 2) = x(x + 2)$

Rewrite: $\frac{2(x + 2)}{(x(x + 2))} - \frac{x}{(x(x + 2))}$

Subtract the numerators: $\frac{(2x + 4 - x)}{(x(x + 2))} = \frac{(x + 4)}{(x(x + 2))}$

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Practice questions

1 Subtract $\frac{7}{(x+1)} - \frac{2}{(x+1)}$.

- **A** $\frac{9}{(x+1)}$
- **B** $\frac{5}{(x+1)}$
- **C** $\frac{7}{(x+1)}$
- **D** $\frac{2}{(x+1)}$

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2 Subtract $\frac{4}{x} - \frac{1}{x}$.

A $\frac{5}{x}$

B $\frac{4}{x}$

C $\frac{3}{x}$

D $\frac{1}{x}$

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3 Subtract $\frac{3}{(x-4)} - \frac{1}{(x-4)}$.

A $\frac{2}{(x-4)}$

B $\frac{4}{(x-4)}$

C $\frac{3}{(x-4)}$

D $\frac{1}{(x-4)}$

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4 Subtract $\frac{1}{x} - \frac{1}{(x+1)}$.

A 0

B $\frac{1}{(x(x+1))}$

C $\frac{-1}{(x(x+1))}$

D $\frac{1}{(2x+1)}$

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5 What is $\frac{1}{(x+1)} - \frac{1}{(x+2)}$?

A $\frac{1}{((x+1)(x+2))}$

B 0

C $\frac{1}{(2x+3)}$

D $\frac{(2x+3)}{((x+1)(x+2))}$

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6 Subtract $\frac{5}{x} - \frac{2}{(x+1)}$.

A $\frac{(3x+5)}{(x(x+1))}$

B $\frac{(5x+3)}{(x(x+1))}$

C $\frac{(7x+5)}{(x(x+1))}$

D $\frac{(3x+5)}{(2x+1)}$

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7 $\frac{4}{(x+1)}$ minus the other fraction equals $\frac{1}{(x+1)}$. What is the other fraction?

A $\frac{5}{(x+1)}$

B $\frac{4}{(x+1)}$

C $\frac{1}{(x+1)}$

D $\frac{3}{(x+1)}$

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8 **Sam subtracts $\frac{1}{x} - \frac{1}{(x+1)}$ and writes 0, saying the x's cancel. Where does Sam go wrong?**

A. The x's cancel, so the difference is 0

B. The difference is $\frac{1}{(x+1)} - \frac{1}{x}$

C. The fractions have different denominators, and the difference is $\frac{1}{(x(x+1))}$

D. Sam should add the denominators to get $\frac{1}{(2x+1)}$

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9 What is $\frac{5}{(x-1)} - \frac{3}{(x-1)} - \frac{1}{(x-1)}$?

A $\frac{1}{(x-1)}$

B $\frac{3}{(x-1)}$

C $\frac{2}{(x-1)}$

D $\frac{9}{(x-1)}$

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10 Which of these differences has fractions with different denominators?

A $\frac{5}{(x+1)} - \frac{2}{(x+1)}$

B $\frac{4}{x} - \frac{1}{x}$

C $\frac{3}{(x+2)} - \frac{1}{(x+2)}$

D $\frac{2}{(x+1)} - \frac{1}{(x+2)}$

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ANSWER KEY

1. $\frac{5}{(x + 1)}$

2. $\frac{3}{x}$

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

4. $\frac{1}{(x(x + 1))}$

5. $\frac{1}{((x + 1)(x + 2))}$

6. $\frac{(3x + 5)}{(x(x + 1))}$

7. $\frac{3}{(x + 1)}$

8. The fractions have different denominators, and the difference is $\frac{1}{(x(x + 1))}$

9. $\frac{1}{(x - 1)}$

10. $\frac{2}{(x + 1)} - \frac{1}{(x + 2)}$

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