MATHEMATICS · GRADES 10-12

Factoring rational expressions

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you simplify a fraction made of formulas by cancelling what the top and bottom share. A rate in its simplest form is easier to use and easier to compare with another rate. Cancelling the shared factors does not change the value, it just strips away the clutter. It is the same as reducing an ordinary fraction, applied to formulas.



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Worked examples

EXAMPLE 1

Q Simplify $\frac{(x^2 - 9)}{(x^2 + 5x + 6)}$

SOLUTION

Factor the top: $(x - 3)(x + 3)$. Factor the bottom: $(x + 2)(x + 3)$

Note the excluded values from the original bottom: x is not -2 and x is not -3.

Cancel the shared bracket $(x + 3)$: $\frac{(x - 3)}{(x + 2)}$

EXAMPLE 2

Q Simplify $\frac{(x^2 - 4x + 4)}{(x^2 - 4)}$

SOLUTION

Factor the top: $(x - 2)(x - 2)$. Factor the bottom: $(x - 2)(x + 2)$

Note the excluded values: x is not 2 and x is not -2.

Cancel one shared bracket: $\frac{(x - 2)}{(x + 2)}$

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Practice questions

1 Simplify $\frac{x^2 - 25}{x^2 + 7x + 10}$

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

B $\frac{(x - 5)}{(x - 2)}$

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

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

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2 Simplify $\frac{x^2 + 4x + 4}{x^2 - 4}$

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

B $\frac{(x + 2)}{(x - 2)}$

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

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

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3 Simplify $\frac{(x^2 - 16)}{(x^2 - 5x + 4)}$

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

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

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

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

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4 Write $\frac{2x^2 + 6x}{x^2 + 3x}$ in simplest form.

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5 Reduce $\frac{x^2 - 9}{x^2 + 6x + 9}$ to lowest terms.

A $\frac{(x - 3)}{(x + 3)}$

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

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

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

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6 Simplify $\frac{x^2 - 4x - 5}{x^2 - 25}$

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

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

C $\frac{(x - 1)}{(x - 5)}$

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

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7 Cancel common factors in $\frac{x^2 + 5x + 6}{x^2 + 2x - 3}$

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

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

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

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

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8 Simplify $\frac{x^2 - 36}{x^2 + 12x + 36}$

A $\frac{(x - 6)}{(x + 6)}$

B $\frac{(x + 6)}{(x - 6)}$

C $\frac{(x - 6)}{(x - 6)}$

D $\frac{(x + 6)}{(x + 6)}$

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9 Write $\frac{3x^2 - 12}{x^2 + 4x + 4}$ in simplest form.

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

B $\frac{(x - 2)}{(x + 2)}$

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

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

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10 Reduce $\frac{x^2 - x - 6}{x^2 - 9}$ to lowest terms.

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

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

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

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

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ANSWER KEY

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

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

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

4. 2

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

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

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

8. $\frac{(x - 6)}{(x + 6)}$

9. $3\ \frac{(x - 2)}{(x + 2)}$

10. $\frac{(x + 2)}{(x + 3)}$

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