

Multiplying and Dividing Rational Expressions

Algebra Worksheet · Grade 9–11

Name: _____

Date: _____

Learning Objectives

- Multiply rational expressions by factoring and canceling common factors
- Divide rational expressions by multiplying by the reciprocal of the second fraction
- Simplify rational expressions using GCF factoring and cancellation techniques

Problems

1. Multiply and simplify the expression below:

$$\frac{x+5}{3} \times \frac{9}{x+5}$$

2. Multiply and simplify the expression below:

$$\frac{x+3}{2} \times \frac{6}{3x-6}$$

3. Multiply and simplify the expression below:

$$\frac{2}{x^2-12x+27} \times \frac{x^2-12x+27}{3}$$

4. Multiply and simplify the expression below:

$$\frac{4x+8}{x^2-9} \times \frac{x+3}{2}$$

5. Divide and simplify the expression below:

$$\frac{1}{5x^2} \div \frac{9x-36}{5x^3-35x^2}$$

6. Divide and simplify the expression below:

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$$\frac{3x+6}{x^2-4} \div \frac{9}{x-2}$$

7. Divide and simplify the expression below:

$$\frac{10x^2-20x}{40x^3-80x^2} \div \frac{6x+30}{16x^3+80x^2}$$

8. Multiply and simplify the expression below:

$$\frac{x^2-5x+6}{x^2-4} \times \frac{x+2}{x-3}$$

9. Divide and simplify the expression below:

$$\frac{x^2+7x+12}{x^2-16} \div \frac{x^2+6x+9}{x^2-x-12}$$

10. Multiply and simplify the expression below:

$$\frac{2x^2-8}{3x^2+6x} \times \frac{x^2+5x+6}{x^2-4x+4}$$

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Multiplying and Dividing Rational Expressions — Answer Key

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Answer Key

1. Answer: 3

- Write as a single fraction: $\frac{(x+5) \cdot 9}{3 \cdot (x+5)}$
 - Cancel the common factor $(x + 5)$ from numerator and denominator
 - Simplify: $\frac{9}{3} = 3$
-

2. Answer: $\frac{x+3}{x-2}$

- Factor the denominator: $3x - 6 = 3(x - 2)$
 - Combine into one fraction: $\frac{6(x+3)^2}{2 \cdot 3(x-2)}$
 - Cancel the common factor 6 from numerator and denominator: $\frac{x+3}{x-2}$
-

3. Answer: $\frac{2}{3}$

- Notice the numerator of the second fraction and the denominator of the first fraction are identical
 - Cancel the common expression $(x^2 - 12x + 27)$
 - The result is $\frac{2}{3}$
-

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

- Factor the numerator: $4x + 8 = 4(x + 2)$
 - Factor the denominator: $x^2 - 9 = (x+3)(x-3)$
 - Cancel the common factor $(x + 3)$
 - Simplify: $\frac{4(x+2)}{2(x-3)} = \frac{2(x+2)}{x-3}$
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5. Answer: $\frac{x-7}{9(x-4)}$

- Rewrite as multiplication by the reciprocal: $\frac{1}{5x^2} \cdot \frac{5x^3 - 35x^2}{9x - 36}$
 - Factor the numerator: $5x^3 - 35x^2 = 5x^2(x - 7)$
 - Factor the denominator: $9x - 36 = 9(x - 4)$
 - Cancel the common factor $5x^2$
 - Result: $\frac{x-7}{9(x-4)}$
-

6. Answer: $\frac{1}{3}$

- Rewrite as multiplication by the reciprocal: $\frac{3x+6}{x^2-4} \cdot \frac{x-2}{9}$
 - Factor: $3x + 6 = 3(x+2)$ and $x^2 - 4 = (x+2)(x-2)$
 - Cancel common factors $(x+2)$ and $(x-2)$
 - Simplify: $\frac{3}{3 \cdot 9} = \frac{1}{3}$
-

7. Answer: $\frac{2x}{3}$

- Rewrite as multiplication by the reciprocal
- Factor each part: $10x^2-20x = 10x(x-2)$, $40x^3-80x^2 = 40x^2(x-2)$, $16x^3+80x^2 = 16x^2(x+5)$, $6x+30 = 6(x+5)$

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- Cancel common factors $(x-2)$, $(x+2)$, and simplify numeric coefficients
 - Result: $\frac{2x}{3}$
-

8. Answer: 1

- Factor the numerator: $x^2 - 5x + 6 = (x-2)(x-3)$
 - Factor the denominator: $x^2 - 4 = (x+2)(x-2)$
 - Cancel common factors $(x-2)$, $(x-3)$, and $(x+2)$
 - Result: 1
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9. Answer: 1

- Rewrite as multiplication by the reciprocal
 - Factor: $x^2+7x+12=(x+3)(x+4)$, $x^2-16=(x+4)(x-4)$, $x^2+6x+9=(x+3)^2$, $x^2-x-12=(x-4)(x+3)$
 - Cancel all common factors: $(x+3)$, $(x+4)$, $(x-4)$, $(x+3)$
 - Result: 1
-

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

- Factor each part: $2x^2-8=2(x^2-4)=2(x+2)(x-2)$, $3x^2+6x=3x(x+2)$, $x^2+5x+6=(x+2)(x+3)$, $x^2-4x+4=(x-2)^2$
 - Combine into a single fraction
 - Cancel common factors $(x+2)$ and one $(x-2)$
 - Result: $\frac{2(x+3)}{3x(x-2)}$
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