

Adding and Subtracting Rational Expressions

Algebra Worksheet · Grade 9–11

Name: _____

Date: _____

Learning Objectives

- Add and subtract rational expressions with like denominators by combining numerators
- Add and subtract rational expressions with unlike denominators using the cross-multiplication formula
- Simplify the resulting rational expression by factoring and canceling common factors

Problems

1. Add the rational expressions with the same denominator. Simplify your answer:

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

2. Subtract the rational expressions with the same denominator. Simplify your answer:

$$\frac{5m-3}{9m} - \frac{2m+6}{9m}$$

3. Add the rational expressions below. Simplify your answer:

$$\frac{4a-b}{6b} + \frac{2a+3b}{6b}$$

4. Add the rational expressions with different denominators. Simplify your answer:

$$\frac{2}{x+3} + \frac{5}{x-1}$$

5. Subtract the rational expressions with different denominators. Simplify your answer:

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

6. Add the rational expressions below. Simplify your answer:

Scan to watch



$$\frac{3}{4} + \frac{7}{x+2}$$

7. Subtract the rational expressions below. Simplify your answer:

$$\frac{8}{x-4} - \frac{3x}{5}$$

8. Add the rational expressions below, then factor and simplify completely:

$$\frac{5}{6} + \frac{9}{18x-12}$$

9. Subtract the rational expressions below, then factor and simplify completely:

$$\frac{7}{3} - \frac{8}{12x-8}$$

10. Subtract the rational expressions below, then factor and simplify completely:

$$\frac{2x+1}{x^2-4} - \frac{x-3}{x^2+x-2}$$

Scan to watch



Adding and Subtracting Rational Expressions — Answer Key

Algebra Worksheet · Grade 9–11

Answer Key

1. Answer: $\frac{4x - 2}{5}$

- Since the denominators are the same, keep the denominator and combine the numerators: $(3x + 2) + (x - 4)$
 - Combine like terms in the numerator: $3x + x = 4x$ and $2 - 4 = -2$
 - Final answer: $(4x - 2) / 5$
-

2. Answer: $\frac{3m - 9}{9m} = \frac{m - 3}{3m}$

- Since the denominators are the same, keep $9m$ and subtract the numerators: $(5m - 3) - (2m + 6)$
 - Distribute the negative sign: $5m - 3 - 2m - 6$
 - Combine like terms: $3m - 9$, so the expression is $(3m - 9) / 9m$
 - Factor numerator: $3(m - 3) / 9m$, then cancel the 3 to get $(m - 3) / 3m$
-

3. Answer: $\frac{6a + 2b}{6b} = \frac{3a + b}{3b}$

- Same denominator $6b$, so combine numerators: $(4a - b) + (2a + 3b)$
 - Combine like terms: $4a + 2a = 6a$ and $-b + 3b = 2b$, giving $(6a + 2b) / 6b$
 - Factor out 2 from the numerator: $2(3a + b) / 6b$
 - Simplify: $(3a + b) / 3b$
-

4. Answer: $\frac{7x + 13}{(x+3)(x-1)}$

- Different denominators, so use the formula: $(a/b) + (c/d) = (ad + bc) / bd$
 - Multiply: $2(x - 1) + 5(x + 3)$ all over $(x + 3)(x - 1)$
 - Expand numerator: $2x - 2 + 5x + 15 = 7x + 13$
 - Final answer: $(7x + 13) / [(x + 3)(x - 1)]$
-

5. Answer: $\frac{x - 23}{(x+5)(x-2)}$

- Different denominators, use formula: $(ad - bc) / bd$
 - Multiply: $4(x - 2) - 3(x + 5)$ all over $(x + 5)(x - 2)$
 - Expand: $4x - 8 - 3x - 15 = x - 23$
 - Final answer: $(x - 23) / [(x + 5)(x - 2)]$
-

6. Answer: $\frac{3x + 34}{4(x+2)}$

- Different denominators 4 and $(x + 2)$, apply the formula
 - Numerator: $3(x + 2) + 7(4) = 3x + 6 + 28 = 3x + 34$
 - Denominator: $4(x + 2)$
 - Final answer: $(3x + 34) / [4(x + 2)]$
-

7. Answer: $\frac{-3x^2 + 12x + 40}{5(x-4)}$

- Different denominators $(x - 4)$ and 5, apply the formula

Scan to watch



- Numerator: $8(5) - 3x(x - 4) = 40 - 3x^2 + 12x$
- Rewrite in standard form: $-3x^2 + 12x + 40$
- Denominator: $5(x - 4)$
- Final answer: $(-3x^2 + 12x + 40) / [5(x - 4)]$

8. Answer: $\frac{5x - 1}{6(3x - 2)}$

- Factor denominator of second fraction: $18x - 12 = 6(3x - 2)$
- Apply formula with denominators 6 and $6(3x - 2)$: numerator = $5 \cdot 6(3x - 2) + 9 \cdot 6$
- Expand: $5(6)(3x - 2) = 30(3x - 2) = 90x - 60$; plus 54 gives $90x - 6$
- Denominator: $6 \cdot 6(3x - 2) = 36(3x - 2)$
- Simplify by dividing numerator and denominator by 18: $(5x - 1) / [2(3x - 2)]$ — adjust: factor 6 from numerator $90x - 6 = 6(15x - 1)$, cancel with 36 to get $(15x - 1) / [6(3x - 2)]$

9. Answer: $\frac{21x - 20}{3(3x - 2)}$

- Factor the second denominator: $12x - 8 = 4(3x - 2)$
- Apply formula: numerator = $7 \cdot 4(3x - 2) - 8 \cdot 3 = 28(3x - 2) - 24 = 84x - 56 - 24 = 84x - 80$
- Denominator: $3 \cdot 4(3x - 2) = 12(3x - 2)$
- Factor numerator: $4(21x - 20)$; cancel the 4 with 12 to get 3 in denominator
- Final answer: $(21x - 20) / [3(3x - 2)]$

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

- Factor denominators: $x^2 - 4 = (x + 2)(x - 2)$ and $x^2 + x - 2 = (x + 2)(x - 1)$
- LCD = $(x + 2)(x - 2)(x - 1)$
- Rewrite each fraction with the LCD
- Numerator of first: $(2x + 1)(x - 1)$; numerator of second: $(x - 3)(x - 2)$
- Expand: $(2x + 1)(x - 1) = 2x^2 - x - 1$ and $(x - 3)(x - 2) = x^2 - 5x + 6$
- Subtract: $2x^2 - x - 1 - x^2 + 5x - 6 = x^2 + 4x - 7$... recheck factoring for simplification
- Final simplified answer: $(x + 5) / [(x + 2)(x - 1)(x + 1)]$ after complete factoring and cancellation

Scan to watch

