

Adding and Subtracting Rational Expressions

Check Skills You'll Need

Simplify each expression.

$$1. \frac{4}{9} + \frac{2}{9} = \frac{6}{9} = \frac{2}{3}$$

$$2. \frac{3}{7} - \frac{5}{7} = \frac{-2}{7}$$

$$3. \frac{1}{2} + \left(-\frac{5}{2}\right) = \frac{-4}{2} = -2$$

$$4. \frac{3 \cdot 5}{3 \cdot 6} + \frac{2 \cdot 2}{2 \cdot 9} = \frac{15 + 4}{18}$$

$$5. \frac{3 \cdot 1}{3 \cdot 4} - \frac{1 \cdot 4}{3 \cdot 4} = \frac{-1}{12}$$

$$6. \frac{5}{12} - \frac{3 \cdot 3}{4 \cdot 3} = \frac{-4}{12} = \frac{-1}{3}$$

$$7. \frac{4x}{9} + \frac{2x}{9} = \frac{6x}{9} = \frac{2x}{3}$$

$$8. \frac{7x}{12} - \frac{1x}{12} = \frac{6x}{12} = \frac{x}{2}$$

$$9. \frac{7}{12y} - \frac{1}{12y} = \frac{6}{12y} = \frac{1}{2y}$$

Factor each quadratic expression.

$$10. x^2 + 3x + 2 \\ (x+1)(x+2)$$

$$11. y^2 + 7y + 12 \\ (y+3)(y+4)$$

$$12. t^2 - 4t + 4 \\ (t-2)(t-2)$$

Adding rational expressions with like denominators is like adding rational numbers with like denominators. If a , b , and c represent polynomials (with $c \neq 0$), then $\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$.

1 EXAMPLE Adding Expressions With Like Denominators

Add $\frac{2}{x+3}$ and $\frac{5}{x+3}$.

$$\frac{2}{x+3} + \frac{5}{x+3} = \frac{2+5}{x+3} \quad \text{Add the numerators.}$$

$$= \frac{7}{x+3} \quad \text{Simplify the numerator.}$$

✓ Check Understanding

1 Add.

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

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

$$\frac{5}{x+2}$$

b. $\frac{y}{y-5} + \frac{3y}{y-5}$

$$\frac{y+3y}{y-5}$$

$$\frac{4y}{y-5}$$

c. $\frac{5n}{n+1} + \frac{2n}{n+1}$

$$\frac{5n+2n}{n+1}$$

$$\frac{7n}{n+1}$$

2**EXAMPLE****Subtracting Expressions With Like Denominators**

Subtract $\frac{2n+1}{2n^2+5n-3}$ from $\frac{3n+4}{2n^2+5n-3}$.

$$\frac{3n+4-(2n+1)}{2n^2+5n-3}$$

$$\frac{n+3}{2n^2+5n-3} = \frac{\cancel{(n+3)}}{(2n-1)\cancel{(n+3)}} = \frac{1}{2n-1}$$

 **Check Understanding**

2 Subtract.

a. $\frac{4}{t-2} - \frac{5}{t-2}$

$$\frac{-1}{t-2}$$

b. $\frac{7b-2}{3b+6} - \frac{b+7}{3b+6}$

$$\frac{6b-9}{3(b+2)}$$

$$\frac{\cancel{3}(2b-3)}{\cancel{3}(b+2)}$$

c. $\frac{2c+1}{5m+2} - \frac{3c-4}{5m+2}$

$$\frac{-c+5}{5m+2}$$

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EXAMPLE

Adding Expressions With Monomial Denominators

Add $\frac{2}{3x} + \frac{1}{6}$

$$\frac{2 \cdot 2}{2 \cdot 3x} + \frac{1 \cdot x}{6 \cdot x}$$

$$\frac{4 + x}{6x}$$

 Check Understanding

3 Add or subtract.

a. $\frac{3}{7y^4} + \frac{2}{3y^2}$

$$\frac{3 \cdot 3}{3 \cdot 7y^4} + \frac{2 \cdot 7y^2}{3y^2 \cdot 7y^2}$$

$$\frac{9 + 14y^2}{21y^4}$$

b. $\frac{4}{25x} - \frac{49}{100}$

$$\frac{4 \cdot 4}{4 \cdot 25x} - \frac{49 \cdot x}{100 \cdot x}$$

$$\frac{16 - 49x}{100x}$$

c. $\frac{5}{12b} + \frac{15}{36b^2}$

$$\frac{3b \cdot 5}{3b \cdot 12b} + \frac{15}{36b^2}$$

$$\frac{\cancel{15}b + \cancel{15}}{\cancel{36}b^2}$$

$$\frac{5b + 5}{12b^2}$$

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EXAMPLE

Adding Expressions With Polynomial Denominators

Add $\frac{5}{c+2}$ and $\frac{6}{c-3}$

$$\frac{\overbrace{(c-3)}^{(c-3)}}{\overbrace{(c-3)}^{(c-3)}} \frac{5}{(c+2)} + \frac{6}{\overbrace{(c-3)}^{(c-3)}} \frac{\overbrace{(c+2)}^{(c+2)}}{\overbrace{(c+2)}^{(c+2)}}$$

$$\frac{5c-15+6c+12}{(c-3)(c+2)} = \frac{11c-3}{(c-3)(c+2)}$$

4 Add.

a. $\frac{5}{t+4} + \frac{3}{t-1}$

$$\frac{5t-5+3t+12}{(t+4)(t-1)}$$

$$\frac{8t+7}{(t+4)(t-1)}$$

b. $\frac{m}{2m+1} + \frac{3}{m-1}$

$$\frac{m^2-m+6m+3}{(2m+1)(m-1)}$$

$$\frac{m^2+5m+3}{(2m+1)(m-1)}$$

c. $\frac{-2}{a+2} + \frac{3a}{2a-1}$

$$\frac{-4a+2+3a^2+6a}{(a+2)(2a-1)}$$

$$\frac{3a^2+2a+2}{(a+2)(2a-1)}$$

Assignment: p. 669, # 1-27 (odd)

Student Edition Answers

pages 669–671 Exercises

1. $\frac{9}{2m}$

2. $\frac{7}{6t-1}$

3. $\frac{n+2}{n+3}$

4. $\frac{14}{c-5}$

5. $\frac{2s^2+1}{4s^2+2}$

6. $\frac{6c-28}{2c+7}$

7. $\frac{-3}{2-b}$

8. $-\frac{1}{t^2+1}$

9. $\frac{-2t}{2t-3}$

10. 1

11. 2

12. -1

13. $2x^2$

14. 18

15. $7z$

16. $35b^3c$

17. $\frac{35+6a}{15a}$

18. $\frac{12-2x}{3x}$

19. $\frac{18+20x^2}{15x^8}$

20. $\frac{9+2m}{24m^3}$

21. $\frac{189-9n}{7n^3}$

22. $\frac{45+36x^2}{20x^2}$

23. $\frac{17m-47}{(m+2)(m-7)}$

24. $\frac{a^2+9a+12}{(a+3)(a+5)}$

25. $\frac{a^2+12a+15}{4(a+3)}$

26. $\frac{c^2+7c+20}{(c+5)(c+3)}$

27. $\frac{4t^2+5t+5}{t^2(t+1)}$

