# Multiplying Rational Expressions

FACTOR → NPVs → SIMPLIFY

Simplify each product completely. State all NPVs from the original denominators.

**MILD**

1. $\frac{2x}{3} \cdot \frac{9}{4x}$

2. $\frac{x-2}{x+3} \cdot \frac{x+3}{x+5}$

3. $\frac{6x^2}{5} \cdot \frac{15}{9x}$

4. $\frac{3(x-1)}{2(x+4)} \cdot \frac{8(x+4)(x+2)}{9(x-1)}$

**MEDIUM**

5. $\frac{x^2-9}{x^2+5x+6} \cdot \frac{x+2}{x-3}$

6. Consider the following product (where defined): $\frac{x-3}{x+2} \cdot \frac{x+2}{x-3} = 1$. Neither rational expression, $\frac{x-3}{x+2}$ nor $\frac{x+2}{x-3}$ equals 1 on its own. Explain why their product equals 1. What relationship exists between the two expressions?

7. $\frac{x^2-4x}{x^2-16} \cdot \frac{x+4}{3(x+1)}$

8. $\frac{x^2+7x+12}{x^2-1} \cdot \frac{x-1}{x+4}$

9. $\frac{x^2+x-6}{x^2-9} \cdot \frac{x^2-3x}{x+2}$

**SPICY**

10. $\frac{x^2+5x+6}{x^2-4} \cdot \frac{x^2-x-6}{x^2+4x+3}$

11. $\frac{2x^2-8x}{x^2-9} \cdot \frac{x^2+4x+3}{4x^2-16x}$

12. A learner is simplifying this product: $\frac{6x^2-12x}{x^2-4} \cdot \frac{x+2}{3(x+1)}$. The learner claims that nothing in the first numerator can cancel with the first denominator because the numerator has two terms. Is this correct? Explain how factoring out a GCF changes what can be cancelled.

13. $\frac{2x^2+5x+2}{x^2-4} \cdot \frac{x^2-2x}{2x^2+7x+3}$

14. $\frac{x^2-4x+3}{x^2-9} \cdot \frac{3-x}{x^2-5x+4}$

**EXTRA SPICY**

15. $\frac{6x^2-x-2}{4x^2-1} \cdot \frac{1-2x}{3x^2+4x+1}$

16. $\frac{2x^3-8x}{3x^2-12x} \cdot \frac{9x^2-36x}{x^2+5x+6}$

17. $\frac{6x^2+5x-6}{x^2-4x+3} \cdot \frac{x^2-9}{2x^2+x-3}$

18. $\frac{x^4-5x^2+4}{2x^2-5x+3} \cdot \frac{3-2x}{x^2+3x+2}$

19. Construct a product of two rational expressions that simplifies to $x + 1$ but has exactly two NPVs: $x = -2$ and $x = 3$. Explain how your factors create both the simplification and the restrictions.