

# Rational Expressions

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 18

## Quick Review and Helpful Hints

A *rational expression* is a fraction whose top and bottom are polynomials. Simplify by factoring both parts and canceling common factors. It is *undefined* wherever the denominator equals 0, so those  $x$ -values must be excluded.

▶ **Example:** Simplify  $\frac{x^2 - 9}{x + 3}$ . **Work:** Factor the top:  $\frac{(x + 3)(x - 3)}{x + 3}$ .  
 Cancel the common  $(x + 3)$ . ★ **Answer:**  $x - 3$  ( $x \neq -3$ )

$$\frac{\cancel{(x + 3)}(x - 3)}{\cancel{(x + 3)}} = x - 3$$

Cancel common factors.

### Practice Problems

Simplify each expression (or answer as directed).

- |                                 |       |   |       |
|---------------------------------|-------|---|-------|
| 1. $\frac{2x}{4}$               | _____ | 8. $\frac{x^2 - 16}{x - 4}$                   | _____ |
| 2. $\frac{6x^2}{3x}$            | _____ | 9. $\frac{5x^2}{10x}$                         | _____ |
| 3. $\frac{x^2 - 4}{x - 2}$      | _____ | 10. $\frac{x^2 + 7x + 10}{x + 5}$             | _____ |
| 4. $\frac{x^2 - 9}{x + 3}$      | _____ | 11. $\frac{x^2 - 25}{x + 5}$                  | _____ |
| 5. $\frac{x^2 + 5x + 6}{x + 2}$ | _____ | 12. $\frac{4x + 8}{x + 2}$                    | _____ |
| 6. $\frac{x^2 - x - 6}{x - 3}$  | _____ | 13. $\frac{x^2 - 1}{x - 1}$                   | _____ |
| 7. $\frac{3x + 6}{3}$           | _____ | 14. $\frac{1}{x - 3}$ is undefined when $x =$ | _____ |

### Word Problems

15. A rectangle has area  $x^2 - 36$  and one side length  $x + 6$ . Simplify  $\frac{x^2 - 36}{x + 6}$  to represent the other side length. \_\_\_\_\_
16. Where is  $\frac{5}{x - 2}$  undefined? \_\_\_\_\_
17. A batch recipe has total ingredient amount  $2x^2 + 4x$  split evenly across  $2x$  containers. Simplify  $\frac{2x^2 + 4x}{2x}$  for the amount per container. \_\_\_\_\_
18. A rectangular garden has area  $x^2 + 8x + 15$  and one side  $x + 3$ . Simplify  $\frac{x^2 + 8x + 15}{x + 3}$  for the missing side. \_\_\_\_\_



## Answer Keys

- |                  |                  |             |
|------------------|------------------|-------------|
| 1. $\frac{x}{2}$ | 7. $x + 2$       | 13. $x + 1$ |
| 2. $2x$          | 8. $x + 4$       | 14. $3$     |
| 3. $x + 2$       | 9. $\frac{x}{2}$ | 15. $x - 6$ |
| 4. $x - 3$       | 10. $x + 2$      | 16. $x = 2$ |
| 5. $x + 3$       | 11. $x - 5$      | 17. $x + 2$ |
| 6. $x + 2$       | 12. $4$          | 18. $x + 5$ |

### Step-by-Step Explanations

1. Start by naming the process: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is Divide top and bottom by 2:  $\frac{x}{2}$ . So the final answer is  $\frac{x}{2}$ .
2. A good way to think about this is: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{6x^2}{3x} = 2x$ . So the final answer is  $2x$ .
3. Step by step: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x-2)(x+2)}{x-2} = x+2$ . So the final answer is  $x+2$ .
4. Take it one move at a time: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x+3)(x-3)}{x+3} = x-3$ . So the final answer is  $x-3$ .
5. Start by naming the process: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x+2)(x+3)}{x+2} = x+3$ . So the final answer is  $x+3$ .
6. A good way to think about this is: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x-3)(x+2)}{x-3} = x+2$ . So the final answer is  $x+2$ .
7. Step by step: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{3(x+2)}{3} = x+2$ . So the final answer is  $x+2$ .
8. Take it one move at a time: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x-4)(x+4)}{x-4} = x+4$ . So the final answer is  $x+4$ .
9. Start by naming the process: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{5x^2}{10x} = \frac{x}{2}$ . So the final answer is  $\frac{x}{2}$ .
10. A good way to think about this is: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x+5)(x+2)}{x+5} = x+2$ . So the final answer is  $x+2$ .
11. Step by step: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x-5)(x+5)}{x+5} = x-5$ . So the final answer is  $x-5$ .
12. Take it one move at a time: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{4(x+2)}{x+2} = 4$ . So the final answer is  $4$ .
13. Start by naming the process: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x-1)(x+1)}{x-1} = x+1$ . So the final answer is  $x+1$ .
14. A good way to think about this is: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is The bottom is 0 when  $x = 3$ . So the final answer is  $3$ .
15. Step by step: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x-6)(x+6)}{x+6} = x-6$ . So the final answer is  $x-6$ .
16. Take it one move at a time: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is The denominator is 0 at  $x = 2$ . So the final answer is  $x = 2$ .
17. Start by naming the process: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{2x(x+2)}{2x} = x+2$ . So the final answer is  $x+2$ .
18. A good way to think about this is: For a rational expression, factor first when possible, then cancel only common factors from the top and bottom. The setup/work is  $\frac{(x+3)(x+5)}{x+3} = x+5$ . So the final answer is  $x+5$ .



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