A **rational expression** is an algebraic fraction whose numerator and denominator are polynomials. Any values of the variable that result in a denominator of zero must be excluded from the domain of the variable. These are called **excluded values** of the rational expression. To simplify a rational expression, eliminate (by dividing) any common factors of the numerator and denominator using the GCF.

**Example**

Simplify \( \frac{b - 3}{b^2 - 2b - 3} \) and state the excluded values of \( b \).

\[
\frac{b - 3}{b^2 - 2b - 3} = \frac{b - 3}{(b - 3)(b + 1)}
\]

Factor the denominator.

\( b - 3 = 0 \) and \( b + 1 = 0 \)

Exclude the values for which \( b - 3 = 0 \) and \( b + 1 = 0 \).

\( b = 3 \)  \( b = -1 \)

Therefore, \( b \) cannot equal 3 or -1.

\[
\frac{b - 3}{(b - 3)(b + 1)} = \frac{b - 3}{(b - 3)(b + 1)}
\]

Simplify the fraction by dividing by the GCF, \( b - 3 \).

\[
= \frac{1}{b + 1}, \quad b \neq -1, 3
\]

**Try These Together**

**Simplify and state the excluded values of the variables.**

1. \( \frac{7a^3}{14a} \)

**HINT:** Find the exclude values before you simplify the expression.

2. \( \frac{x^2 + 3x + 2}{x^2 - 4x - 5} \)

**HINT:** Factor both the numerator and the denominator.

**Practice**

Simplify and state the excluded values of the variables.

3. \( \frac{6x^2y}{30x} \)

4. \( \frac{9x^4y^2z}{x^5y} \)

5. \( \frac{20xy^3z}{60x^2y^3} \)

6. \( \frac{8a}{a^2 + 3a} \)

7. \( \frac{12x}{3x + 6} \)

8. \( \frac{10x - 5x^2}{2x^2} \)

9. \( \frac{x^2 - 25}{x - 5} \)

10. \( \frac{b^2 - 4}{4b - 8} \)

11. \( \frac{3x + 3}{x^2 - 1} \)

12. \( \frac{a + 7}{a^2 + 9a + 14} \)

13. \( \frac{x^2 + 6x + 8}{6x + 24} \)

14. \( \frac{y^2 + 7y + 6}{y^2 + 5y - 6} \)

15. **Standardized Test Practice** Simplify the rational expression \( \frac{2x^2 - 98}{8x - 56} \).

**A** \( 4(x + 7) \)

**B** \( 4(x - 7) \)

**C** \( \frac{x^2 - 49}{x - 7} \)

**D** \( \frac{x + 7}{4} \)