

12-2 Rational Expressions

(Pages 648–653)

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 .

$$\frac{b-3}{b^2-2b-3} = \frac{b-3}{(b-3)(b+1)} \quad \text{Factor the denominator.}$$

$$b-3=0 \quad \text{and} \quad b+1=0 \quad \text{Exclude the values for which } b-3=0 \text{ and } b+1=0.$$

$$b=3 \qquad \qquad \qquad b=-1$$

Therefore, b cannot equal 3 or -1 .

$$\frac{b-3}{(b-3)(b+1)} = \frac{\overset{1}{\cancel{b-3}}}{(\cancel{b-3})(b+1)} \quad \text{Simplify the fraction by dividing by the GCF, } b-3.$$

$$= \frac{1}{b+1}, b \neq -1, 3$$

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. $\frac{9x^4y^2z}{x^6y}$

5. $\frac{20xyz^3}{60x^2yz^3}$

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

Answers: 1. $\frac{2}{3}$, $a \neq 0$ 2. $\frac{x+2}{x+5}$, $x \neq -2, -5$ 3. $\frac{5}{xy}$, $x \neq 0, y \neq 0$ 4. $\frac{x}{yz}$, $x \neq 0, y \neq 0, z \neq 0$ 5. $\frac{3x}{1}$, $x \neq 0, y \neq 0, z \neq 0$ 6. $\frac{a+3}{8}$, $a \neq 0, -3$ 7. $\frac{x+2}{4x}$, $x \neq -2$ 8. $\frac{2x}{10-5x}$, $x \neq 0, 2$ 9. $x+5$, $x \neq -5$ 10. $\frac{4}{b+2}$, $b \neq -2$ 11. $\frac{x-1}{3}$, $x \neq -1, 1$ 12. $\frac{a+2}{1}$, $a \neq -2, -7, -1$ 13. $\frac{6}{x+2}$, $x \neq -4$ 14. $\frac{y-1}{y+1}$, $y \neq -6, 1$ 15. D