

8.4 Rational Expressions

Simplifying Rational Expressions Warm Up

Simplify the following completely:

$$\frac{15}{65}$$

$$\frac{\cancel{5} \cdot 3}{\cancel{5} \cdot 13}$$

$$\boxed{\frac{3}{13}}$$

$$\frac{\cancel{4(x+3)}}{(x-5)\cancel{(x+3)}}$$

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

$$\frac{x^2 + 7x}{x^2}$$

$$\frac{x(x+7)}{x^2}$$

$$\frac{\cancel{x(x+7)}}{\cancel{x} \cdot x}$$

$$\frac{(x+7)}{x}$$

EXAMPLE 1 Simplify a rational expression

Simplify: $\frac{x^2 - 2x - 15}{x^2 - 9}$

$$\begin{array}{l} x^2 - 2x - 15 \\ \quad \quad \quad \uparrow \quad \downarrow \\ \quad \quad \quad -5 \quad 3 \\ (x-5)(x+3) \end{array}$$

$$\begin{array}{l} x^2 + 0x - 9 \\ \quad \quad \quad \quad \quad \quad \uparrow \quad \downarrow \\ \quad \quad \quad \quad \quad \quad 3 \quad -3 \\ (x+3)(x-3) \end{array}$$

$$\frac{(x-5)\cancel{(x+3)}}{\cancel{(x+3)}(x-3)}$$

$$\boxed{\frac{x-5}{x-3}}$$

EXAMPLE 1 Simplify a rational expression

Simplify the expression, if possible.

$$\frac{2(x+1)}{(x+1)(x+3)}$$

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

$$\frac{40x+20}{10x+30}$$
$$\frac{20(2x+1)}{10(x+3)}$$
$$\frac{2(2x+1)}{x+3}$$

$$\frac{4}{x(x+2)}$$

EXAMPLE 1 Simplify a rational expression

Simplify the expression, if possible.

$$\frac{x+4}{x^2-16}$$

$$\frac{\cancel{x+4}}{(\cancel{x+4})(x-4)}$$

$$\boxed{\frac{1}{x-4}}$$

$$\frac{x^2-2x-3}{x^2-x-6}$$

$$\frac{(\cancel{x-3})(x+1)}{(\cancel{x-3})(x+2)}$$

$$\boxed{\frac{x+1}{x+2}}$$

$$\frac{2x^2+10x}{3x^2+16x+5}$$

$$\frac{2x(\cancel{x+5})}{(\cancel{x+5})(3x+1)}$$

$$\boxed{\frac{2x}{3x+1}}$$

REASONING Match the rational expression with its simplified form.

$$3. \frac{x^2 - 9x + 14}{x^2 - 5x - 14} = \frac{\cancel{(x-7)}(x-2)}{\cancel{(x-7)}(x+2)}$$

A. $\frac{x-2}{x+7}$

B. $\frac{x-2}{x+2}$

C. $\frac{x+7}{x-2}$

SIMPLIFYING Simplify the rational expression, if possible.


6. $\frac{4x^2}{20x^2 - 12x}$

$$\frac{\cancel{4}x \cdot x}{\cancel{4}x(5x-3)}$$

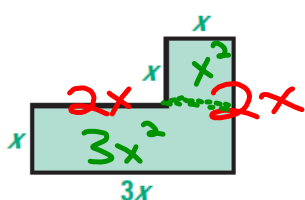
$$\boxed{\frac{x}{5x-3}}$$

16. $\frac{5x^2 + 18x - 8}{10x^2 - x - 2}$

$$\boxed{\frac{(x+4)(5x-2)}{(5x+2)(2x-1)}}$$

 **GEOMETRY** A farmer wants to fence in the field shown. Write a simplified rational expression for the ratio of the field's perimeter to its area.

22.



$$\frac{P}{A} = \frac{10x}{4x^2} = \frac{5}{2x}$$

$$P = 3x + 2x + x + x + 2x + x = 10x$$

$$A = 3x^2 + x^2 = 4x^2$$