

Algebra 2 8.1
Simplify rational expressions
Simplify complex fractions
rational
simplify (a fraction)
GCF

→ Is it ever OK to divide by zero?
whiteboards

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

$$\frac{2^x}{5}$$

$$\frac{4}{5y}$$

How to simplify fractions:

EX. $8/12$

$10/20$

$25/125$

$$\begin{array}{l} 8 \\ 2 \wedge 4 \\ 2 \wedge 2 \end{array}$$

$$\frac{8 \div 4}{12 \div 4} = \frac{2}{3}$$

$$\frac{10 \div 10}{20 \div 10} = \frac{1}{2}$$

$$\begin{array}{l} 10 \\ 2 \wedge 5 \\ 20 \\ 2 \wedge 2 \wedge 5 \end{array}$$

$$\begin{array}{l} 12 \\ 3 \wedge 4 \\ 2 \wedge 2 \end{array}$$

$$\frac{\cancel{2} \cdot \cancel{2} \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot 3} = \frac{2}{3}$$

$$\frac{\cancel{2} \cdot \cancel{5}}{\cancel{2} \cdot \cancel{2} \cdot 5} = \frac{1}{2}$$

$$\frac{8}{12} = \frac{2 \cdot \cancel{4}}{3 \cdot \cancel{4}} = \frac{2}{3}$$

GCF = 4

$$\frac{x^2 - 4x + 3}{x^2 - 6x + 5} = \frac{(x-3)(x-1)}{(x-5)(x-1)}$$

$$\frac{(x-3)(x-1)}{(x-5)(x-1)}$$

Is there a GCF?

FFOO

Is there a GCF?

Example 1 Simplify a Rational Expression

a. Simplify

$$\frac{5x(x^2 + 4x + 3)}{(x - 6)(x^2 - 9)}$$

$$\frac{3}{1}$$

$$\frac{5x(x+3)(x+1)}{(x-6)(x+3)(x-3)}$$

$$\frac{5x(x+1)}{(x-6)(x-3)}$$

$$x \neq 6 \quad x \neq 3$$

b. Under what conditions is this expression undefined?

$$\therefore x = 6 \quad x = 3$$

Is division by zero ever OK?

Find factors...

Standardized Test Example 2 Use Elimination

For what value(s) is $\frac{x^2(x^2 - 5x - 14)}{4x(x^2 + 6x + 8)}$ undefined?
Simplify

~~$\frac{-7}{-5}$~~
 ~~$\frac{4}{6}$~~
 ~~$\frac{8}{2}$~~

Is there a GCF?
Is division by zero OK?

$$\frac{x \cancel{x^2} (x-7)(\cancel{x+2})}{4 \cancel{x} (x+4)(\cancel{x+2})}$$

$4 \cdot (x+4)$

$x = -4$

$x \neq -4$

Guided Practice

2. For what value(s) of x is $\frac{x(x^2 + 8x + 12)}{-6(x^2 - 3x - 10)}$ undefined?

$$\frac{6 \times 2 \times 2}{8}$$

Simplify

$$\frac{x(x+6)(x+2)}{-6(x-5)(x+2)}$$

$$\frac{-10 \times 2}{-5 \times -3}$$

$$x \neq 5$$

$$\begin{aligned} x-5 &= 0 \\ x &= 5 \end{aligned}$$

are there any common factors?

Example 3 Simplify Using -1

$$\text{Simplify } \frac{-w(4w+3y)(w+y)}{(3y-4w)(5w+y)}$$

$$\frac{-w(w+y)}{5w+y}$$

Common factors?

• **Guided Practice**

Simplify each expression.

3A. $\frac{(xz - 4z)}{z^2(4 - x)}$ $\frac{-z(-x + 4)}{z^2(4 - x)}$ $\frac{-z}{z \cdot z} = -\frac{1}{z}$

When is the expression not defined?

3B. $\frac{ab^2 - 5ab}{(5 + b)(5 - b)}$

$$\frac{1}{2} \div \frac{3}{5} = \frac{5}{6} \quad \left(\frac{5}{6} \right)$$

$$\frac{1}{2} \times \frac{5}{3} = \frac{5}{6}$$

$$\frac{\frac{1}{2} \cdot \frac{5}{3}}{\frac{5}{3} \cdot \frac{5}{3}} = \frac{5}{6}$$

Multiplication

$$\frac{2}{9} \cdot \frac{15}{4} = \frac{\overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{3}} \cdot 5}{\cancel{3} \cdot 3 \cdot \underset{1}{\cancel{2}} \cdot 2} = \frac{5}{3 \cdot 2} = \frac{5}{6}$$

$$\frac{3}{5} \cdot \frac{35}{6} = \frac{\cancel{3} \cdot 5 \cdot 7}{\cancel{6} \cdot 2 \cdot 3} = \frac{7}{2}$$

$$\frac{3}{5} \div \frac{6}{35} = \frac{3}{5} \cdot \frac{35}{6} = \frac{\cancel{3} \cdot \overset{1}{\cancel{5}} \cdot 7}{\cancel{3} \cdot 2 \cdot \overset{1}{\cancel{5}}} = \frac{7}{2}$$

$$\frac{2}{9} \cdot \frac{15}{4} = \frac{30}{36} \div 6 = \frac{5}{6}$$

$$\frac{\overset{1}{\cancel{2}}}{\underset{3}{\cancel{9}}} \cdot \frac{\overset{5}{\cancel{15}}}{\underset{2}{\cancel{4}}} = \frac{5}{6}$$

To solve: multiply by the reciprocal...but why?

$$\frac{2}{5 \cdot 3} \cdot \frac{5 \cdot 7}{2 \cdot 3} = \frac{5}{6}$$

Example 4 Multiply and Divide Rational Expressions

Simplify each expression.

a. $\frac{6c}{5d} \cdot \frac{15cd^2}{8a}$ $\frac{\cancel{2} \cdot 3 \cdot \cancel{c} \cdot \cancel{3} \cdot \cancel{5} \cdot \cancel{c} \cdot \cancel{d} \cdot \cancel{d}}{\cancel{5} \cdot \cancel{d} \cdot \cancel{2} \cdot \cancel{2} \cdot a}$

$$\frac{9c^2d}{4a}$$

b. $\frac{18xy^3}{7a^2b^2} \div \frac{12x^2y}{35a^2b}$

$$\frac{\cancel{2} \cdot \cancel{3} \cdot \cancel{3} \cdot y \cdot y \cdot y}{\cancel{7} \cdot a \cdot \cancel{b} \cdot \cancel{b} \cdot y} \cdot \frac{\cancel{5} \cdot \cancel{7} \cdot a \cdot a \cdot b}{\cancel{7} \cdot \cancel{2} \cdot \cancel{3} \cdot x \cdot y \cdot \cancel{5}} = \frac{1}{2bx}$$

$$\frac{15y^2}{2xb}$$

$$\cancel{2bx}$$

► **Guided Practice**

4A. $\frac{12c^3d^2}{21ab} \cdot \frac{14a^2b}{8c^2d}$

4B. $\frac{6xy}{15ab^2} \cdot \frac{21a^3}{18x^4y}$

$$4C. \frac{16mt^2}{21a^4b^3} \div \frac{24m^3}{7a^2b^2} = \frac{2t^2}{9a^2bm^2}$$

$$4D. \frac{12x^4y^2}{40a^4b^4} \div \frac{6x^2y^4}{16a^2x} = \frac{4x^3}{5a^2b^4y^2}$$

$4 \begin{matrix} \wedge \\ 2 \end{matrix} \quad 10 \begin{matrix} \wedge \\ 2 \end{matrix} \quad 5$

8.1

17-390

81-86

