

Sect 8.1 Multiplying & Dividing Rational Expressions

A ratio of two polynomial expressions is called a rational expression.

How do you write a fraction in simplest form??

Write $\frac{24}{56}$ in simplest form. $\frac{\cancel{8} \cdot 3}{\cancel{8} \cdot 7} = \boxed{\frac{3}{7}}$

cancel common factors

Rational expressions are simplified the same way. However, you may need to do some **FACTORING** in order to find the Greatest Common Factor and reduce the expression.

Let's review some basic factoring.

a) $2x^2y + 4xy^2$
 $2xy(x + 2y)$

b) $x^2 - 8x + 15$
 $(x-3)(x-5)$

c) $2x^2 + 8x - 24$
 $2(x^2 + 4x - 12)$
 $2(x+6)(x-2)$

d) $x^2 - 16$
 $(x+4)(x-4)$

STEPS TO SIMPLIFY RATIONAL EXPRESSIONS

- 1) Factor both the numerator and denominator.
- 2) Cancel any common factors from numerator and denominator.
- 3) Multiply remaining factors for both the numerator and denominator.

Simplify each rational expression. Under what conditions is the expression undefined?

1) $\frac{\cancel{(x+3)}(x-4)}{2(x+5)\cancel{(x+3)}} = \frac{x-4}{2(x+5)}$
 $= \boxed{\frac{x-4}{2x+10}}$

2) $\frac{x^2 - 5x - 14}{2x^2 + 16x + 24} = \frac{(x-7)\cancel{(x+2)}}{2(x+6)\cancel{(x+2)}} = \frac{x-7}{2(x+6)}$
 $= \boxed{\frac{x-7}{2x+12}}$

3) $\frac{ab^2 - b^2}{ab^3 - b^3} = \frac{b^2\cancel{(a-1)}}{b^3\cancel{(a-1)}} = \frac{b^2}{b^3} = \boxed{\frac{1}{b}}$

4) $\frac{x^2 - 16}{x^2 - 6x + 8} = \frac{(x+4)\cancel{(x-4)}}{\cancel{(x-4)}(x-2)} = \boxed{\frac{x+4}{x-2}}$

Do you remember multiplication and division of fractions??

$$\text{Multiply. } \frac{5}{6} \cdot \frac{4}{45} = \frac{20}{270} = \boxed{\frac{2}{27}}$$

$$\text{Divide. } \frac{3}{7} \div \frac{9}{14} = \frac{3}{7} \cdot \frac{14}{9} = \frac{42}{63} = \boxed{\frac{2}{3}}$$

↓
multiply
by the
reciprocal

Now let's apply the same procedure to rational expressions.

Multiply.

$$5) \frac{6x^2}{5y} \cdot \frac{25y^3}{12x} = \frac{150x^2y^3}{60xy} = \boxed{\frac{5xy^2}{2}}$$

$$6) \frac{\cancel{(x+2)}(x+1)}{x^2+3x+2} \cdot \frac{2\cancel{(x-8)}}{3x+6} = \frac{2(x+1)}{3(x-1)} = \boxed{\frac{2x+2}{3x-3}}$$

Divide.

$$7) \frac{18xy^2}{25x^2y^3} \div \frac{9y}{10xy}$$

$$\frac{18xy^2}{25x^2y^3} \cdot \frac{10xy}{9y} = \frac{180x^2y^3}{225x^2y^4} = \boxed{\frac{4}{5y}}$$

$$8) \frac{\cancel{(x+7)}(x-5)}{x^2+2x-35} \div \frac{2x-10}{x+2} \rightarrow$$

$$\frac{\cancel{(x+7)}(x-5)}{\cancel{(x+2)}(x-2)} \cdot \frac{\cancel{x+2}}{2(x-5)} = \frac{x+7}{2(x-2)} = \boxed{\frac{x+7}{2x-4}}$$