

9.3-9.4 Simplifying, Multiplying and Dividing Rational Expressions

Objective:

- Be able to simplify rational expressions.
- Be able to multiply and divide rational expressions

Warm-up:

Simplify the following fractions.

$$1. \frac{8}{12} = \frac{2}{3}$$

$$2. \frac{12}{42} = \frac{2}{7}$$

$$3. \frac{25}{40} = \frac{5}{8}$$

Rational Expression:

a fraction whose numerator and denominator are both nonzero polynomials

ex. $\frac{x}{x^2-9}$ or $\frac{4}{x}$

Simplifying Rational Expressions:

Ex. $\frac{5\cancel{2}y}{1\cancel{2}}$

$$\boxed{\frac{5y}{1}}$$

Ex. $\frac{1\cancel{4}}{3\cancel{4}x^2}$

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

Ex. $\frac{x-4}{x}$

cannot be simplified
b/c not multiplication

Your Turn:

1. $\frac{1\cancel{12}y^2}{5\cancel{60}y^2} \cdot \frac{y^2}{y}$

$$\boxed{\frac{y^2}{5}}$$

2. $\frac{7\cancel{70}y^3}{10\cancel{100}y} \cdot \frac{y^2}{x}$

$$\boxed{\frac{7y^2}{10x}}$$

3. $\frac{2\cancel{10}}{5\cancel{10}}$

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

Ex. $\frac{p+4}{p^2+6p+8}$

$$= \frac{\cancel{p+4}}{\cancel{(p+4)}(p+2)} = \boxed{\frac{1}{p+2}}$$

Your Turn:

4. $\frac{m+7}{m^2+4m-21}$

$$= \frac{\cancel{m+7}}{\cancel{(m+7)}(m-3)} = \boxed{\frac{1}{m-3}}$$

Ex. $\frac{x^2-2x-15}{x^2-6x+5}$

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

Ex. $\frac{a^2+5a+4}{a^2+9a+20}$

$$= \frac{\cancel{(a+4)}(a+1)}{\cancel{(a+5)}\cancel{(a+4)}} = \boxed{\frac{a+1}{a+5}}$$

5. $\frac{2a^2+10a}{3a^2+15a}$

$$= \frac{2\cancel{a}(a+5)}{3\cancel{a}(a+5)} = \boxed{\frac{2}{3}}$$

6. $\frac{x^2+x-6}{x^2+8x+15}$

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

Review of Multiplying Fractions:

multiply across

$$\frac{2}{3} \cdot \frac{4}{2} = \frac{8}{6} = \boxed{\frac{4}{3}}$$

Perform the indicated operation. Simplify all answers completely.

Ex. $\frac{6y^2}{3y} \cdot \frac{9y^3}{12y^6}$

$$= \frac{54y^5}{36y^7} = \boxed{\frac{3}{2y^2}}$$

Ex. $\frac{4x^2}{3x} \cdot \frac{9x}{8x^5} = \frac{36x^3}{24x^6} = \boxed{\frac{3}{2x^3}}$

1. factor all numerators and denominators

2. multiply across

3. cancel common factors

4. simplify

Ex. $\frac{3x}{4x-12} \cdot \frac{x^2-9}{x}$

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

$$\boxed{\frac{3(x+3)}{4}}$$

Ex. $\frac{2x}{3x-6} \cdot \frac{2x-4}{x^2}$

$$\frac{\cancel{2}\cancel{x} \cdot \cancel{2}\cancel{(x-2)}}{3\cancel{(x-2)} \cdot \cancel{x^2}}$$

$$\boxed{\frac{4}{3x}}$$

Practice:

$$7. \frac{7x^2}{3y^3} \cdot \frac{6xy}{4x^2}$$

$$\frac{42x^3y}{12y^3x^2}$$

$$= \boxed{\frac{7x}{2y^2}}$$

$$8. \frac{4x+8}{x^3} \cdot \frac{6x}{x^2-4}$$

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

$$\boxed{\frac{24}{x^2(x-2)}}$$

$$9. \frac{16x^4}{x+5} \cdot \frac{x^2+3x-10}{8x^6}$$

$$2 \frac{16x^4}{x+5} \cdot \frac{(x+5)(x-2)}{8x^6}$$

$$\boxed{\frac{2(x-2)}{x^2}}$$

Review of Dividing Fractions:

$$\text{ex. } \frac{2}{3} \div \frac{2}{5} = \frac{2}{3} \cdot \frac{5}{2} = \frac{10}{6} = \boxed{\frac{5}{3}}$$

* multiply by the reciprocal
or
keep, change, flip

Perform the indicated operation. Simplify all answers completely.

$$\text{Ex. } \frac{x}{6} \div \frac{2x}{3}$$

$$\frac{x}{6} \cdot \frac{3}{2x}$$

$$\frac{3x}{12x}$$

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

$$\text{Ex. } \frac{x+5}{3x} \div \frac{2x+10}{6x^2}$$

$$\frac{x+5}{3x} \cdot \frac{6x^2}{2(x+5)}$$

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

$$= \boxed{x}$$

$$\text{Ex. } \frac{1}{3x-12} \div \frac{x}{4x-16}$$

$$\frac{1}{3(x-4)} \cdot \frac{4(x-4)}{x}$$

$$\boxed{\frac{4}{3x}}$$