

Example #2: Multiply the rational expression.

1. $\frac{x}{3x^2 - 9x} \cdot \frac{x-3}{2x^2 + x - 3}$

$2 \cdot -3 = -6$
 $-2 + 3 = 1$

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

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

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

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

2. $\frac{y-5}{3y^2 - 3y} \cdot \frac{2y^2}{y^2 - 6y + 5}$

$1 \cdot 5 = 5$
 $-6 = -5 + -1$

$$\frac{y-5}{3y(y-1)} \cdot \frac{2 \cdot y \cdot y}{(y-5)(y-1)}$$

$$\frac{2 \cdot y \cdot y \cdot \cancel{(y-5)}}{3 \cdot y \cdot \cancel{(y-1)} \cdot \cancel{(y-5)} \cdot (y-1)}$$

$$\boxed{\frac{2y}{3(y-1)(y-1)}}$$

You practice: Multiply the rational expression.

1. $\frac{y^3}{2y^2} \cdot \frac{4y^2}{6}$

$$\frac{y \cdot y \cdot y}{2 \cdot y \cdot y} \cdot \frac{2 \cdot 2 \cdot y \cdot y}{3 \cdot 2}$$

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

$$\boxed{\frac{y^3}{3}}$$

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

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

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

$$\boxed{(x+2)(x+3)}$$

Example #3: Multiply the rational expression.

1. $\frac{7x}{x^2 + 5x + 4} \cdot \frac{(x+4)}{1}$

$1 \cdot 4 = 4$
 $4 + 1 = 5$

$$\frac{7 \cdot x}{(x+4)(x+1)} \cdot \frac{x+4}{1}$$

$$\frac{7 \cdot x \cdot \cancel{(x+4)}}{\cancel{(x+4)}(x+1)}$$

$$\boxed{\frac{7x}{x+1}}$$

2. $\frac{(x-3)}{1} \cdot \frac{x+3}{x^2-9}$

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

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

$$\boxed{1}$$

Exploration #2: Work with a partner and divide the following fractions.

1. $\frac{3}{10} \div \frac{1}{5}$

$\frac{3}{10} \cdot \frac{5}{1}$

$\frac{15}{10} = \boxed{\frac{3}{2}}$

2. $\frac{4}{7} \div \frac{4}{5}$

$\frac{4}{7} \cdot \frac{5}{4}$

$\frac{20}{28} = \boxed{\frac{5}{7}}$

3. $\frac{4}{5} \div \frac{1}{2}$

$\frac{4}{5} \cdot \frac{2}{1}$

$\boxed{\frac{8}{5}}$

Notes:

To divide rational expressions:

1. We multiply by the reciprocal of the second fraction.

2. We factor the numerators and the denominators.

3. We multiply the numerators and multiply the denominators.

4. We simplify the expression.

Example #4: Divide the rational expression.

1. $\frac{4n}{n+5} \div \frac{n-9}{n+5}$

$\frac{4n}{n+5} \cdot \frac{n+5}{n-9}$

$\frac{4 \cdot n \cdot (n+5)}{(n+5) \cdot (n-9)}$

$\boxed{\frac{4n}{n-9}}$

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

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

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

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

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

You practice: Divide the rational expression.

1. $\frac{n-2}{2n} \div \frac{n-2}{n+5}$

$\frac{n-2}{2n} \cdot \frac{n+5}{n-2}$

$\frac{(\cancel{n-2})(n+5)}{2 \cdot n \cdot (\cancel{n-2})}$

$\boxed{\frac{n+5}{2n}}$

2. $\frac{x^2-9}{4x^2} \div (x-3)$

$\frac{x^2-9}{4x^2} \cdot \frac{1}{x-3}$

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

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

$\boxed{\frac{x+3}{4x^2}}$