

Multiplying and Dividing Rational Expressions... *when they're factored for you***Rule #2:** To multiply, just multiply across, canceling the factors on top and bottom that match.**EXAMPLE**

$$\frac{(x+7)(x-2)}{(3)(x-6)} \cdot \frac{(9)(x-6)}{(x-2)(x+5)}$$

Multiply across, and cancel any matches.

$$\begin{aligned} &= \frac{(x+7)\cancel{(x-2)}(9)\cancel{(x-6)}}{(3)\cancel{(x-6)}\cancel{(x-2)}(x+5)} \\ &= \frac{(9)(x+7)}{(3)(x+5)} \\ &= \frac{\cancel{(3)}(3)(x+7)}{\cancel{(3)}(x+5)} \\ &= \frac{(3)(x+7)}{x+5} \\ &= \boxed{\frac{3x+21}{x+5}} \end{aligned}$$

**EXAMPLE**

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

Multiply and cancel.

$$\begin{aligned} &= \frac{(10)(x-1)\cancel{(4)(x+3)}}{\cancel{(x+3)}(x+2)(5)(x+1)} \\ &= \frac{(10)(4)(x-1)}{(5)(x+2)(x+1)} \\ &= \frac{\cancel{(5)}(2)(4)(x-1)}{\cancel{(5)}(x+2)(x+1)} \\ &= \frac{(8)(x-1)}{(x+2)(x+1)} = \boxed{\frac{8x-8}{x^2+3x+2}} \end{aligned}$$

**EXAMPLE**

$$\frac{(5)(x+4)}{(20)(x+1)} \cdot \frac{(6)(x-7)}{(x-7)(x-7)}$$

Multiply and cancel.

$$\begin{aligned} &= \frac{(5)(x+4)\cancel{(6)(x-7)}}{(20)(x+1)\cancel{(x-7)}(x-7)} \\ &= \frac{(5)(6)(x+4)}{(20)(x+1)(x-7)} \\ &= \frac{\cancel{(5)}\cancel{(2)}(3)(x+4)}{\cancel{(5)}\cancel{(2)}(2)(x+1)(x-7)} \\ &= \frac{(3)(x+4)}{(2)(x+1)(x-7)} \\ &= \frac{3x+12}{(2)(x^2-6x-7)} \\ &= \boxed{\frac{3x+12}{2x^2-12x-14}} \end{aligned}$$

1.  $\frac{(x+8)(x-3)}{(4)(x+2)} \cdot \frac{(8)(x+2)}{(x-3)(x+10)}$

2.  $\frac{(7)(x+1)}{(5)(x+19)} \cdot \frac{(20)(x+19)}{(21)(x-4)}$

3.  $\frac{(x+2)(x-6)}{(2)(x+9)} \cdot \frac{(8)(x+9)}{(3)(x+2)(x+6)}$

4.  $\frac{(x+3)(x-7)}{(20)(x-5)} \cdot \frac{(16)(x)}{(x+3)(x-1)}$

5.  $\frac{(x+7)(x+6)}{(5)(x-12)} \cdot \frac{(10)(x-12)}{(x+7)(x-1)}$

6.  $\frac{(11)(x-5)}{(13)(x-8)} \cdot \frac{(8)(x-8)}{(2)(x+14)}$

**Rule #3:** To divide, flip the **second fraction**. Then multiply.

**EXAMPLE**

$$\frac{(x-4)(x+3)}{(8)(x+5)} \div \frac{(x-4)(x-7)}{(4)(x+5)}$$

Flip the **second fraction**.

$$\frac{(x-4)(x+3)}{(8)(x+5)} \cdot \frac{(4)(x+5)}{(x-4)(x-7)}$$

Multiply and cancel.

$$\begin{aligned} &= \frac{\cancel{(x-4)}(x+3)(4)\cancel{(x+5)}}{(8)\cancel{(x+5)}(x-4)(x-7)} \\ &= \frac{(4)(x+3)}{(8)(x-7)} \\ &= \frac{\cancel{(4)}(x+3)}{\cancel{(4)}(2)(x-7)} \\ &= \frac{x+3}{(2)(x-7)} \\ &= \frac{x+3}{2x-14} \end{aligned}$$

**EXAMPLE**

$$\frac{(7)(x+6)}{(x+8)(x-9)} \div \frac{(14)(x+1)}{(3)(x+8)}$$

Flip the **second fraction**.

$$\frac{(7)(x+6)}{(x+8)(x-9)} \cdot \frac{(3)(x+8)}{(14)(x+1)}$$

Multiply and cancel.

$$\begin{aligned} &= \frac{(7)(x+6)(3)\cancel{(x+8)}}{\cancel{(x+8)}(x-9)(14)(x+1)} \\ &= \frac{(7)(3)(x+6)}{(14)(x-9)(x+1)} \\ &= \frac{\cancel{(7)}(3)(x+6)}{\cancel{(7)}(2)(x-9)(x+1)} \\ &= \frac{(3)(x+6)}{(x-9)(x+1)} = \frac{3x+18}{x^2-8x-9} \end{aligned}$$

**EXAMPLE**

$$\frac{(11)(x-3)}{(15)(x+10)} \div \frac{(x+2)(x-5)}{(12)(x+10)}$$

Flip the **second fraction**.

$$\frac{(11)(x-3)}{(15)(x+10)} \cdot \frac{(12)(x+10)}{(x+2)(x-5)}$$

Multiply and cancel.

$$\begin{aligned} &= \frac{(11)(x-3)(12)\cancel{(x+10)}}{(15)\cancel{(x+10)}(x+2)(x-5)} \\ &= \frac{(11)(12)(x-3)}{(15)(x+2)(x-5)} \\ &= \frac{(11)\cancel{(3)}(4)(x-3)}{\cancel{(3)}(5)(x+2)(x-5)} \\ &= \frac{(11)(4)(x-3)}{(5)(x+2)(x-5)} \\ &= \frac{44(x-3)}{(5)(x^2-3x-10)} \\ &= \frac{44x-132}{5x^2-15x-50} \end{aligned}$$

7.  $\frac{(x-5)(x+8)}{(24)(x-7)} \div \frac{(x+8)(x+3)}{(16)(x-7)}$

8.  $\frac{(9)(x+13)}{(7)(x+10)} \div \frac{(18)(x-3)}{(35)(x+10)}$

9.  $\frac{(x-3)(x-8)}{(12)(x+20)} \div \frac{(2)(x-3)(x)}{(3)(x+20)}$

10.  $\frac{(x+17)(x)}{(6)(x-3)} \div \frac{(x+17)(x)}{(18)(x+4)}$

11.  $\frac{(x-7)(x+8)}{(4)(x+13)} \div \frac{(x-7)(x+1)}{(2)(x+13)}$

12.  $\frac{(10)(x-2)}{(3)(x+12)} \div \frac{(20)(x+13)}{(7)(x+12)}$