

# Simplifying Rational Expressions

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Consider the expression:

$$\frac{2x+4}{2}$$

We CANNOT cancel the **2**'s, but we can factor the numerator

$$2x + 4 = 2(x + 2)$$

so our expression can be written

$$\frac{2(x+2)}{2}$$

Now the **2** in the numerator can be cancelled with the **2** in the denominator.

$$\frac{2(x+2)}{2} = \boxed{x + 2}$$

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Example 1:

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Simplify each expression:

a.)  $\frac{3x+12}{2x+8}$

We must factor the top and bottom first to see if any factors will cancel:

$$\frac{3x+12}{2x+8} = \frac{3(x+4)}{2(x+4)} = \boxed{\frac{3}{2}}$$

Notice that the binomials cancel!

b.) 
$$\frac{(x+3)(x+5)}{(x-3)(x+5)}$$

Here the numerator and denominator are already factored, since there is an  $(x + 5)$  on the TOP AND in the BOTTOM, they will cancel.

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

c.) 
$$\frac{4x^2-4x}{5x-5}$$

We need to factor the top and the bottom first, to see if any factors will cancel:

$$\frac{4x^2-4x}{5x-5} = \frac{4x(x-1)}{5(x-1)} = \boxed{\frac{4x}{5}}$$

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

We need to factor the top and bottom first to see if any factors will cancel.

Let's start with the top:

$$x^2 + 2x - 15$$

We need to use the **abc** method.

$$x^2 + 2x - 15$$

$$a = 1$$

$$b = 2$$

$$c = -15$$

$$\underline{a \cdot c = -15}$$

we need factors of **-15** that add to **2**  
(the **b**-term)

<u>-15</u>		<u>SUM (we want 2)</u>
1	-15	-14
3	-5	-2
-3	5	2

So we get:

$$x^2 + 2x - 15 = (x - 3)(x + 5)$$

Now the denominator:

$$x^2 + 6x + 5$$

$$a = 1$$

$$b = 6$$

$$c = 5$$

$$a \cdot c = 5$$

We need factors of **5** that add to **6** (the **b**-term).

The factors are **5** and **1**.

So we get:

$$x^2 + 6x + 5 = (x + 5)(x + 1)$$

Therefore our expression can be written:

$$\frac{x^2 + 2x - 15}{x^2 + 6x + 5} = \frac{(x - 3)(x + 5)}{(x + 5)(x + 1)} =$$

Will anything cancel?

What is the final solution?

Answer:

e.)  $\frac{6-x}{x-6}$

We are hoping to factor the top or bottom so that something will cancel.

If we factor out an  $-1$  from the top, we get:

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

Using the commutative property of addition, we can write the top binomial as

$$x + (-6) = x - 6$$

So our expression becomes:

$$\frac{-1(x-6)}{x-6}$$

The binomials cancel and our final answer is  $-1$

# Simplifying Rational Expressions

## Practice Problems

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Simplify each expression:

1.  $\frac{5x-15}{x-3}$

2.  $\frac{7x^2+7x}{2x+2}$

3.  $\frac{x^2-9}{x^2+x-6}$

4.  $\frac{x^2-1}{1-x}$