

AA5-1 Investigation
Simplifying Rational Expressions

Name _____

Rational Expressions are fractions. Simplifying a Rational Expression means to reduce it to lowest terms by **dividing** numerator and denominator by a **common factor**. In other words, making ones and "cancelling out".

Example: $\frac{20}{35} = \frac{5 \cdot 4}{5 \cdot 7} \stackrel{\text{step 1}}{=} \frac{5 \cdot 4}{5 \cdot 7} \stackrel{\text{step 2}}{=} \frac{4}{7}$

Step 1: Find common factors in the numerator and denominator.

Step 2: Divide out the common factors

This works with numbers as well as variables. Simplify the following.

1. $\frac{4}{12}$

2. $\frac{30x^{10}}{15x^7}$

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

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

What happens if all of the factors in the numerator or denominator cancel out?

Simplifying first:

#3 and #4 above were already factored. If a rational expression is not in fully factored form we need to factor it before simplifying.

We are going to review three techniques to simplify quadratic expressions.

A. Factoring binomials (aka, undistributing or two box). For each expression, find the greatest common factors and rewrite the binomial. Example: $15x^2 + 10x = 5x(3x + 2)$

Factor these expressions:

1. $20x^2 - 4x$

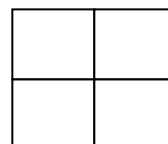
2. $3x - 3$

3. $24x^2 + 5x$

B. Difference of perfect squares

Using the box for FOIL method multiply the binomials and write the standard form.

1) $(x+4)(x-4) =$ _____



Do you see the pattern? Without a box, write the standard form of each expression:

2) $(x+12)(x-12) =$ _____ 3) $(x+1)(x-1) =$ _____

These are a little harder, but the pattern still holds.

4) $(3x+7)(3x-7) =$ _____ 5) $(4x+10)(4x-10) =$ _____

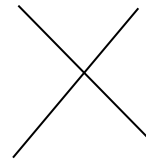
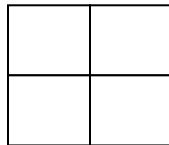
We can use this pattern to quickly factor a DIFFERENCE OF SQUARES.

6) $x^2 - 36 = (\quad) (\quad)$ 7) $16x^2 - 100 = (\quad) (\quad)$

Note: This only works for a DIFFERENCE of squares. For example, $x^2 + 25$, cannot be factored.

C. Factoring a trinomial using a box and diamond technique. This is the technique we have been using all semester.

Example: Factor $x^2 + 6x + 9$



Putting it all together: Factor out the numerator and denominator of each rational expression below and then simplify:

$$\frac{4x^2+16x}{2x+8}$$

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