Multiplication and Division of Rational Expressions

To multiply fractions, you learned to multiply the numerators together, then multiply the denominators together, and then reduce, if possible.

$$\frac{3}{8} \times \frac{5}{7} = \frac{15}{56}$$

We use this same process with rational expressions.

$$\frac{4}{5x} \times \frac{11x}{13} = \frac{44x}{65x} = \frac{44}{65}$$

Sometimes it is simpler to reduce or cancel *common factors* before multiplying.

$$\frac{4}{5x} \times \frac{11x}{13} = \frac{4}{5\cancel{x}} \times \frac{11\cancel{x}}{13} = \frac{44}{65}$$

When we need to divide fractions, we invert (flip over) the fraction to the right of the division symbol and then multiply.

invert

$$\frac{2x^2}{3y} \div \left(\frac{4x}{5y^3}\right) = \frac{2x^2}{3y} \cdot \left(\frac{5y^3}{4x}\right) = \frac{10x^2y^3}{12xy} = \frac{5xy^2}{6}$$

Pay careful attention to *negative* signs in the factors.

Decide before you multiply whether the answer will be positive *or* negative.

- If the number of negative factors is *even*, the result will be *positive*.

- If the number of negative factors is *odd*, the answer will be *negative*.

Remember: In this unit, we agreed that *no* denominator equals 0.