Multiplying Rational Expressions:

Example: $\dfrac{4x^2y}{5z^3} \bullet \dfrac{25z^2}{8x^4y}$

Step 1: Write the numerator and denominator as products of factors. $\dfrac{4 \cdot x^2 \cdot y \cdot 25 \cdot z^2}{5 \cdot z^3 \cdot 8 \cdot x^4 \cdot y}$

Step 2: Cancel factors that appear in both the numerator and denominator $\dfrac{5}{2x^2z}$

    (Remember numbers divide into numbers and with variables we use
the Laws of Exponents- namely when we have bases in both
numerators and denominator we subtract exponents and write the resulting
variable in the position where the variable had the largest exponent)

    *In this example 4 divides into 8 with a result of 2 and this is written in the
denominator, 5 divides into 25 equally 5 and this answer is placed in the numerator, the
larger power of x is in the denominator so we subtract 4 -2 and get 2 and write the
answer x^2 in the denominator, we do the same with the variable z and we cancel the
variable y since they both have the same exponent.*

Example: $\dfrac{\left(6x^2y\right)^3}{4xy} \bullet \dfrac{\left(3xy\right)^3}{\left(2x^5y\right)^2}$

Step 1: Remove the brackets using the Laws of Exponents which states $\dfrac{6^3 \cdot x^6 \cdot y^3 \cdot 3^3 \cdot x^3 \cdot y^3}{4 \cdot x \cdot y \cdot 2^2 \cdot x^{10} \cdot y^2}$

    "if we have a power inside the bracket and a power outside we
multiply exponents" Be careful **numbers and variables with no
obvious exponent have an exponent of "1"**

Step 2: expand $6^3 = 216$, $3^3 = 27$ and $2^2 = 4$ and combine like variables in $\dfrac{216 \cdot 27 \cdot x^9 \cdot y^6}{4 \cdot 4 \cdot x^{11} \cdot y^3}$

    the numerator and denominator using the Law of Exponents which
states that if we multiply bases we add exponents.

Step 3: Repeat step 2 from the first example. Write out the answer

Example: $\dfrac{y^2 + 4y - 21}{y^2 - 6y - 16} \bullet \dfrac{y^2 - 8y + 15}{y^2 + 9y + 14}$

Step 1: **Never - Never start canceling at this point.** Place brackets $\dfrac{y^2 + 4y - 21}{y^2 - 6y - 16} \bullet \dfrac{y^2 - 8y + 15}{y^2 + 9y + 14}$

around each numerator and denominator and you will see that
they are not the same and therefore cannot be canceled.

Step 2: Factor each numerator and denominator and write as one $\dfrac{(y + 7)(y - 3)(y - 5)(y - 3)}{(y - 8)(y + 2)(y + 7)(y + 2)}$

large fraction

Step 3: Identify the factors that are common in both the numerator
and denominator and cancel only those factors. Only common factor is (y +7)

Step 4: Write your answer leaving all the factors in their factored form. $\dfrac{(y - 3)(y - 5)(y - 3)}{(y - 8)(y + 2)(y + 2)}$

There is no need to multiply them out.