

# Rational Expressions

## *Multiplication and Division*

### *With Monomial Factors*

When we are working with monomial factors, we have two different ways we can go about simplifying (whether it is multiplication or division). We can multiply the two terms together and then reduce. We can also “cross cancel” with common factors in the beginning and then multiply at the end. Most students prefer to multiply first and then simplify. I learned it through cross canceling. I’m going to sound like that OLD teacher right now... We cross cancelled back in my day because we didn’t use the calculator so we wanted to keep the numbers as small as possible to make the computations easier.

Remember, when doing division with fractions, you must change the division sign to multiplication and invert (use the reciprocal) of the 2<sup>nd</sup> fraction. Then you proceed using your multiplication rules. You might remember this as “keep, change, change” or “invert and multiply”.

In the video, we will do both practice problems BOTH WAYS. When you are doing the problems on your own, you choose whichever way you like best. Both ways are 100% acceptable. But remember, even though you can do the problem two different ways, there is only one correct answer to each problem.

Multiply First and reduce:

$$A) \frac{8x^7}{3y^5} \cdot \frac{6y^2}{12x}$$

Cross Cancelling First and Multiply 2<sup>nd</sup>

$$A) \frac{8x^7}{3y^5} \cdot \frac{6y^2}{12x}$$

$$B) \frac{5x^7}{18y^5} \div \frac{10x^{10}}{27y^{11}}$$

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$$1) \frac{9b^7}{32c^5} \cdot \frac{16c^2}{12b^{11}}$$

$$2) \frac{14x^{12}}{16y^9} \cdot \frac{6y^7}{7x^{11}}$$

$$3) \frac{24f^{17}}{21a^{15}} \div \frac{32f^{12}}{27a^{11}}$$

$$4) \frac{16m^7}{8p^{13}} \div \frac{48m^{10}}{12p^{10}}$$

$$5) \frac{18g^7}{45h^9} \cdot \frac{20h^{18}}{7g}$$

$$6) \frac{4r^3}{32q^{15}} \cdot \frac{16q^7}{8r^9}$$

$$7) \frac{21x^{14}}{5y^{12}} \div \frac{27x^{14}}{10y^{11}}$$

$$8) \frac{36t^7}{20u^{15}} \div \frac{27t^{11}}{25u^{20}}$$

## *Multiplication and Division*

### *With Polynomial Factors*

*When we have polynomial factors, it becomes difficult to multiply binomials by trinomials or trinomials by trinomials, so we do not multiply first and reduce at the end like we could with monomials.*

*Instead we approach it this way:*

Factor each numerator and denominator.

Reduce where possible.

Keep what's left.

$$E) \frac{x^3 + 4x^2 - 77x}{32x^2 - 50} \bullet \frac{32x - 40}{x^3 - 7x^2}$$

$$F) \frac{3x^2 - 48}{x^2 + 10x + 24} \div \frac{9x^2 + 9x - 180}{x^2 + 11x + 30}$$

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# Multiplication and Division:

**DO ALL PROBLEMS WITH FACTORING DONE (STEP BY STEP) ON THE SIDE!**

$$1) \frac{6x^3 - 48x^2}{x^2 - x - 56} \cdot \frac{x^2 + 18x + 77}{3x^2 - 363}$$

$$2) \frac{x^2 + 15x + 54}{x^2 - 81} \div \frac{x^2 - 6x - 72}{x^2 - 21x + 108}$$

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$$3) \frac{10x^3 - 360x}{4x^2 + 24x} \cdot \frac{x^2 + 7x + 6}{5x^2 - 25x - 30}$$

$$4) \frac{x^2 - 13x + 42}{x^2 - 4x - 21} \div \frac{x^2 - 2x - 24}{3x + 12}$$

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5)  $\frac{x^2 + 4x - 96}{x^2 - 144} \cdot \frac{x^2 - 4x - 96}{x^2 + 16x + 64}$

6)  $\frac{x^2 - 16x + 55}{6x^4 - 66x^3} \div \frac{x^2 - 25}{8x^3 + 40x^2}$

**ANSWER KEY:**

1)  $\frac{2x^2}{(x - 11)}$    2)  $1$    3)  $\frac{x + 6}{2}$    4)  $\frac{3}{(x+3)}$    5)  $\frac{x - 8}{x + 8}$    6)  $\frac{4}{3x}$

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## Practice:

$$1) \frac{24x - 120}{14x - 6} \bullet \frac{49x^2 - 9}{6x^2 - 150}$$

$$2) \frac{x^2 - x - 90}{x^2 - 14x + 40} \div \frac{x^2 + 15x + 54}{6x - 24}$$

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$$3) \frac{x^2 + 5x - 14}{x^2 + 16x + 63} \bullet \frac{x^2 + 6x - 16}{2x^2 + 34x + 144}$$

$$4) \frac{4x^4 - 16x^2}{2x^2 - 14x - 36} \div \frac{x^5 + 4x^4 - 12x^3}{x^2 + 15x + 54}$$



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$$5) \frac{x^7 - 49x^5}{12x^2 - 84x} \div \frac{9x^2 - 49}{12x - 28}$$

$$6) \frac{6x^2 + 12x}{24x^2 - 72x - 240} \cdot \frac{2x^2 - 8x - 10}{x^5 - x^3}$$

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$$7) \frac{3x^4 - 15x^3 - 108x^2}{x^5 + x^4 - 12x^3} \bullet \frac{4x^3 - 36x}{12x^2 - 72x - 324}$$

$$8) \frac{2x^5 + 12x^4 - 14x^3}{4x + 28} \div \frac{x^4 + 2x^3 - 3x^2}{8x^2 - 8x - 96}$$

Answer Key:

$$1) \frac{2(7x+3)}{x+5}$$

$$2) \frac{6}{x+6}$$

$$3) \frac{(x-2)(x-2)}{2(x+9)(x+9)}$$

$$4) \frac{2(x+9)}{x(x-9)}$$

$$5) \frac{x^4(x+7)}{3(3x+7)}$$

$$6) \frac{1}{2x^2(x-1)}$$

$$7) 1$$

$$8) 4x(x-4)$$