

# Math-1010

## Lesson 4-2 Multiply and Divide Rational Expressions

# Multiplying Fractions

$$\frac{6}{7} * \frac{14}{9} \text{ multiply} = \frac{6*14}{7*9} = \frac{84}{63} \text{ simplify} = \frac{6*14}{7*9}$$

$$= \frac{\cancel{2*3} * \cancel{2*7}}{\cancel{7} * \cancel{3} * 3} = \frac{4}{3}$$

$$\frac{6}{7} * \frac{14}{9} \text{ simplify} = \frac{\cancel{2*3} * \cancel{2*7}}{\cancel{7} * \cancel{3} * 3} = \frac{4}{3}$$

Do you multiply first or do you simplify THEN multiply?

BE CAREFUL!!!!

$$\frac{x + \cancel{7}}{\cancel{7}(x + 9)}$$

No !!

Cannot use the Inverse Property of Multiplication on Addends.

Addition and Subtraction mean:

Combine the terms into one term (if you can)

If you can't combine them (unlike terms)  
they still are connected to each other.

Put binomials into a parentheses.  $\frac{(x + 7)}{7(x + 9)}$

# Multiplying Rational Expressions

Simplify before you multiply.

$$\begin{aligned} \frac{(x-1)}{2(x+3)} * \frac{x^2-9}{(x+1)} &= \frac{(x-1)}{2(x+3)} * \frac{(x+3)(x-3)}{(x+1)} \\ &= \frac{\cancel{(x+3)}}{\cancel{(x+3)}} * \frac{(x-1)(x-3)}{2(x+1)} = \frac{(x-1)(x-3)}{2(x+1)} \end{aligned}$$

DON'T multiply the simplified version of the product,  
just leave it in factored form.

Your turn:

Multiply the expressions

$$\frac{3\cancel{(x-4)}}{\cancel{(x-3)}} * \frac{\cancel{(x-2)}}{\cancel{(x-4)}} * \frac{\cancel{(x-3)}}{6\cancel{(x-2)}} = \frac{3}{6} = \frac{1}{2}$$

$$\frac{(x+3)}{(x-5)} * \frac{(x^2-16)}{(x+4)} = \frac{(x+3)(x-4)\cancel{(x+4)}}{(x-5)\cancel{(x+4)}}$$
$$= \frac{(x+3)(x-4)}{(x-5)}$$

Your turn:

Multiply the expressions

(Solutions on this slide)

$$\frac{x^2 + x - 12}{x^2 - 9} * \frac{x^2 - 2x - 15}{x^2 - 16}$$

$$\frac{\cancel{(x-3)}\cancel{(x+4)}}{\cancel{(x-3)}\cancel{(x+3)}} * \frac{(x-5)\cancel{(x+3)}}{\cancel{(x+4)}(x-4)} = \frac{(x-5)}{(x-4)}$$

Your turn:                      Multiply the expressions

$$\frac{2x^2 - 8x - 24}{x^2 + 2x - 3} * \frac{x^2 + 7x + 12}{x^2 - 2x - 24}$$

$$\frac{2(x^2 - 4x - 12)}{(x+3)(x-1)} * \frac{(x+3)(x+4)}{(x-6)(x+4)} = \frac{2(x^2 - 4x - 12)}{(x-1)(x-6)}$$

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

# Divide Rational Expressions

$$\frac{2}{3} \div \frac{5}{7}$$

What do we do?

Multiply by the reciprocal

$$\frac{2}{3} * \frac{7}{5} = \frac{14}{15}$$



# Divide Rational Expressions

$$\frac{12xyz}{5mnp} \div \frac{4x^2z}{5mn}$$

Multiply by the reciprocal

$$\frac{12xyz}{5mnp} * \frac{5mn}{4x^2z} = \frac{12xy}{p} * \frac{1}{4x^2} = \frac{4 * 3xy}{p} * \frac{1}{4 * x * x}$$

$$= \frac{3y}{p} * \frac{1}{x} = \frac{3y}{px}$$

Your turn:

$$\begin{aligned} & \frac{6abz}{7mp^2} \div \frac{4b^3z}{14m^2p} \\ & \frac{6ab\cancel{z}}{7mp^2} * \frac{14m^2p}{4b^3\cancel{z}} = \frac{\cancel{2} * 3 * a * \cancel{b}}{\cancel{7} * \cancel{m} * \cancel{p} * p} * \frac{\cancel{2} * \cancel{7} * \cancel{m} * m * \cancel{p}}{\cancel{2} * \cancel{2} * \cancel{b} * b * b} \\ & = \frac{3am}{pb^2} \end{aligned}$$

# Dividing Rational Expressions

$$\frac{x+3}{x^2+x-6} \div \frac{x-8}{x-2} = ? = \frac{x+3}{x^2+x-6} * \frac{x-2}{x-8}$$

simplify then multiply!

$$= \frac{x+3}{(x+3)(x-2)} * \frac{x-2}{x-8} = \frac{\cancel{(x+3)}\cancel{(x-2)}}{\cancel{(x+3)}\cancel{(x-2)}(x-8)}$$

$$\frac{1}{(x-8)} \quad \text{OR} \quad (x-8) \quad ?$$

Your turn:

$$\frac{x+3}{x^2+x-6} \div \frac{x-8}{x^2+x-6}$$

$$\frac{x+3}{x^2+x-6} * \frac{x^2+x-6}{x-8} = \frac{(x+3)}{\cancel{(x^2+x-6)}} * \frac{\cancel{(x^2+x-6)}}{(x-8)} = \frac{(x+3)}{(x-8)}$$

Your turn:

$$\frac{x^2 + 2x - 35}{x^2 - 4x - 12} \div \frac{x^2 - 2x - 15}{x^2 + 9x + 14}$$

$$\frac{x^2 + 2x - 35}{x^2 - 4x - 12} * \frac{x^2 + 9x + 14}{x^2 - 2x - 15} = \frac{(x+7)\cancel{(x-5)}}{(x-6)\cancel{(x+2)}} * \frac{\cancel{(x+2)}(x+7)}{\cancel{(x-5)}(x+3)}$$

$$= \frac{(x+7)(x+7)}{(x-6)(x+3)}$$

Your Turn:

divide

$$\frac{x^2 - x - 20}{x^2 + 2x - 15} \div \frac{x^2 - 5x + 4}{x^2 + 5x}$$

Divide

$$\frac{28x^2 y^3}{y} \div \frac{14x^2}{6x^3 y^2}$$

Your Turn:

Multiply  $\frac{4(x+5)}{4x-16} * \frac{x(x+1)}{2(x+5)}$

Multiply  $\frac{x^2-3x-10}{x^2-2x-15} * (x^2+10x+21)$

divide  $\frac{x^2-x-2}{x^2+4x-5} \div \frac{2x-4}{5x+25}$

# Compound (or Complex) Fraction

$$\frac{\frac{1}{3}}{\frac{2}{5}} = \frac{1}{3} \div \frac{2}{5} = \frac{1}{3} * \frac{5}{2}$$

$$= \frac{1*5}{3*2} = \frac{5}{6}$$



# Simplifying a Compound Rational Function

$$\frac{\frac{2x}{x-1}}{\frac{4x}{x-1}} = \frac{2x}{x-1} * \frac{x-1}{4x} = \frac{2}{4} = \frac{1}{2}$$

Convert division to multiplication

remove common factors in Numerator/denominator

# Compound Rational Functions

Convert Division into multiplication

$$\frac{\frac{2x-3}{x-1}}{\frac{x-4}{x-3}} \equiv \frac{2x-3}{x-1} * \frac{x-3}{x-4}$$

Leave as is

$$\frac{(2x-3)(x-3)}{(x-1)(x-4)}$$