

## Getting Ready



for Unit 6



- I can multiply and divide fractions.
- I can simplify monomials.

Simplify the following. (without a calculator!)

$$1. \frac{\cancel{17}}{\cancel{12}} \cdot \frac{\cancel{8}^2}{\cancel{21}_3} = \frac{2}{9}$$

$$2. \frac{3}{\cancel{4}_1} \cdot \frac{\cancel{8}^2}{7} = \frac{6}{7}$$

$$3. \frac{9}{\cancel{8}_4} \cdot \frac{\cancel{18}}{1} = \frac{81}{4}$$

$$4. \frac{\cancel{32}^4 \cancel{ab}^2}{\cancel{40}^5 \cancel{a^2}^1 \cancel{b}} = \frac{4b^2}{5a}$$

$$5. \frac{(5x^4y^3)^2}{50x^2y} = \frac{\cancel{25}^1 \cancel{x^8}^4 \cancel{y^6}^3}{\cancel{50}^2 \cancel{x^2}^1 \cancel{y}^1} = \frac{x^6y^5}{2}$$

# Multiplying & Dividing Rational Expressions



Obj: Multiply and divide algebraic fractions.



Obj: Simplify algebraic fractions.

Rational Expression: a ratio (fraction) of two polynomial expressions

## How to simplify rational (Fractional) expressions

Is there an addition or subtraction problem in the numerator or denominator or both?

YES

NO

Try to Factor the Numerator or Denominator.

- Common Factors?
- Square or Cube Formula?
- **FOIL backwards?**
- Grouping?

Cancel/Reduce

- Reduce Coefficients
- Variables with exponents subtract and place in top or bottom.

# Multiplying & Dividing Rational Expressions



Obj: Multiply and divide algebraic fractions.



Obj: Simplify algebraic fractions.

Simplify.

$$1) \frac{3y \cancel{(y+7)}}{\cancel{(y+7)}(y^2+9)} = \frac{3y}{y^2+9}$$

$$2) \frac{p^2 + 2p - 3}{p^2 - 2p - 15} = \frac{\cancel{(p+3)}(p-1)}{\cancel{(p+3)}(p-5)} = \frac{p-1}{p-5}$$



Sometimes you must factor out "-1" in numerator or denominator to simplify expression **opposites**

$$3) \frac{a^4b - 2a^4}{2a^3 - a^3b} \Rightarrow \frac{\cancel{a^3} \cancel{a} (\cancel{b-2})}{\cancel{a^3} \cancel{a} (\cancel{2-b})} = \frac{-a}{1} = -a$$

$\downarrow$   
 $-1(-b+2)$   
 $-1(2-b)$

# Multiplying & Dividing Rational Expressions



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## How to Multiply rational (Fractional) expressions

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- Common Factors?
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- **Foil backwards?**
- Grouping?

Cancel/Reduce

- Reduce Coefficients
- Variables with exponents subtract and place in top or bottom.

**Cancel/Reduce Factors**

Write your answer as one fraction by writing the factors that are left in the numerator and denominator

# Multiplying & Dividing Rational Expressions



Obj: Multiply and divide algebraic fractions.



Obj: Simplify algebraic fractions.

$$4) \frac{\overset{1}{\cancel{5}}a^{\overset{1}{\cancel{4}}}c^{\overset{1}{\cancel{1}}}}{\underset{1}{\cancel{12}}b^{\underset{1}{\cancel{1}}}} \cdot \frac{\overset{2}{\cancel{24}}bc^{\overset{2}{\cancel{2}}}}{\underset{3}{\cancel{15}}a^{\underset{3}{\cancel{3}}}b^{\underset{1}{\cancel{2}}}} = \frac{2ac^3}{3b^2}$$

$$5) \frac{\overset{1}{\cancel{8}}x^{\overset{1}{\cancel{1}}}}{\underset{3}{\cancel{21}}y^{\underset{3}{\cancel{3}}}} \cdot \frac{\overset{1}{\cancel{7}}y^{\overset{1}{\cancel{2}}}}{\underset{2}{\cancel{16}}x^{\underset{2}{\cancel{8}}}} = \frac{1}{6x^2y}$$

# Multiplying & Dividing Rational Expressions



Obj: Multiply and divide algebraic fractions.



Obj: Simplify algebraic fractions.

## How to divide rational (fractional) expressions

Keep change flip

Change the division problem to a multiplication problem by flipping the second fraction.

$$6) \frac{10ps^2}{3c^2d} \div \frac{5ps}{6c^2d^2} = \frac{4ds}{1} = \boxed{4ds}$$

Handwritten annotations for the first fraction:  $\frac{10ps^2}{3c^2d}$  with exponents 2, 1, 2, 1 above the terms and a vertical line below. A circled division symbol  $\div$  is drawn above the second fraction, with an arrow pointing to the division line between the two fractions.

**EVERY TIME YOU DO THIS:**



$$f(x) = \frac{\cancel{x^2} + 2x + 1}{\cancel{x^2} + 3}$$
$$= \frac{2x + 1}{3}$$

**A KITTEN DIES.**

**Don't Be A Kitten Killer!!!!**

# Multiplying & Dividing Rational Expressions



Obj: Multiply and divide algebraic fractions.



Obj: Simplify algebraic fractions.

$$7) \frac{\cancel{k-3}}{\cancel{k+1}} \cdot \frac{\cancel{(1-k)}\cancel{(1+k)}}{1-k^2} = \textcircled{-1}$$

$\frac{k^2 - 4k + 3}{(k-1)(k-3)}$

$$8) \frac{2d+6}{d^2+d-2} \div \frac{d+3}{d^2+3d+2} = \textcircled{\frac{2(d+1)}{d-1}}$$

flip

$\frac{2(d+3)}{(d+2)(d-1)} \cdot \frac{(d+2)(d+1)}{(d+3)}$



## Multiplying & Dividing Rational Expressions



Obj: Multiply and divide algebraic fractions.



Obj: Simplify algebraic fractions.

Complex Fraction: a rational expression whose numerator or denominator contains a rational expression.

$$9) \frac{\frac{x^2}{9x^2 - 4y^2}}{\frac{x^3}{2y - 3x}} \cdot \frac{x^2}{(3x+2y)(3x-2y)} \cdot \frac{(2y-3x)}{x^3} = \frac{-1}{x(3x+2y)}$$

The handwritten solution shows the following steps:

- Original complex fraction:  $\frac{\frac{x^2}{9x^2 - 4y^2}}{\frac{x^3}{2y - 3x}}$
- Flipping the denominator:  $\frac{x^2}{9x^2 - 4y^2} \cdot \frac{2y - 3x}{x^3}$  (labeled "flip")
- Factoring the denominator:  $\frac{x^2}{(3x+2y)(3x-2y)} \cdot \frac{2y-3x}{x^3}$
- Canceling terms:  $\frac{\cancel{x^2}}{(3x+2y)\cancel{(3x-2y)}} \cdot \frac{\cancel{(2y-3x)}}{x^3}$
- Final simplified result:  $\frac{-1}{x(3x+2y)}$  (circled)