Adding and Subtracting Rational Expressions

Interactive Math Notebook Activities and Scaffolded Notes

- Review: Simplifying Fractions
- What is a common denominator?
- Steps for Adding Fractions with a Common Denominator
- Adding Fractions with a Common Denominator
- Steps for Subtracting Fractions with a Common Denominator
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- Adding/Subtracting Fractions with Different Denominators
- Adding/Subtracting an Integer and a Fraction
- Adding/Subtracting a Polynomial and a Fraction
- Finding the Least Common Denominator (Denominators are Integers)
- Finding the Least Common Denominator (Denominators are Terms)
- Finding the Least Common Denominator (Denominators are Polynomials)
- Use Common Denominators to Solve Equations
- What is a proportion?

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Scaffolded Notes

Review: Simplifying Fractions

First, factor the numerator and denominator.
Then, cancel out factors that occur in both the numerator and denominator.

$\frac{8}{12}$	$\frac{9xy}{3x^2}$	$\frac{12x+4}{8y}$
$\frac{x+1}{4x+4}$	$\frac{x-5}{x^2-25}$	$\frac{2x+8}{x^2+8x+16}$

What is a common denominator?	Example

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Review: Simplifying Fractions

First, factor the numerator and denominator.
Then, cancel out factors that occur in both the numerator and denominator.

$\frac{8}{12}$ $\frac{\cancel{2}\cdot\cancel{2}\cdot 2}{\cancel{2}\cdot\cancel{2}\cdot 3}$ $\frac{2}{3}$	$\frac{9xy}{3x^2}$ $\frac{\cancel{3}\cdot 3\cdot\cancel{x}\cdot y}{\cancel{3}\cdot\cancel{x}\cdot x}$ $\frac{3y}{x}$	$\frac{12x+4}{8y}$ $\frac{\cancel{2}\cdot\cancel{2}(3x+1)}{\cancel{2}\cdot\cancel{2}\cdot 2\cdot y}$ $\frac{3x+1}{2y}$
$\frac{x+1}{4x+4}$ $\frac{\cancel{(x+1)}}{4\cancel{(x+1)}}$ $\frac{1}{4}$	$\frac{x-5}{x^2-25}$ $\frac{\cancel{(x-5)}}{(x+5)\cancel{(x-5)}}$ $\frac{1}{x+5}$	$\frac{2x+8}{x^2+8x+16}$ $\frac{2\cancel{(x+4)}}{\cancel{(x+4)}(x+4)}$ $\frac{2}{x+4}$

What is a common denominator?

When two fractions have the same denominator it is said that they have common denominators.

Example

The fractions $\frac{4x-1}{2a}$ and $\frac{25}{2a}$

have a common denominator of 2a.

Steps for Adding Fractions with a Common Denominator

Step 1: Add the numerators, but keep the denominator the same.	
Step 2: Combine like terms and simplify.	

Adding Fractions with a Common Denominator

Add two fractions with a common integer as a denominator.	
Add two fractions with a common variable term as a denominator.	
Add two fractions with a common binomial as a denominator.	
Add two fractions with a common polynomial as a denominator.	

Steps for Subtracting Fractions with a Common Denominator

Step 1: Replace the subtraction sign with an addition sign and distribute the subtraction sign to the numerator that follows.	
Step 2: Add the numerators, but keep the denominator the same.	
Step 3: Combine like terms and simplify.	

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Steps for Adding Fractions with a Common Denominator

Step 1: Add the numerators, but keep the denominator the same.	$\frac{x}{5}+\frac{3x}{5}$ $\frac{x+3x}{5}$
Step 2: Combine like terms and simplify.	$\frac{4x}{5}$

Adding Fractions with a Common Denominator

Add two fractions with a common integer as a denominator.	$\frac{2}{3}+\frac{5}{3}$ $\frac{2+5}{3}=\frac{7}{3}$
Add two fractions with a common variable term as a denominator.	$\frac{3}{x}+\frac{8}{x}$ $\frac{3+8}{x}=\frac{11}{x}$
Add two fractions with a common binomial as a denominator.	$\frac{1}{x+1}+\frac{5}{x+1}$ $\frac{1+5}{x+1}=\frac{6}{x+1}$
Add two fractions with a common polynomial as a denominator.	$\frac{9}{2x^2+x+1}+\frac{2}{2x^2+x+1}$ $\frac{9+2}{2x^2+x+1}=\frac{11}{2x^2+x+1}$

Steps for Subtracting Fractions with a Common Denominator

Step 1: Replace the subtraction sign with an addition sign and distribute the subtraction sign to the numerator that follows.	$\frac{2x}{9}-\frac{4x}{9}$ $\frac{2x}{9}+\frac{-4x}{9}$
Step 2: Add the numerators, but keep the denominator the same.	$\frac{2x+(-4x)}{9}$
Step 3: Combine like terms and simplify.	$\frac{-2x}{9}$

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Distribute Before Adding Fractions

First, make sure that the numerators and denominators are in simplest form.
Then, add the numerators.
Finally, combine like terms.

$\frac{5(x+1)}{2}+\frac{3(x+2)}{2}$	$\frac{2(x+4)}{3}+\frac{8(x-1)}{3}$	$\frac{9(x+3)}{7x}+\frac{(x+2)}{7x}$
$\frac{-1(x+2)}{6x}+\frac{4(x+1)}{6x}$	$\frac{2x(x+3)}{2x^2}+\frac{3x(x+2)}{2x^2}$	$\frac{2x(3x+7)}{9x^3}+\frac{x(x-2)}{9x^3}$

Distribute Before Subtracting Fractions

First, make sure that the numerators and denominators are in simplest form.
Then, change the subtraction problem to an addition problem and add the numerators.
Finally, combine like terms.

$\frac{5(x+3)}{4}-\frac{2(x+1)}{4}$	$\frac{4(x+1)}{2x}-\frac{2(x+5)}{2x}$	$\frac{-x(3x+1)}{x^3}-\frac{9(x-1)}{x^3}$

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Distribute Before Adding Fractions

First, make sure that the numerators and denominators are in simplest form.
Then, add the numerators.
Finally, combine like terms.

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

$$\frac{5x+5}{2}+\frac{3x+6}{2}$$

$$\frac{5x+5+3x+6}{2}$$

$$\frac{8x+11}{2}$$

$$\frac{2(x+4)}{3}+\frac{8(x-1)}{3}$$

$$\frac{2x+8}{3}+\frac{8x-8}{3}$$

$$\frac{2x+8+8x-8}{3}$$

$$\frac{10x}{3}$$

$$\frac{9(x+3)}{7x}+\frac{2(x+2)}{7x}$$

$$\frac{9x+27}{7x}+\frac{2x+4}{7x}$$

$$\frac{9x+27+2x+4}{7x}$$

$$\frac{11x+31}{7x}$$

$$\frac{-1(x+2)}{6x}+\frac{4(x+1)}{6x}$$

$$\frac{-x-2}{6x}+\frac{4x+4}{6x}$$

$$\frac{-x-2+4x+4}{6x}$$

$$\frac{3x+2}{6x}$$

$$\frac{2x(x+3)}{2x^2}+\frac{3x(x+2)}{2x^2}$$

$$\frac{2x^2+6x}{2x^2}+\frac{3x^2+6x}{2x^2}$$

$$\frac{2x^2+6x+3x^2+6x}{2x^2}$$

$$\frac{5x^2+12x}{2x^2}=\frac{5x+12}{2x}$$

$$\frac{2x(3x+7)}{9x^3}+\frac{x(x-2)}{9x^3}$$

$$\frac{6x^2+14x}{9x^3}+\frac{x^2-2x}{9x^3}$$

$$\frac{6x^2+14x+x^2-2x}{9x^3}$$

$$\frac{7x^2+12x}{9x^3}=\frac{7x+12}{9x^2}$$

Distribute Before Subtracting Fractions

First, make sure that the numerators and denominators are in simplest form.
Then, change the subtraction problem to an addition problem and add the numerators.
Finally, combine like terms.

$$\frac{5(x+3)}{4}-\frac{2(x+1)}{4}$$

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

$$\frac{5x+15+(-2x)+(-2)}{4}$$

$$\frac{3x+13}{4}$$

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

$$\frac{4x+4}{2x}-\frac{2x+10}{2x}$$

$$\frac{4x+4+(-2x)+(-10)}{2x}$$

$$\frac{2x-6}{2x}=\frac{x-3}{x}$$

$$\frac{-x(3x+1)}{x^3}-\frac{9(x-1)}{x^3}$$

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

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

$$\frac{-3x^2+(-10x)+9}{x^3}$$

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Adding/Subtracting Fractions with Different Denominators

Step 1: Find a common denominator between your two fractions.	
Step 2: Substitute your equivalent fractions into your problem.	
Step 3: If it is not already an addition problem, change it to addition.	
Step 4: Add the numerators, but keep the denominator the same.	
Step 5: Combine like terms and simplify.	

Adding/Subtracting an Integer and a Fraction

Step 1: Rewrite your integer as a fraction.	
Step 2: Find a common denominator between your two fractions.	
Step 3: Substitute your equivalent fractions into your problem.	
Step 4: If it is not already an addition problem, change it to addition.	
Step 5: Add the numerators, but keep the denominator the same.	
Step 6: Combine like terms and simplify.	

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Adding/Subtracting Fractions with Different Denominators

Step 1: Find a common denominator between your two fractions.	$\frac{2x}{3} + \frac{x}{6}$ If I multiply 3 by 2 it will also be 6. $2 \cdot \frac{2x}{3} = \frac{4x}{6}$ $2 \cdot$
Step 2: Substitute your equivalent fractions into your problem.	$\frac{4x}{6} + \frac{x}{6}$
Step 3: If it is not already an addition problem, change it to addition.	$\frac{4x}{6} + \frac{x}{6}$
Step 4: Add the numerators, but keep the denominator the same.	$\frac{4x + x}{6}$
Step 5: Combine like terms and simplify.	$\frac{5x}{6}$

Adding/Subtracting an Integer and a Fraction

Step 1: Rewrite your integer as a fraction.	$8 - \frac{3}{4}$ $\frac{8}{1} - \frac{3}{4}$
Step 2: Find a common denominator between your two fractions.	$\frac{8}{1} - \frac{3}{4}$ If I multiply 1 by 4 it will also be 4. $4 \cdot \frac{8}{1} = \frac{32}{4}$ $4 \cdot$
Step 3: Substitute your equivalent fractions into your problem.	$\frac{32}{4} - \frac{3}{4}$
Step 4: If it is not already an addition problem, change it to addition.	$\frac{32}{4} + \frac{(-3)}{4}$
Step 5: Add the numerators, but keep the denominator the same.	$\frac{32 + (-3)}{4}$
Step 6: Combine like terms and simplify.	$\frac{29}{4}$

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Adding/Subtracting a Polynomial and a Fraction

Step 1: Rewrite your integer as a fraction.	
Step 2: Find a common denominator between your two fractions.	
Step 3: Substitute your equivalent fractions into your problem.	
Step 4: If it is not already an addition problem, change it to addition.	
Step 5: Add the numerators, but keep the denominator the same.	
Step 6: Combine like terms and simplify.	

Finding the Least Common Denominator (Denominators are Integers)

Step 1: Factor the denominators.	Step 2: Multiply each denominator by the factors of the other denominator that are missing.	Step 3: Multiply each numerator by the factors of the other denominator that are missing.	Step 4: Simplify.

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Adding/Subtracting a Polynomial and a Fraction

Step 1: Rewrite your polynomial as a fraction.	$(x+1)-\frac{3}{x}$ $\frac{(x+1)}{1}-\frac{3}{x}$
Step 2: Find a common denominator between your two fractions.	$\frac{(x+1)}{1}-\frac{3}{x}$ $x\cdot\frac{x+1}{1}=\frac{x^2+x}{x}$ If I multiply 1 by x it will also be x.
Step 3: Substitute your equivalent fractions into your problem.	$\frac{x^2+x}{x}-\frac{3}{x}$
Step 4: If it is not already an addition problem, change it to addition.	$\frac{x^2+x}{x}+\frac{(-3)}{x}$
Step 5: Add the numerators, but keep the denominator the same.	$\frac{x^2+x+(-3)}{x}$
Step 6: Combine like terms and simplify.	$\frac{x^2+x+(-3)}{x}$

Finding the Least Common Denominator (Denominators are Integers)

Step 1: Factor the denominators.	Step 2: Multiply each denominator by the factors of the other denominator that are missing.	Step 3: Multiply each numerator by the factors of the other denominator that are missing.	Step 4: Simplify.
$\frac{5}{12}+\frac{7}{8}$ 12 → $2\cdot6$ → $2\cdot3$ $12=2\cdot2\cdot3$ 8 → $2\cdot4$ → $2\cdot2$ $8=2\cdot2\cdot2$	$\frac{5}{12\cdot2}=\frac{}{24}$ $\frac{7}{8\cdot3}=\frac{}{24}$	$\frac{5\cdot2}{12\cdot2}=\frac{10}{24}$ $\frac{7\cdot3}{8\cdot3}=\frac{21}{24}$	$\frac{10}{24}+\frac{21}{24}$ $\frac{31}{24}$

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Finding the Least Common Denominator (Denominators are Terms)

Step 1: Factor the denominators.	Step 2: Multiply each denominator by the factors of the other denominator that are missing.	Step 3: Multiply each numerator by the factors of the other denominator that are missing.	Step 4: Simplify.

Finding the Least Common Denominator (Denominators are Polynomials)

Step 1: Factor the denominators.	Step 2: Multiply each denominator by the factors of the other denominator that are missing.	Step 3: Multiply each numerator by the factors of the other denominator that are missing.	Step 4: Simplify.

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Finding the Least Common Denominator (Denominators are Terms)

Step 1: Factor the denominators.	Step 2: Multiply each denominator by the factors of the other denominator that are missing.	Step 3: Multiply each numerator by the factors of the other denominator that are missing.	Step 4: Simplify.
$\frac{2}{x^2y} + \frac{4}{xy^2}$ $x^2y = xxy$ $\quad xy^2 = xyy$	$\frac{2}{x^2y \cdot y} = \frac{}{x^2y^2}$ $\frac{4}{xy^2 \cdot x} = \frac{}{x^2y^2}$	$\frac{2}{x^2y \cdot y} = \frac{2y}{x^2y^2}$ $\frac{4}{xy^2 \cdot x} = \frac{4x}{x^2y^2}$	$\frac{2y}{x^2y^2} + \frac{4x}{x^2y^2}$ $\frac{2y + 4x}{x^2y^2}$

Finding the Least Common Denominator (Denominators are Polynomials)

Step 1: Factor the denominators.	Step 2: Multiply each denominator by the factors of the other denominator that are missing.	Step 3: Multiply each numerator by the factors of the other denominator that are missing.	Step 4: Simplify.
$\frac{3}{x^2 - 25} + \frac{5}{2x + 10}$ $x^2 - 25 = (x + 5)(x - 5)$ $2x + 10 = 2(x + 5)$	$\frac{3}{x^2 - 25} = \frac{}{2(x + 5)(x - 5)}$ $\frac{5}{2x + 10} = \frac{}{2(x + 5)(x - 5)}$	$\frac{3}{x^2 - 25} = \frac{2 \cdot 3}{2(x + 5)(x - 5)}$ $\frac{5}{2x + 10} = \frac{5(x - 5)}{2(x + 5)(x - 5)}$	$\frac{6}{2(x + 5)(x - 5)} + \frac{5x - 25}{2(x + 5)(x - 5)}$ $\frac{6 + 5x - 25}{2(x + 5)(x - 5)}$ $\frac{5x - 19}{2(x + 5)(x - 5)}$

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Use Common Denominators to Solve Equations

$\frac{2}{3}+\frac{5}{x}=\frac{14}{3}$	$\frac{x}{5}+\frac{2x}{5}=4$	$\frac{x+1}{9}=\frac{x}{3}-\frac{1}{3}$
$x+\frac{24}{x}=11$	$\frac{3}{x-1}=\frac{1}{2}-\frac{6}{x-1}$	$\frac{2x}{5}-\frac{x}{10}=4$

What is a proportion?	Step 1: Cross multiply.	
	Step 2: Simplify	
	Step 3: Solve	

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Use Common Denominators to Solve Equations

$$\frac{2}{3}+\frac{5}{x}=\frac{14}{3}$$

$3x(\frac{2}{3}+\frac{5}{x}=\frac{14}{3})$

$\frac{3x\cdot 2}{3}+\frac{3x\cdot 5}{x}=\frac{3x\cdot 14}{3}$

$2x+5=14x$

$x=\frac{5}{12}$

$$\frac{x}{5}+\frac{2x}{5}=4$$

$5(\frac{x}{5}+\frac{2x}{5}=4)$

$\frac{5\cdot x}{5}+\frac{5\cdot 2x}{5}=5\cdot 4$

$x+2x=20$

$x=\frac{20}{3}$

$$\frac{x+1}{9}=\frac{x}{3}-\frac{1}{3}$$

$9(\frac{x+1}{9}=\frac{x}{3}-\frac{1}{3})$

$\frac{9(x+1)}{9}=\frac{9x}{3}-\frac{9\cdot 1}{3}$

$x+1=3x-3$

$x=2$

$$2x+\frac{24}{x}=11$$

$3x(\frac{2x}{3x}+\frac{24}{x}=11)$

$\frac{3x\cdot 2x}{3x}+\frac{3x\cdot 24}{x}=3x\cdot 11$

$2x+72=33x$

$x=\frac{72}{31}$

$$\frac{3}{x-1}=\frac{1}{2}-\frac{6}{x-1}$$

$2(x-1)\cdot(\frac{3}{x-1}=\frac{1}{2}-\frac{6}{x-1})$

$\frac{2(x-1)\cdot 3}{x-1}=\frac{2(x-1)\cdot 1}{2}-\frac{2(x-1)\cdot 6}{x-1}$

$6=x-1-12$

$x=19$

$$\frac{2x}{5}-\frac{x}{10}=4$$

$10(\frac{2x}{5}-\frac{x}{10}=4)$

$\frac{10\cdot 2x}{5}-\frac{10x}{10}=10\cdot 4$

$4x-x=40$

$x=\frac{40}{3}$

What is a proportion?

A simple rational equation stating that one fraction is equal to the other.

Step 1: Cross multiply.

$\frac{-10}{8}\times\frac{x}{12}$

$-10\cdot 12=8x$

Step 2: Simplify

$-120=8x$

Step 3: Solve

$\frac{-120}{8}=\frac{8x}{8}$

$x=-15$

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Interactive Math Notebook Review Activities

Common Denominator

Define and give an example.

1. Cut along the bold lines and fold along the dotted lines.
2. Write your examples inside of the folds.
3. Insert your finished matchbook into your math notebook.

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Steps for Adding Fractions with a Common Denominator

Step 1: Add the numerators, but keep the denominator the same.

Step 2: Combine like terms and simplify.

Glue this flap into your math journal.

Steps for Subtracting Fractions with a Common Denominator

Step 1: Replace the subtraction sign with an addition sign and distribute the subtraction sign to the numerator that follows.

Step 2: Add the numerators, but keep the denominator the same.

Step 3: Combine like terms and simplify.

Glue this flap into your math journal.

Directions:

1. Cut along the bold lines and fold along the dotted lines.
2. When you fold along the dotted line you will have a mini-book.
3. Flip up each flap and write your examples in the inside pages.
4. Insert your finished book into your math notebook.

Distribute before Adding Fractions

Give an example.

Distribute before Subtracting Fractions

Give an example.

Directions:

1. Cut along the bold lines and fold along the dotted lines.
2. When you fold along the dotted line you will have a mini-book.
3. Flip up each flap and write your definitions and examples in the inside pages.
4. Insert your finished book into your math notebook.

Add two fractions with different denominators.	Add an integer and a fraction.	Add a polynomial and a fraction.

Directions:

1. Cut along the bold lines and fold along the dotted lines.
2. When you fold along the dotted line you will have a mini-book.
3. Flip up each flap and write your definitions and examples in the inside pages.
4. Insert your finished book into your math notebook.

Subtract a polynomial and a fraction.	Subtract an integer and a fraction.	Subtract two fractions with different denominators.

Finding the Least Common Denominator

Step 1: Factor the denominators.	Step 2: Multiply each denominator by the factors of the other denominator that are missing.	Step 3: Multiply each numerator by the factors of the other denominator that are missing.	Step 4: Simplify.

Directions:

1. Cut along the bold lines and fold along the dotted lines.
2. Use a little bit of glue underneath the top flap to insert the flap book into your math notebook.
3. Flip up each flap and write your examples directly onto your math notebook page.

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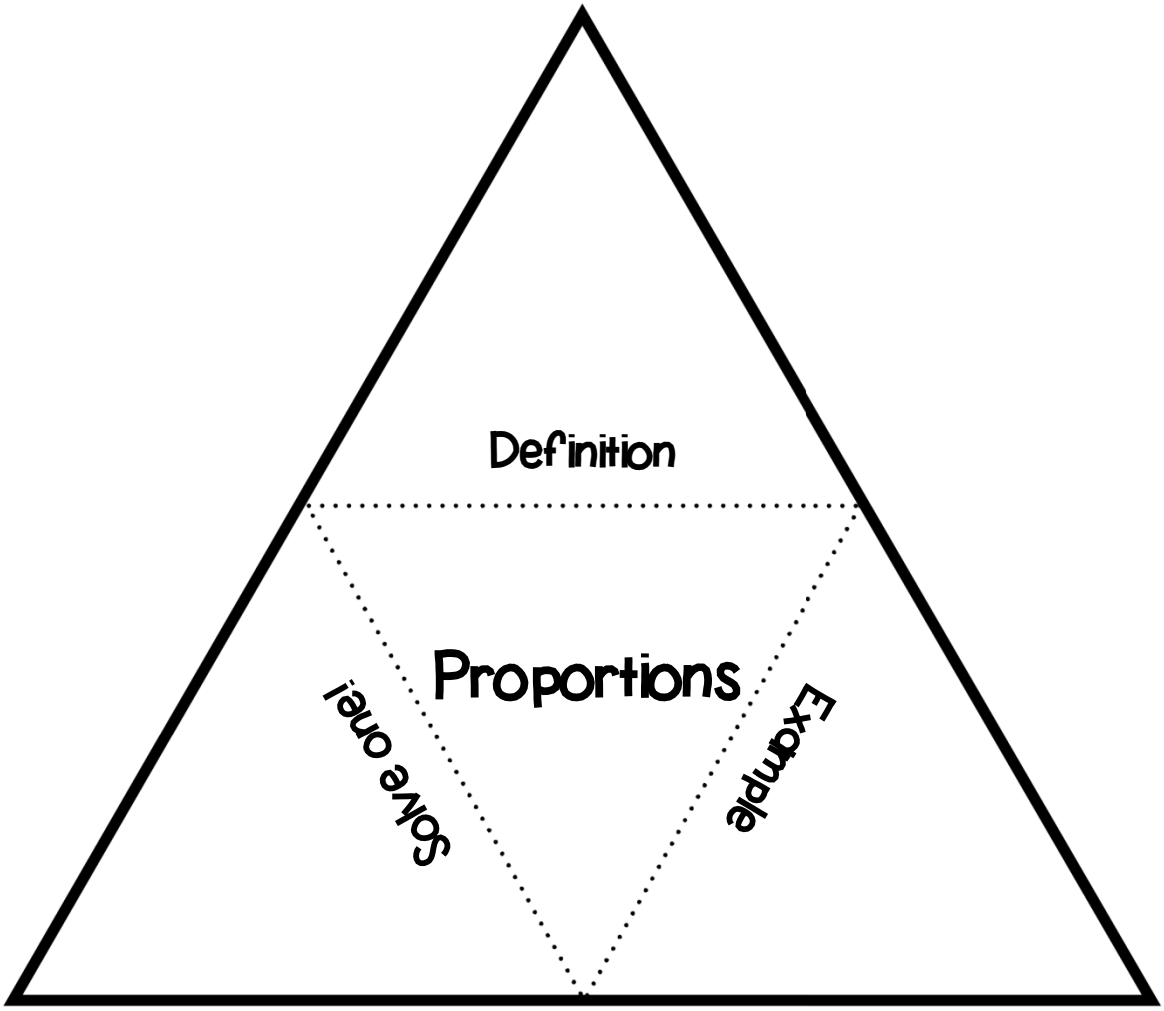

Directions:

1. Cut along the bold lines and fold along the dotted lines.
2. When you fold along the dotted line you will have a triangle flap book.
3. Flip up each flap and write your examples in the inside pages.
4. Insert your finished book into your math notebook.

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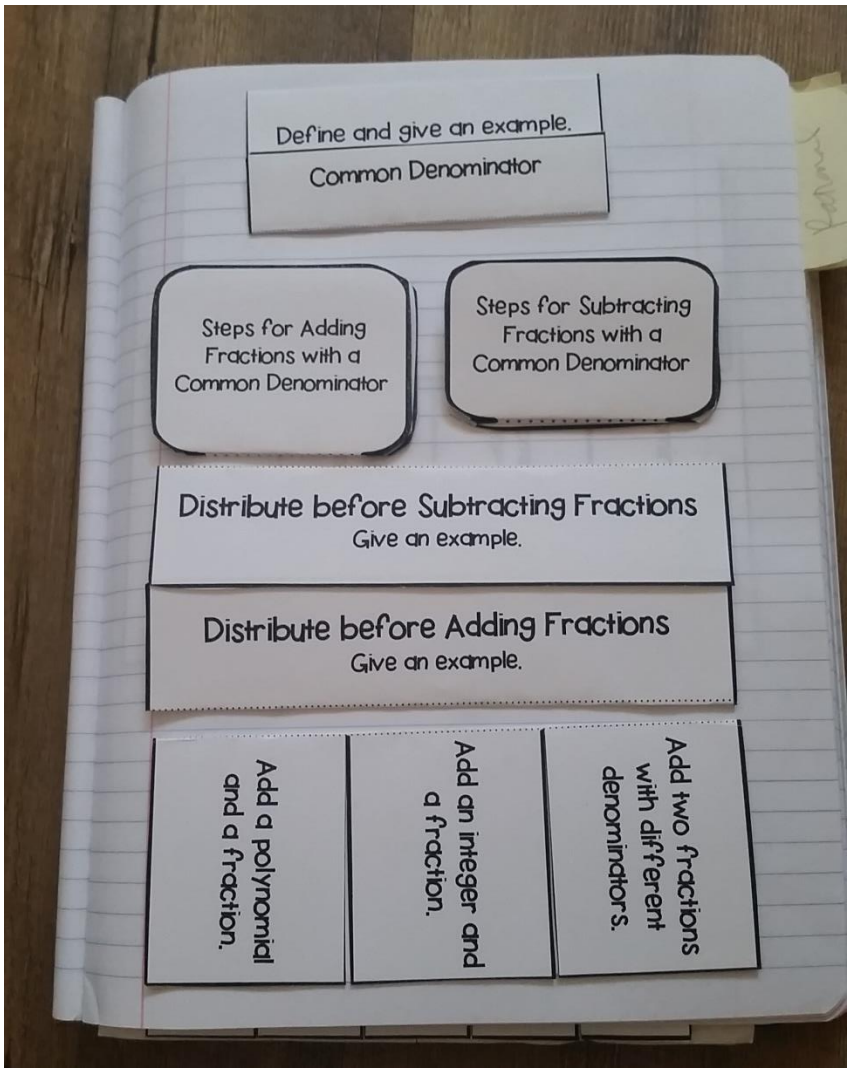
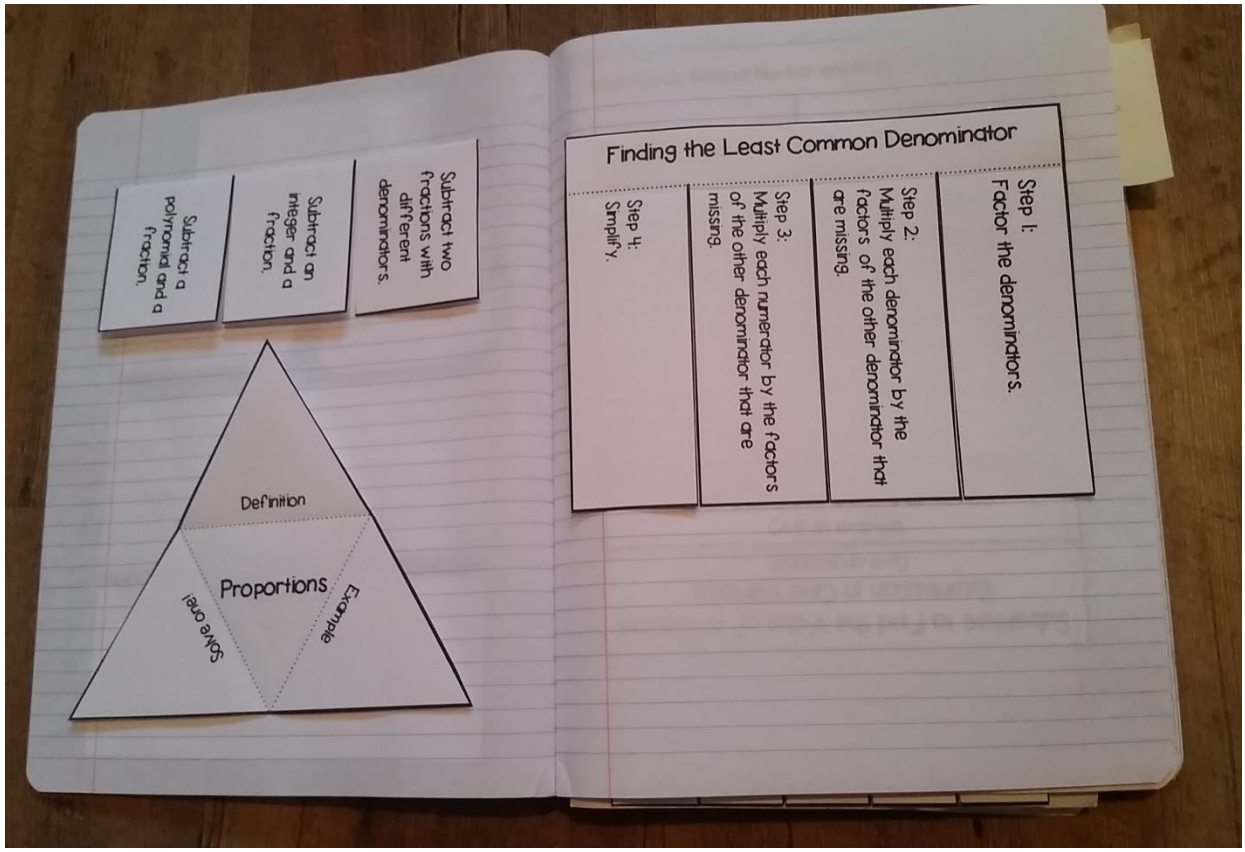

Define and give an example.
Common Denominator
Steps for Adding Fractions with a Common Denominator
Steps for Subtracting Fractions with a Common Denominator
Distribute before Subtracting Fractions
Give an example.
Distribute before Adding Fractions
Give an example.
Add a polynomial and a fraction.
Add an integer and a fraction.
Add two fractions with different denominators.

INB SAMPLES


Subtract a polynomial and a fraction.
Subtract an integer and a fraction.
Subtract two fractions with different denominators.
Definition
Proportions
Example
Solve one!
Finding the Least Common Denominator
Step 1: Factor the denominators.
Step 2: Multiply each denominator by the factors of the other denominator that are missing.
Step 3: Multiply each numerator by the factors of the other denominator that are missing.
Step 4: Simplify.

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