5th Grade Unit 4

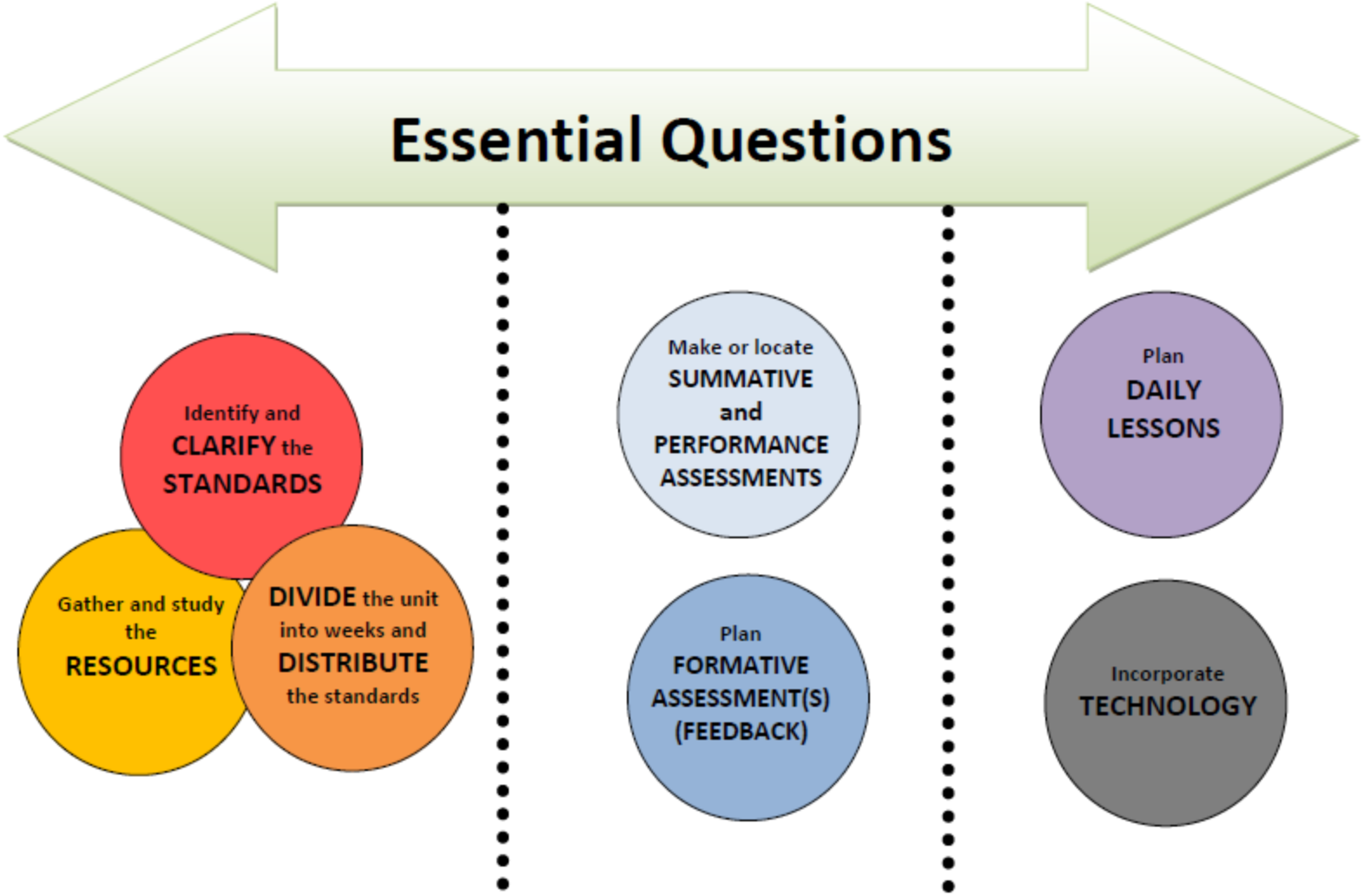
Operations with Fractions

Unit Planning Team:

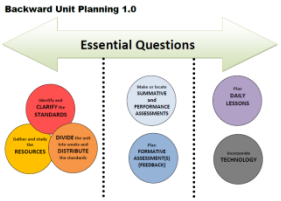
Traci Rhoades (RG), Paige Brown (NS),

Brooke Bradley (LW), Stacy Dustman (ET), Pam Keith (ET)

Backward Unit Planning 1.0



Essential Questions



R.P.S. Common Core Math Curriculum | 5th Grade

Unit 4 – Operations with Fractions (p.1 of 2) **15 Weeks**

Students will add and subtract fractions and mixed numbers with like and unlike denominators with their understanding of equivalency, visual models, benchmark fractions, estimation, and equations. Students will extend their understanding of multiplication to multiply fractions and mixed numbers (fraction by a whole number or fraction by a fraction). They will extend their understanding of division to divide unit fractions by whole numbers and whole numbers by unit fractions. Students will explain multiplication as resizing by comparing factors of related products and examining whether fractions will increase or decrease when you multiply by a fraction greater than or less than 1. Students will solve real-world problems involving area, multiplication of fractions and mixed numbers, and division with unit fractions. They continue building their strategies for multi-digit multiplication and division, and in 4th quarter, students will solidify fluency and apply the standard algorithm to multi-digit multiplication.

Essential Questions:

How can I apply and extend my understanding of operations with whole numbers to operations with fractions and mixed numbers including real-world situations?

How can understanding multiplication as scaling help me reason abstractly about their products?

Number and Operations - Fractions (continued on next page)	
Use equivalent fractions as a strategy to add and subtract fractions.	
5.NF.1	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*
5.NF.2	Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.*
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.	
5.NF.4	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
	a. Interpret the product (a/b) × q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.)*
	b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.
5.NF.5	Interpret multiplication as scaling (resizing), by:
	a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
	b. Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence *a/b = (n×a)/(n×b)* to the effect of multiplying *a/b* by 1.
5.NF.6	Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

How can I apply and extend my understanding of operations with whole numbers to operations with fractions and mixed numbers including real-world situations?

How can understanding multiplication as scaling help me reason abstractly about their products?

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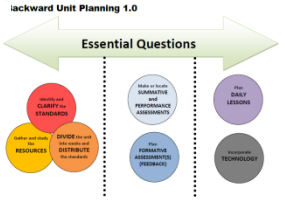
5.NF.6	Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

NF.1 and NF.2: students had experiences in Unit 2 through their work with equal sharing and multiple groups problems.

NF.4 a: This standard is new. Now the number of groups is a fractional amount, not just a whole number of groups.
Fraction times a whole number and fraction times a fraction.

NF.5 : This idea continues from 4th grade multiplicative comparison.

**Highlighted standards are new this unit.



Identify and **CLARIFY** the **STANDARDS**

Number and Operations - Fractions

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

5.NF.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.
	a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3.*
	b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.*
	c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?

Measurement and Data

Represent and interpret data.

5.MD.2	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.*

Number and Operations in Base Ten

Perform operations with multi-digit whole numbers and with decimals to hundredths.

5.NBT.5	Fluently multiply multi-digit whole numbers using the standard algorithm.
	Minimum expectation: Standard algorithm is not expected to be applied until 4th quarter.
5.NBT.6	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Operations and Algebraic Thinking

Write and interpret numerical expressions.

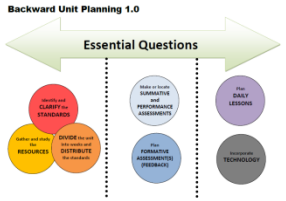
These standards will not be taught in isolated lessons, but will be addressed during Number Talks and Problem Solving discussion and notation.

5.OA.1	Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
5.OA.2	Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.*

**Highlighted standards are new this unit.

5.NF. 7a: This standard is new and addresses a unit fraction (1/2, 1/3, 1/7…) divided by a whole number.

NF.7 b continues from Unit 2 Whole number divided by a unit fraction



Identify and **CLARIFY** the **STANDARDS**

Big Ideas for Unit 4:

Fractions: In and out of context

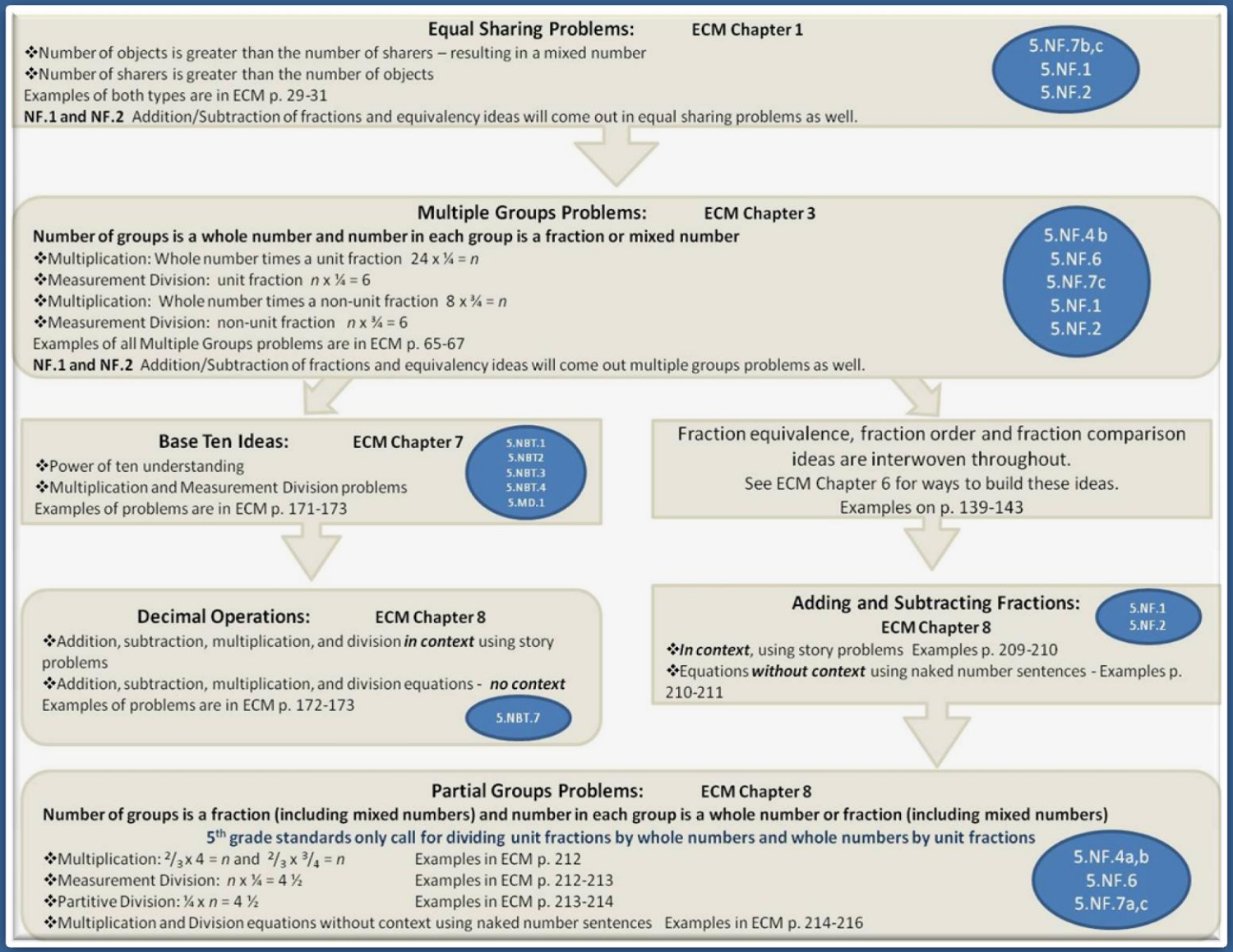
- Multiply fractions (including mixed numbers): NF.4, NF.5, NF.6
  - Unit 2: whole number X fraction
  - Unit 4: fraction X whole number
    fraction X fraction
    area problems
    scaling idea
- Dividing fractions: (NF.7)
  - Unit 2: Whole number divided by **unit** fraction
  - Unit 4: **Unit** fraction divided by whole number
- Add/Subtract fractions: (NF.1, NF.2) with like and unlike denominators
  - Unit 2: experiences through equal sharing and multiple groups problems
  - Unit 4: Continued experiences through equal sharing and multiple groups problems PLUS equivalency problems and addition and subtraction problem types
- (MD.2: solve fraction problems involving information presented in line plots)

Whole Number Operations: (NBT.5, NBT.6)

When solving multiplication and division problems involving fractions, whole number sets can be included as well as decimal number sets.

Whole Number Operations

Multi-Digit Multiplication
5.NBT.5



Multi-Digit Division
with up to four-digit dividends and two-digit divisors
5.NBT.6

[Problem Type Charts]

Equal Sharing Problems: ECM Chapter 1

❖Number of objects is greater than the number of sharers – resulting in a mixed number
❖Number of sharers is greater than the number of objects
Examples of both types are in ECM p. 29-31
NF.1 and NF.2 Addition/Subtraction of fractions and equivalency ideas will come out in equal sharing problems as well.

5.NF.7b,c
5.NF.1
5.NF.2

Multiple Groups Problems: ECM Chapter 3

Number of groups is a whole number and number in each group is a fraction or mixed number
❖Multiplication: Whole number times a unit fraction 24 x ¼ = *n*
❖Measurement Division: unit fraction *n* x ¼ = 6
❖Multiplication: Whole number times a non-unit fraction 8 x ¾ = *n*
❖Measurement Division: non-unit fraction *n* x ¾ = 6
Examples of all Multiple Groups problems are in ECM p. 65-67
NF.1 and NF.2 Addition/Subtraction of fractions and equivalency ideas will come out multiple groups problems as well.

5.NF.4 b
5.NF.6
5.NF.7c
5.NF.1
5.NF.2

Base Ten Ideas: ECM Chapter 7

❖Power of ten understanding
❖Multiplication and Measurement Division problems
Examples of problems are in ECM p. 171-173

5.NBT.1
5.NBT2
5.NBT.3
5.NBT.4
5.MD.1

Fraction equivalence, fraction order and fraction comparison ideas are interwoven throughout.
See ECM Chapter 6 for ways to build these ideas.
Examples on p. 139-143

Decimal Operations: ECM Chapter 8

❖Addition, subtraction, multiplication, and division ***in context*** using story problems
❖Addition, subtraction, multiplication, and division equations - ***no context***
Examples of problems are in ECM p. 172-173

5.NBT.7

Adding and Subtracting Fractions: ECM Chapter 8

❖***In context***, using story problems Examples p. 209-210
❖Equations ***without context*** using naked number sentences - Examples p. 210-211

5.NF.1
5.NF.2

Partial Groups Problems: ECM Chapter 8

Number of groups is a fraction (including mixed numbers) and number in each group is a whole number or fraction (including mixed numbers)
5th grade standards only call for dividing unit fractions by whole numbers and whole numbers by unit fractions
❖Multiplication: $^2/_3$ x 4 = *n* and $^2/_3$ x $^3/_4$ = *n* Examples in ECM p. 212
❖Measurement Division: *n* x ¼ = 4 ½ Examples in ECM p. 212-213
❖Partitive Division: ¼ x *n* = 4 ½ Examples in ECM p. 213-214
❖Multiplication and Division equations without context using naked number sentences Examples in ECM p. 214-216

5.NF.4a,b
5.NF.6
5.NF.7a,c

Week	Standards	Structure/Resources
1	5.NF.1 and 5.NF.2: students will be adding and subtracting fractions when solving equal sharing/multiple groups problems but NF.1 and NF.2 will be directly addressed through problems later in the quarter 5.NF.7b 5.NF.7c 5.NF.4b 5.NF.6	**Equal Sharing/ Multiple Groups Problems** (pg 29-31 ECM Book) Include whole numbers in problems to continue to address NBT. 5 and NBT.6 **Number Talks**: Supplemental Number Talks for Unit 4 Supplemental Number Talks for Unit 4 with Mixed Numbers Fractions and Decimals
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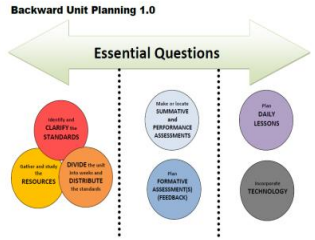

DIVIDE the unit into weeks and **DISTRIBUTE** the standards

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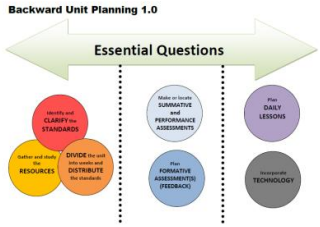
3	**5.NF.1 and 5.NF.2: students will be adding and subtracting fractions when solving equal sharing/multiple groups problems but NF.1 and NF.2 will be directly addressed through problems later in the quarter** **5.NF.7b** **5.NF.7c** **5.NF.4b** **5.NF.6**	**Equal Sharing/ Multiple Groups Problems (pg 29-31 ECM Book)** **Include whole numbers in problems to continue to address NBT. 5 and NBT.6** **Number Talks:** Fractions and Decimals Supplemental Number Talks for Unit 4 Supplemental Number Talks for Unit 4 with Mixed Numbers
4	**5.NF.1** **5.NF.2** **5.NF.7b** **5.NF.7c** **5.NF.4b** **5.NF.6** **5.NF.5**	**Equivalence Problems from (Chapter 6 ECM)** **These types of problems are necessary to build idea of equivalence which is important before adding and subtracting fractions** **Tasks addressing 5.NF.5** Running a Mile Comparing a Number and a Product Comparing Products Comparing a Number and a Product parts a-h Calculator Trouble Fundraising Grass Seedlings Reasoning about Multiplication Half a Recipe Making Cookies **Number Talks:** Fractions and Decimals Supplemental Number Talks for Unit 4 Supplemental Number Talks for Unit 4 with Mixed Numbers



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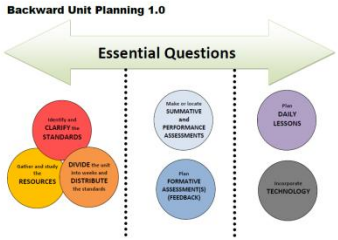
6	5.NF.1 5.NF.2	**Adding and Subtracting Fraction Problems (ECM pg 209-211) Include decimal number sets when posing these problems to keep students thinking about decimal operations** **Number Talks** Supplemental Number Talks for Unit 4 Supplemental Number Talks for Unit 4 with Mixed Numbers



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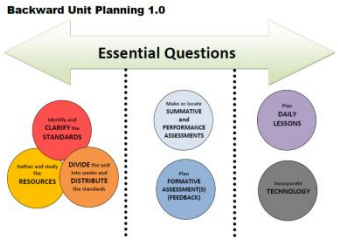

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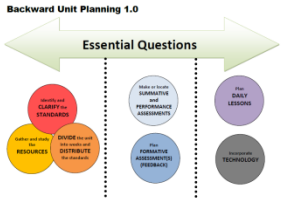
8	5.NF.1 5.NF.2	Adding and Subtracting Fraction Problems (ECM pg 209-211) Include decimal number sets when posing these problems to keep students thinking about decimal operations Number Talks Supplemental Number Talks for Unit 4 Supplemental Number Talks for Unit 4 with Mixed Numbers
9	5.NF.1 5.NF.2 5.NF.4a 5.NF.4b: area 5.NF.6 5.NF.7a 5.NF.7c	2 Days: Adding and Subtracting Fractions(ECM pg 209-211) Include decimal number sets when posing these problems to keep students thinking about decimal operations 3 Days: Partial Groups Problems (ECM Book pg 212-213) **Include area problems and whole numbers for NBT.5 and NBT.6 Number Talks:



DIVIDE the unit into weeks and **DISTRIBUTE** the standards

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- Number Talks for Unit 4
- Teacher Created Resources for Unit 4
- Assessments

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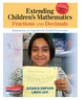
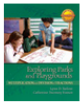
Lesson Resources



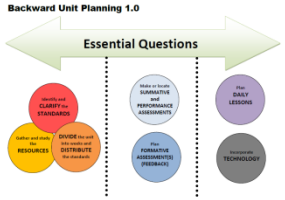
Extending Children's Mathematics: Fractions and Decimals
by Susan B. Empson and Linda Levi
Guide for Using Extending Children's Mathematics
This book is referenced throughout the unit and will guide your instruction with fractions. The authors share how a student's understanding of whole-number operations can be extended to fractions and decimals. Full of examples and student work, it provides rich understanding and insight to problem solving with fractions. Page xxiv provides correlation between this book and the CCSS.
Instructional Progression of Fraction and Decimal Operations

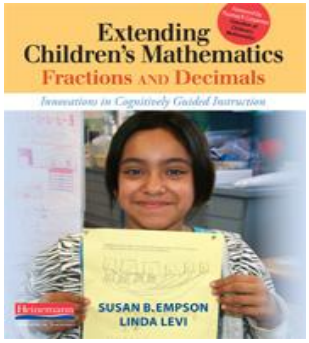


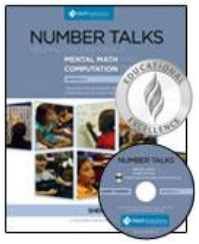
Exploring Parks and Playgrounds
This Contexts for Learning Mathematics unit focuses on the development of students' understanding of multiplication and division with rational numbers. Students work with these big ideas: fractions represent a relation; the whole matters; to maintain equivalence, the ratio of the related numbers must be kept constant; the properties for whole numbers also apply to rational numbers; and the relationship between multiplication and division of fractions. (10 days) (5.NF.3, 5.NF.4, 5.NF.5, 5.NF.6, 5.NF.7)

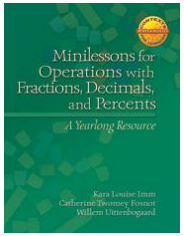
Best Buys, Ratios, and Rates: Addition & Subtraction of Fractions
This Contexts for Learning Mathematics unit focuses on addition and subtraction of fractions and the development of students' understanding of equivalence of fractions, proportional reasoning, and rates. Some of the big ideas students will work with in this unit: fractions express relationships; fractions may represent division - thus representing a rate; to maintain equivalence, the ratio must be kept contstant; to compare, add or subtract fractions a common whole is needed. (10 days) (5.NF.1, 5.NF.2, 5.NF.3, 5.NF.4, 5.NF.6, 5.NF.7)

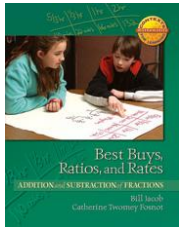
Gather and study the RESOURCES

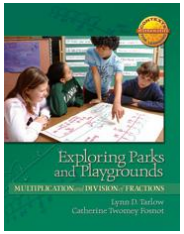












Whole Number Operations

Multi-Digit Multiplication 5.NBT.5

Equal Sharing Problems: ECM Chapter 1
- Number of objects is greater than the number of sharers – resulting in a mixed number
- Number of sharers is greater than the number of objects

Examples of both types are in ECM p. 29-31
NF.1 and NF.2 Addition/Subtraction of fractions and equivalency ideas will come out in equal sharing problems as well.
5.NF.7b,c, 5.NF.1, 5.NF.2

Multiple Groups Problems: ECM Chapter 3
Number of groups is a whole number and number in each group is a fraction or mixed number
- Multiplication: Whole number times a unit fraction $24 \times \frac{1}{4} = n$
- Measurement Division: unit fraction $n \times \frac{1}{4} = 6$
- Multiplication: Whole number times a non-unit fraction $8 \times \frac{3}{4} = n$
- Measurement Division: non-unit fraction $n \times \frac{3}{4} = 6$

Examples of all Multiple Groups problems are in ECM p. 65-67
NF.1 and NF.2 Addition/Subtraction of fractions and equivalency ideas will come out multiple groups problems as well.
5.NF.4b, 5.NF.6, 5.NF.7c, 5.NF.1, 5.NF.2

Base Ten Ideas: ECM Chapter 7
- Power of ten understanding
- Multiplication and Measurement Division problems

Examples of problems are in ECM p. 171-173
5.NBT.1, 5.NBT.2, 5.NBT.3, 5.NBT.4, 5.NBT.5

Fraction equivalence, fraction order and fraction comparison ideas are interwoven throughout.
See ECM Chapter 6 for ways to build these ideas.
Examples on p. 139-143

Decimal Operations: ECM Chapter 8
- Addition, subtraction, multiplication, and division ***in context*** using story problems
- Addition, subtraction, multiplication, and division equations - ***no context***

Examples of problems are in ECM p. 172-173
5.NBT.7

Adding and Subtracting Fractions: ECM Chapter 8
- ***In context***, using story problems Examples p. 209-210
- Equations ***without context*** using naked number sentences - Examples p. 210-211

5.NF.1, 5.NF.2

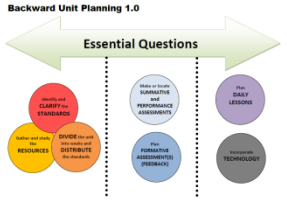
Partial Groups Problems: ECM Chapter 8
Number of groups is a fraction (including mixed numbers) and number in each group is a whole number or fraction (including mixed numbers)
5th grade standards only call for dividing unit fractions by whole numbers and whole numbers by unit fractions
- Multiplication: $\frac{2}{3} \times 4 = n$ and $\frac{2}{3} \times \frac{3}{4} = n$ Examples in ECM p. 212
- Measurement Division: $n \times \frac{1}{3} = 4\frac{1}{3}$ Examples in ECM p. 212-213
- Partitive Division: $\frac{1}{3} \times n = 4\frac{1}{3}$ Examples in ECM p. 213-214
- Multiplication and Division equations without context using naked number sentences Examples in ECM p. 214-216

5.NF.4a,b, 5.NF.6, 5.NF.7a,c

Multi-Digit Division 5.NBT.6
with up to four-digit dividends and two-digit divisors

Problem Type Charts

Options for Assessment – available online for Unit 4



5.NF.7

Name:_____

2 people want to share $1\frac{3}{4}$ submarine sandwiches so that each one gets the same amount. How much should each person get?

5.NF.4

Name:_____

Millie designed a rectangular label to put on the front of her scrapbook. The label was 4 inches long and $\frac{2}{3}$ inch wide. What was the area, in square inches, of the label?

Do NOT Calculate to find your answer.

Circle which is the greater value:

66 OR $\frac{2}{3}$x66

Explain how you know which value is greater:

Circle which is the greater value:

$2\frac{1}{3}$x23 OR $\frac{1}{3}$x23

Explain how you know which value is greater:

Circle which is the greater value:

$\frac{2}{3}$x$\frac{3}{9}$ OR $\frac{3}{9}$

Explain how you know which value is greater:

Make or locate SUMMATIVE and PERFORMANCE ASSESSMENTS

LESSONS AND RESOURCES ARE AVAILABLE ONLINE.

Plan
DAILY LESSONS

Incorporate
TECHNOLOGY

NEW Teacher Created Resources pages!!!

RESOURCES

Beth Pesnell
Elementary Curriculum Specialist
bpesnell@rps.k12.ar.us