



San Diego Unified School District

Instructional Module to Enhance the Teaching of

HARCOURT

Math

California Edition

Grade 5

Module 9 – Reorganized

OPERATIONS WITH FRACTIONS:
MULTIPLICATION AND DIVISION

San Diego City Schools
Instruction and Curriculum Division
MATHEMATICS CURRICULUM MAP – GRADE 5

MODULE 9 – OPERATIONS WITH FRACTIONS: MULTIPLICATION AND DIVISION
Modules represent individual units of study that lead to essential learnings

THREADS THROUGHOUT THE YEAR:

The threads represent ongoing learning opportunities in which students should be actively engaged throughout all units of inquiry during the entire school year. These items should not be isolated to any one particular unit of inquiry.

Students will:

1. Develop understanding of numbers and the number system and use their understanding to solve problems and recognize reasonable results.
2. Develop understanding of and fluency in basic computation and procedural skills.
3. Use mathematical reasoning to solve problems.
4. Communicate their mathematical thinking using words, numbers, symbols, graphs and charts, and translate between the different representations.
5. Use equations and variables to express generalizations of patterns and relationships.
6. Develop logical thinking to analyze evidence and build arguments to support or refute a hypothesis.
7. Make connections among mathematical ideas and between other disciplines
8. Develop and use strategies, skills, and concepts to solve problems.
9. Use appropriate tools, including technology, as vehicles to learn mathematical concepts.

These are essential learnings that represent bigger ideas/concepts:

- *Students use their understanding about the properties and meanings of operations for whole numbers for estimation and computation with fractions.*
- *Students use their understanding about relationships between operations of whole numbers for estimation and computation with fractions.*
- *Students use their fraction sense for estimation and computation with fractions.*
- *When dividing by fractions, students understand that the two ways of thinking about division--partition and measurement--result in two different division procedures..*

These are essential questions that learners ask themselves in order to achieve the essential learnings:

- **How do I use my understanding of basic operations with whole numbers to make meaning of multiplication and division with fractions?*
- *How do I use models, pictures, and manipulatives to understand and solve multiplication problems with fractions?*
- *How does the use of the *distributive property and the area model for multiplication of whole numbers connect to using the area model for multiplication of fractions?*
- *How do I use the *inverse relationship between multiplication and division of whole numbers to help me understand and solve multiplication and division of fraction problems?*

*** Presented in previous grade(s)**

Resources: Van de Walle, Chapter 16 (pp. 270-278); Mathematics Source Book, (pp.59-70)

Harcourt Math – Grade 5
Operation with Fractions: Multiplication and Division
Chapters 21, and 22

MODULE 9

Key Mathematical Concepts:

- The word “of” as used in “ $\frac{1}{4}$ of $\frac{2}{3}$ ” indicates multiplication.
- Division of fractions asks the same question asked in division of whole numbers:
 $12 \div 4$ asks “How many 4’s are in 12?”
 $1 \frac{1}{2} \div \frac{1}{4}$ asks “How many $\frac{1}{4}$ ’s are in $1 \frac{1}{2}$?”
- Multiplication and division are inverse operations. This means that dividing by a whole number or fraction has the same answer as multiplying by the reciprocal of the divisor.

Harcourt Mathematics

Grade 5

Module 9: Operations with Fractions: Multiplication and Division
Chapters 21, and 22**MODULE 9 NOTES**

- The vocabulary used in this module can be difficult all learners, especially English Language Learners. Reinforce fraction vocabulary with a chart as suggested on p. 344B, “English Language Learners”.
- Extra time is spent developing the concept of multiplication of fractions (21.2 – two lessons; 21.2 – two lessons) before introducing the algorithm. (Number Sense 2.4)
- Several models are provided as tools to think about division of fractions beyond just using the reciprocal. (Number Sense 2.4)
- Lesson plans were not provided for problem-solving lessons 21.5, and 22. These lessons do not focus on the Key Standards for the grade level. (Mathematical Reasoning 2.1 – estimation -- is emphasized in this unit.) Writing their own problems deepens student understanding of concepts and enhances their ability to choose the correct operation for a given problem.

Operations with Fractions: Multiplication and Division
11 Days of Instruction: Chapters 21, and 22

<u>Day 1</u> CHAPTER 21 Multiply Fractions Lesson 21.1 Multiply Fractions & Whole Numbers, Part 1	<u>Day 2</u> Lesson 21.1 Multiply Fractions & Whole Numbers, Part 2	<u>Day 3</u> Lesson 21.2 Multiply a Fraction by a Fraction, Part 1	<u>Day 4</u> Lesson 21.2 Multiply a Fraction by a Fraction, Part 2	<u>Day 5</u> Lesson 21.3 Multiply Fractions & Mixed Numbers
<u>Day 6</u> Lesson 21.4 Multiply with Mixed Numbers	<u>Day 7</u> CHAPTER 22 Divide Fractions Lesson 22.1 Hands On: Divide Fractions	<u>Day 8</u> Lesson 22.2 Reciprocals	<u>Day 9</u> Lesson 22.3 Divide Whole Numbers by Fractions	<u>Day 10</u> Lesson 22.4 Divide Fractions
<u>Day 11</u> Assessment Chapters 21 & 22				

DAY: 1
 Unit 6: Operations with Fractions
 Module 7: Chapter 21: Multiply Fractions
 LESSON 21.1, Pp. 380-381 Part 1

MATERIALS:	One copy of TR 19 and 20 for each student and overhead transparencies for the teacher (or have students draw the open number lines); Challenge 21.1 for homework if you choose that assignment. Fraction Bars for each student.
LESSON FOCUS:	Multiply Fractions and Whole Numbers
CALIFORNIA STANDARDS:	Number Sense 2.4: Understand the concept of multiplication and division of fractions; 2.5 Compute and perform simple multiplication and division fractions and apply these procedures to solving problems.
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • To use models (Fraction Kit/Fraction Bars, circles, arrays, number lines) to help students understand the concept of multiplication of fractions; • To understand the word “of” as in 3 groups of $\frac{3}{4}$ ($3 \times \frac{3}{4}$) indicates multiplication; • To connect multiplication with fractions to multiplication of whole numbers/repeated addition.
<p>LAUNCH: Introduce students to concepts.</p> <p>Books closed.</p>	<p>Alternative Teaching Strategy, P. 380B. Repeat with different examples.</p> <p>Learn, P. 380: Baker’s Dozen.</p> <ul style="list-style-type: none"> • Write problem on board/overhead. • Ask them to discuss the problem with a partner. • Students work in pairs to solve the problem. Use models. Share solutions and strategies. • Ask students how they might write the problem: <ul style="list-style-type: none"> - With words: three groups of three-fourths. - As repeated addition: $\frac{3}{4} + \frac{3}{4} + \frac{3}{4}$. - As multiplication: $3 \times \frac{3}{4}$ (the “of” indicates multiplication). <p>Teach, P. 380; Guided Instruction questions to guide discussion.</p> <ul style="list-style-type: none"> • Ask students to think about how to model the problem with the number line labeled fourths on TR 19. (Circle/highlight 3 groups of 3 fourths from left to right as shown below.) <div style="text-align: center; margin-top: 20px;"> </div>

	<p>Discuss Step 3:</p> <p style="text-align: center;"><i>How many wholes in $9/4$?</i></p> <ul style="list-style-type: none"> • Students may use their Fraction Kit/Fraction Bars, the open number line on TR 19, and any procedure they have learned to answer. • Ask students for a procedure for changing an improper fraction to a mixed number to explain to the class why it works.
<p>EXPLORE: Work with the concept. Focus on students “doing” mathematics.</p>	<p>Check, P. 381 #1.</p> <ul style="list-style-type: none"> • Discuss. • Then do #2 – 6. Work with a partner. • Draw a picture. • Ask students to work with a partner to solve them using TR 19. Ask them to note any patterns or shortcuts they notice as they work. Discuss.
<p>PRACTICE: Focus on Communication and Representation.</p>	<p>Practice & Problem Solving, P. 381 # 10-12. Then, #23 – 26. Use fraction model or number line.</p>
<p>SUMMARIZE: Connect purpose to activities.</p>	<p>ASSESS, P. 381: DISCUSS. Share.</p> <ul style="list-style-type: none"> • Ask students to discuss any patterns of shortcuts they noticed as they worked. <ul style="list-style-type: none"> ○ Multiply whole number by the numerator to get the number of parts $3 \times 2/3 = 6$ thirds ○ The denominator does not change $3 \times 2/3 = 6/3$ (Ask why.) ○ You can skip count 2-4-6 thirds
<p>HOMEWORK:</p>	<p>Challenge 21.1</p> <ul style="list-style-type: none"> • Write the number sentence for each picture. <p>Mixed Review, P. 381.</p>

ROUTINES:

Students needing more practice changing improper fractions to mixed numbers and mixed numbers to improper fractions will benefit from using TR 19 and 20 to practice those skills.

Students can draw open number lines to model multiplication of a fraction by a whole number. They can write “story” problems to go with each problem. These could be copied on construction paper to post for the class.

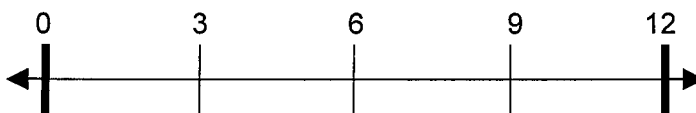
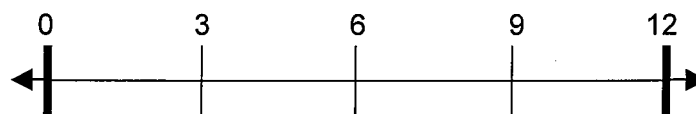
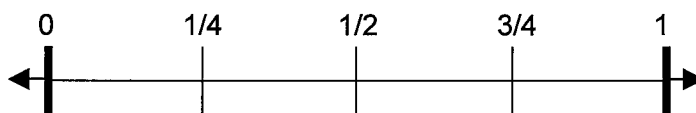
DAY: 2

 Unit 6: Operations with Fractions
 Module 7: Chapter 21: Multiply Fractions
 LESSON 21.1, Pp. 380-381 Part 2

MATERIALS:	Overhead transparency of Reteach 21.1 for the teacher and one copy per student if the class can't work from the overhead; one copy of Practice 21.1 per student for homework; Fraction Kit/Fraction Bars
LESSON FOCUS:	Multiply Fractions by a Whole Number
CALIFORNIA STANDARDS:	Number Sense 2.4: Understand the concept of multiplication and division of fractions; 2.5 Compute and perform simple multiplication and division fractions and apply these procedures to solving problems.
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • To use models and pictures to help students understand how to find a fractional part of a whole number ($\frac{2}{3} \times 12$); • To understand that the product of a whole number and a fraction less than one is less than the whole number. • To connect to multiplying by decimals ($.2 \times 10$), and finding the percent of a number (25% of 16)
LAUNCH: Introduce students to concepts.	<ul style="list-style-type: none"> • Show overhead transparency of the top part of Reteach 21.1. (Or draw on the board.) • Discuss how the problem was represented with a picture. <ul style="list-style-type: none"> • <i>How many did you start with? (12)</i> • <i>How many groups? (3) thirds</i> • <i>How many thirds? (2)</i> • Complete page and discuss. <p>Warm-up: <i>There are 12 students at the homework center. One third of them are boys. How many students at the homework center are boys?</i></p> <ul style="list-style-type: none"> • Students work in pairs to solve and share their strategies. • Ask students to draw a picture of the problem. Use number lines or other models. (Accept student suggestions- maybe 12 faces, stick figures, or other.) <p><i>What fraction of the group are boys? ($\frac{1}{3}$) How many parts/equal groups do we need to make? (3) Circle three equal groups.</i></p> <p>Possible Prompts: <i>What does this problem ask us to find?</i> <i>Ask: How can I write it in words? (one-third of twelve)</i> <i>Ask: How can I write a number sentence for this problem?</i> $\frac{1}{3} \times 12 = ?$</p>

<p>EXPLORE: Work with the concept. Focus on students “doing” mathematics.</p>	<p>Practice & Problem Solving, P. 381 #27 – 32. • Write with partners. Draw/use models. Discuss.</p>
<p>PRACTICE: Focus on Communication and Representation.</p>	<p>Practice & Problem Solving, P. 381 # 13,14,15,22, p. 381</p>
<p>SUMMARIZE: Connect purpose to activities.</p>	<p>ASSESS, P. 381: WRITE. • Discuss Common Error Alert, p. 381TE margin.</p>
<p>HOMEWORK:</p>	<p>Practice 21.1</p>

ROUTINES: Double number lines are another model students can use to find fractional parts of whole numbers and connect that work to work with percents.

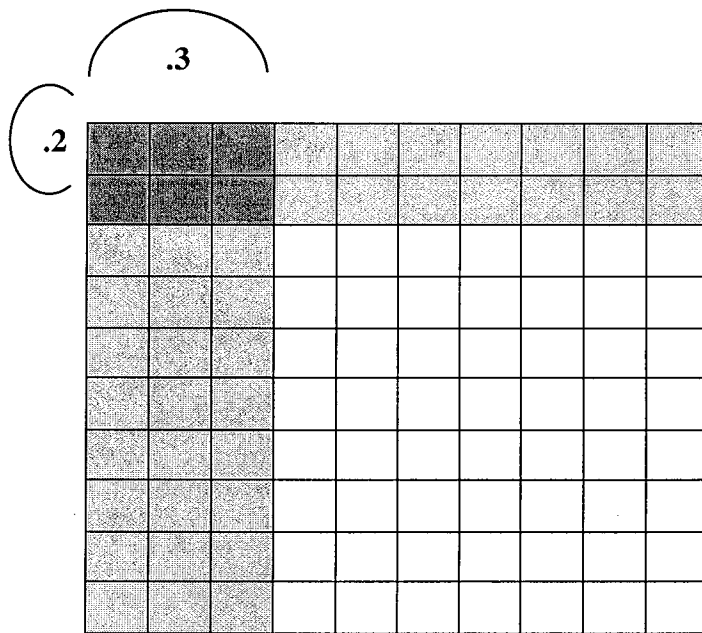


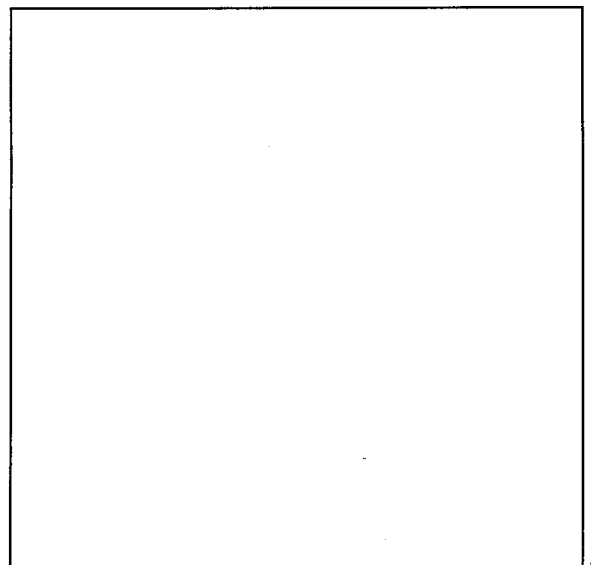
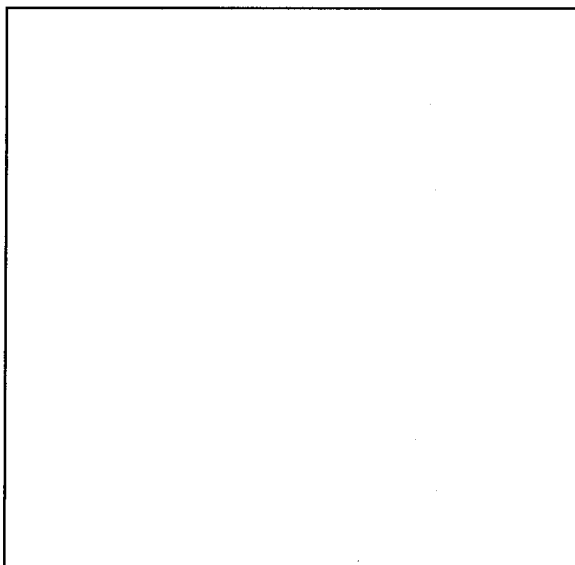
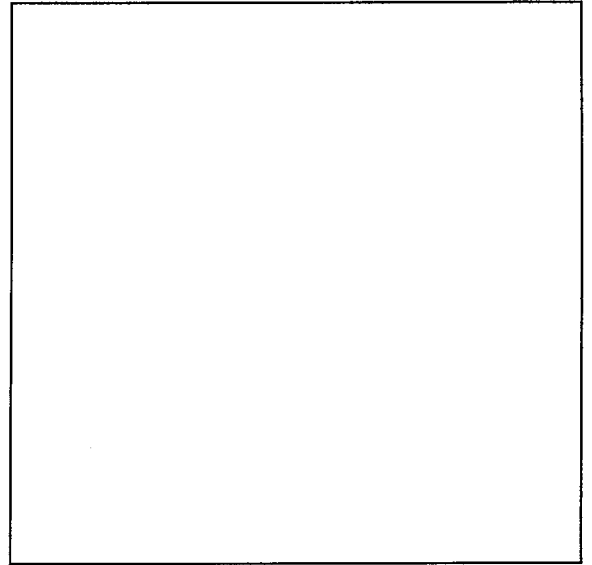
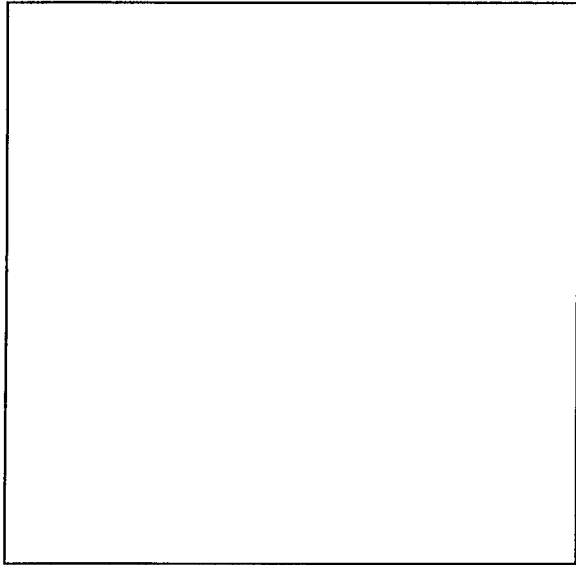
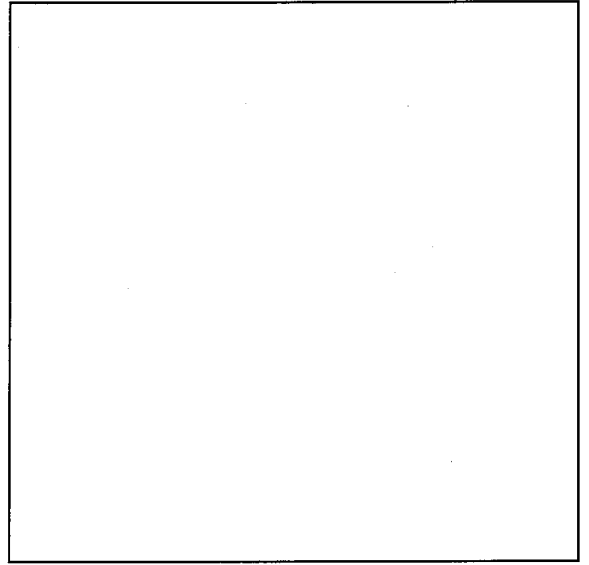
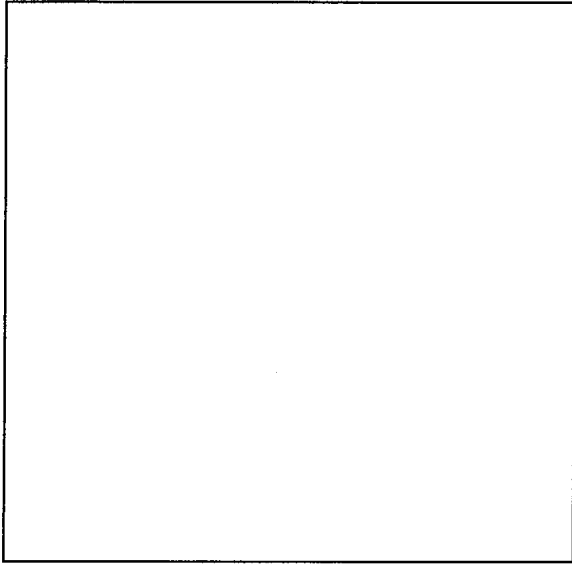
DAY: 3
 Unit 6: Operations with Fractions
 Module 7: Chapter 21: Multiply Fractions
 LESSON 21.2, Pp. 382-383 Part 1

MATERIALS:	Overhead transparency of squares and several copies per student (Or students can draw the squares.) Per student: paper to fold; ruler, p. TR27.
LESSON FOCUS:	Multiply a Fraction by a Fraction
CALIFORNIA STANDARDS:	Number Sense 2.4 Understand the concept of multiplication and division of fractions; 2.5 Compute and perform simple multiplication and division fractions and apply these procedures to solving problems.
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • To use an area model (array) to help students think about/visualize multiplication of a fraction by a fraction; • To understand the word “of” as used in $\frac{1}{4}$ of $\frac{2}{3}$ indicates multiplication
LAUNCH: Introduce students to concepts. Paper to fold.	Learn, P. 382: High Strung. <ul style="list-style-type: none"> • Write problem on the board/overhead. Read with students. • Ask students to work in pairs to find a strategy to use to solve. • Share and discuss. • Model as students work through the Steps. Teach, P. 382; Guided Instruction questions to guide discussion. Highlight Math Idea, bottom SE P. 382.
EXPLORE: Work with the concept. Focus on students “doing” mathematics.	Check P. 383 #2-6, Check, P. 383 #1 Discuss.
PRACTICE: Focus on Communication and Representation.	Practice & Problem Solving, P. 383 # 22-25, Discuss. <ul style="list-style-type: none"> • Create rectangular arrays to show the products.
SUMMARIZE: Connect purpose to activities.	ASSESS P. 383: Discuss. <ul style="list-style-type: none"> • Work with a partner to discuss. (If students do not rotate the square, rotate it on the overhead to show the commutative relationship. • Relate to whole number multiplication. $2 \times 3 = 3 \times 2$)
HOMEWORK:	Practice & Problem Solving, P. 383: #7-11


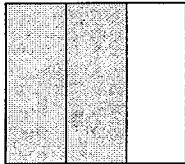

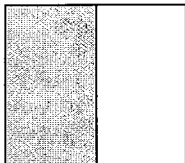

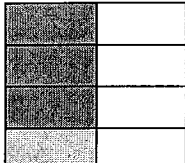
ROUTINES: Connect the array to decimal multiplication.

$.2 \times .3 = .06$ (two-tenths of three tenths equals six hundredths)





DAY: 4
 Unit 6: Operations with Fractions
 Module 7: Chapter 21: Multiply Fractions
 LESSON 21.2, Pp. 382-383 Part 2

MATERIALS:	Overhead square for the teacher and one sheet of squares per student
LESSON FOCUS:	Multiply a Fraction by a Fraction
CALIFORNIA STANDARDS:	Number Sense 2.4 Understand the concept of multiplication and division of fractions; 2.5 Compute and perform simple multiplication and division fractions and apply these procedures to solving problems.
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • Connect visual work with arrays to the algorithm for multiplying fractions; • To look for patterns in the product to generalize a procedure for multiplying fractions; • To understand that when you multiply fractions less than 1 the product will be less than either factor
<p>LAUNCH: Introduce students to concepts.</p>	<p>Warm-Up: Do together with students. Maya brought $\frac{2}{3}$ of a cake to school. Use a rectangle to represent what her cake might have looked like. Share student ideas.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p>Maya shared half of what she had with her friends. Use a rectangle to show how much of the cake her friends got. Share student ideas.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p>Jun had $\frac{1}{2}$ of a cake. Use a rectangle to represent what his cake might have looked like. Share student ideas.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p>If Jun ate $\frac{3}{4}$ of what he had, how much did he eat? Use a rectangle to draw a picture of how much he ate.</p>
EXPLORE: Work with the concept. Focus on students "doing" mathematics.	Practice & Problem Solving, P. 383: #26-28. Check with drawings.

PRACTICE: Focus on Communication and Representation.	Practice & Problem Solving, P. 383: #17-21. Discuss
SUMMARIZE: Connect purpose to activities.	Practice & Problem Solving, P. 383: #29. Share responses.
HOMEWORK:	Practice & Problem Solving, P. 383: #12-16. Review/Test, P. 390 #1-3, 4, 5, 8, 9.

ROUTINES:

