MathBuilders

Unit 7

Fractions, Mixed Numbers, and Decimals

UEB

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MathBuilders – Unit 7
Fractions, Mixed Numbers, and Decimals

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Table of Contents

Introduction

Fractions must be included in the early elementary math curriculum to enhance children's understanding of the world around them and to furnish a solid foundation for more formal work with fractions in the intermediate grades. The emphasis in this unit is on developing beginning fraction concepts: the ideas of "whole," "parts," and "equal-sized parts." Exploration of these ideas is necessary long before oral or symbolic terms for fractions are introduced. Children need to use natural language to describe familiar experience with parts and wholes. Conversely, computation involving fractions is not emphasized in this unit. The ultimate goal is to help the student develop an understanding of the meaning of fractions. They must begin to establish a rich foundation of real life experiences and model work which is fundamental to further learning.

The word, "fraction," comes from the Latin word, *fractio*, which is a form of the Latin word, *frangere*, meaning "to break." The words "fragment" and "broken down" were frequently used in the past as synonyms for fraction. Most children initially encounter fractions through "sharing" an item with others or "breaking down" an item (e.g., one-third of a pizza, half a candy

bar, etc.). Of course, fractions can also include numbers greater than or equal to one. Children need active exploration and concrete experience to build a rich foundation. Activities must involve natural language. The more diverse and varied the collection of experiences and natural terms, the broader the base from which a teacher can draw examples, non-examples, applications, and problems for future work. This natural base also allows students to express themselves and communicate with others and to discover misconceptions.

The most important idea underlying all fraction work is the part/whole relationship—that is, the use of a fraction to denote part of a whole. Children need to identify when a whole thing is broken into parts, that the parts can be large or small, equal-sized or not. In a fraction the bottom number, denominator, indicates the number of equal parts in a whole, and the top number, numerator, indicates the number of parts being considered. Activities in everyday context must be established involving descriptive language for these fraction whole/part experiences.

To have a useful and broad understanding of a fraction, children need to associate multiple

examples of models for fractions. Some models are easier for children to conceptualize than others. Children initially seem to have difficulty with number lines and set models (fractional parts of a group). A variety of region models (fractional parts of a whole) should be used first. Children need to focus on these region models since they can provide a more obvious context in which to talk about parts and wholes.

The timing of the introduction of fraction symbolism is important. Children must have a sound background in concrete experiences and oral language for fractions before symbols are introduced. Without proper development, children seem to treat fraction symbols like they treat whole numbers and forget to associate the symbols with an amount or quantity (e.g., 2/4 is seen as an answer to 1/2 + 1/2).

Why are fractions so difficult for so many children? A variety of reasons can be discussed. Often, manipulatives and models are not used to their full advantage or are abandoned too quickly. Manipulatives and models are very important in developing the students' understanding of fraction concepts. In some cases, an insufficient amount of time is spent on the development of the concept of fractions and on order and equivalence

activities before the introduction of operation on fractions. Thus, many children who do not understand the concept of fractions are asked to perform mathematical operations using fractions. This can result in meaningless applications of rote procedures and in the student's inability to assess the reasonableness of the results of those procedures. For example, students are told that one of two equal-sized parts is called one-half and written as 1/2. The symbol, 1/2, can be very confusing to students who have only experienced whole numbers. The symbol name requires students to recognize that the numbers 1 and 2 represent how many of how many equal-sized parts, but at the same time these numbers represent another number, the number 1/2. This sophisticated reasoning is probably inaccessible to most children in the early elementary years.

The concept of parts and wholes is at the core of understanding fractions. Clear understanding of parts and wholes leads to oral names and equal-sized pieces that in turn will eventually lead to symbols. For children of preschool through kindergarten age (3 - 5 years), the major goal is to develop the concept of "whole," "parts," and "parts that make a whole." Students should understand these key ideas:

Wholes can be broken into parts and reassembled into wholes.

Sometimes there are not enough parts to make a whole.

Sometimes there are more than enough parts to make a whole or even several wholes.

There are big parts, small parts, and equal-sized parts.

Parts can be shared by cutting or breaking again.

For children in kindergarten through Grade 3 the focus is on equal-sized parts and oral names. Fraction symbols should not be attempted until after the following ideas have been experienced:

Equal-sized parts have special names which tell exactly how many equal-sized parts fit into one whole.

Wholes are counted with the familiar numbers 0, 1, 2, 3, etc.

The sizes of different parts, such as halves and quarters, can be compared.

Parts, such as thirds and halves, can be counted. In doing this, it may be discovered that there are not enough parts to make a whole.

Sometimes there are enough parts to make more than a whole or even several wholes.

The special fraction names (e.g., thirds and fifths) apply to all kinds of real objects, such as oranges, candy bars, crayons, and paper.

Amounts can be named by using a whole number and a fraction name (mixed numbers).

Fractions and mixed numbers can be used to estimate amounts.

It should be noted that fractions will not be mastered in these early grades. The important aspect at this stage is to build language and modeling experiences that have children finding parts and wholes in their daily lives, as well as through geometry and measurement activities.

The objectives for each lesson were identified by an APH focus group and aligned to the Principles and Standards for School Mathematics (NCTM 2000). Standards are listed with the permission of the National Council of Teachers of Mathematics (NCTM). NCTM does not endorse the content or the validity of these alignments.

In addition, some objectives are noted as being a NCTM Curriculum Focal Point. In 2006 the National Council of Teachers of Mathematics published *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. In this document NCTM provides a "description of the most significant mathematical concepts and skills at each grade level" (NCTM, 2006, p. 1).

Included at the end of this unit is an Assessment Checklist that includes all of the objectives for the unit. This checklist is divided by grade levels. Prior to beginning the activities, review the checklist to determine which objectives your student has mastered and which objectives you will need to teach or review. Because some students have gaps in their skills, you may want to review the objectives for the preceding grade level/levels. Additionally, your school or district may align the math curriculum differently. You may find that you will need to teach lessons that are included at a different grade level or delay some objectives until the next school year.

Some children will need more time and experience with activities involving fractions than others. The following lessons, as a rule, provide only one worksheet per lesson. If your student needs more practice, less difficult activities, or more challenging activities, use products like *Focus in Math*, *DRAFTSMAN*, *Puzzle Form Board Kit*, or *Fractional Parts of Wholes Sets* that will allow you to create problems and activities to meet your child's specific needs.

As you use the worksheets with your students, please note that the directions for Kindergarten will ask the student to "find" the answer. Students may tell the answer, show the answer, or mark the answer in the fashion he or she has been taught. In Grades 1 through 3, the directions will ask the students to "mark" the answer. Some teachers may want the child to color the answer, underline the answer, mark with stickers or Wikki-Stix, or designate the answer in another fashion. The directions are not specific in how to "mark" the answer in order to allow for individual differences.

Literature plays an important role in the learning process. There are many good children's books that reinforce math concepts. Following is a list of books you may want to use to introduce or reinforce the concepts of fractions. Not all are available in braille and some are dependent on pictures to convey meaning.

- Adler, David. *Fraction fun*. New York: Holiday House, 1996.
- Dragonwagon, Crescent. *Half a moon and one whole star*. New York: Macmillan, 1986.
- Giganti, Paul. *How many snails*? New York: Greenwillow, 1988. [braille]
- Hutchins, Pat. *The doorbell rang*. New York: Greenwillow, 1986. [braille]
- Leedy, Loreen. *Fraction action*. New York: Holiday House, 1994.
- McMillan, Bruce. *Eating fractions*. New York: Scholastic, 1991. [braille]
- Matthews, Louise. *Gator pie*. New York: Dodd Mead, 1979.
- Murphy, Stuart J. *Give me half*. New York: HarperCollins, 1996.
- Murphy, Stuart J. *Jump, kangaroo, jump*. New York: HarperCollins, 1999.
- Pallotta, Jerry. *Hershey's milk chocolate bar fraction book*. New York: Cartwheel Books, 1999. [braille]

- Pallotta, Jerry. *Twizzlers percentages book*. New York: Scholastic, 2001. [braille]
- Pomerantz, Charlotte. *The half birthday party*. New York: Clarion, 1984.
- Rocklin, Joanne, Marilyn Burns & Rowan Barnes-Murphy. *One hungry cat*. New York: Scholastic, 1997.
- Townsend, Donna. *Apple fractions*. New York: Children's Press, 2004.
- Wood, Don and Audrey. *The little mouse, the red ripe strawberry, and the big hungry bear*. New York: Child's Play (International), 1984. [braille]
- Ziefert, Harriet. *Rabbit and hare divide an apple*. New York: Puffin, 1998.

Bibliography

National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence.* Reston, VA: National Councils of Teachers of Mathematics, 2006.

National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics.* Reston, VA: National Council of Teachers of Mathematics, 2000.

Learning Objectives

Kindergarten

F K-1	Recognize whole objects and discriminate them from like objects that are not whole.
F K-2*	Demonstrate fractional parts as equal parts or fair shares.
F K-3	Use half and whole in real life.

First Grade

F 1-1*	Identify half of a whole object, picture, and/or fractional part.
F 1-2*	Identify one-third and one-fourth of a whole object, picture, and/or fractional model.
F 1-3*	Identify half of a set of objects.

Second Grade

F 2-1	Use objects and fractional models to identify the whole and the fractional parts of the whole for halves, thirds, and fourths.
F 2-2*	Use objects or a set of pictures to identify the fractional part of a set for halves, thirds, and fourths.
F 2-3	Use objects and fractional models to identify the whole and the fractional parts of the whole to twelfths.
F 2-4*	Use objects or a set of pictures to identify the fractional parts of a set for fractions to twelfths.
F 2-5*	Read fractions 1/2 to 12/12 and associate the written form with the corresponding fractional parts of a whole and fractional parts of a set.
F 2-6	Write fractions from 1/2 to 12/12 from dictation.

Third Grade

F 3-1* Use an object, a picture, or a fraction model to identify the fractional part of a whole for halves to twelfths.

F 3-2* Use a set of objects or a set of pictures to identify the fractional part of a set for halves to twelfths.

F 3-3* Read and write fractions for 1/2 to 12/12 and associate the written form with the corresponding fractional part of a whole or fractional part of a set.

F 3-4* Compare simple fractions (halves, thirds, and fourths) represented by an object, a picture, or a fractional model.

F 3-5* Identify and read mixed numbers involving fractions for halves to twelfths and associate the written form with the corresponding fractional part of a whole or fractional part of a set.

F 3-6 Write mixed numbers involving halves to twelfths (i.e., in Nemeth Code, using mixed number indicators) or in UEB without mixed number indicators written as two unspaced numerals. out of sequence from dictation.

F 3-7 Show quantities in decimal tenths and hundredths represented by manipulatives.

F 3-8* Read numerals containing decimal tenths or hundredths.

F 3-9 Write numerals containing decimal tenths or hundredths

F 3-10* Compare decimals (tenths and hundredths) represented by an object, a picture, or a model.

F 3-11 Identify the relationship of simple fractions (halves, fourths, fifths, and tenths) to their decimal equivalent.

F 3-12* Solve addition and subtraction problems involving simple fractions

with like denominators.

F 3-13* Solve addition and subtraction problems involving decimal numbers with tenths or hundredths with no regrouping.

F 3-14 Solve addition and subtraction problems involving decimal numbers with tenths and hundredths on a calculator.

* Worksheet included

Kindergarten

Learning Objectives

Kindergarten

F K-1	Recognize whole objects and discriminate them from like objects that are not whole.
F K-2*	Demonstrate fractional parts as equal parts or fair shares.
F K-3	Use half and whole in real life.

*Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to add variety and to give the child more experiences with objects from his or her environment.

APH Fractional Parts of Wholes Set F K-1, F K-2
APH Puzzle Form Board Kit F K-1, F K-2
Fruit F K-3
Modeling clay F K-3
Paper cups F K-2, F K-3
Pencils F K-2
Puzzles F K-1
Straws F K-2
Wikki Stix F K-2

F K-1
Fractions

Objective: The student will recognize whole objects and discriminate them from like objects that are not whole.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- APH Puzzle Form Board Kit
- APH Fractional Parts of Wholes Set
- Puzzles

Materials: *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: The purpose of this objective is for the student to develop an understanding of whole versus part. Provide the student with multiple examples comparing a whole object with part of the same object.

Food is an excellent choice to use in teaching this concept because it can easily be cut. For example, provide the student with a whole apple and then cut the apple in half. Make sure the student understands that the "whole" apple is now being cut into two "parts."

Another option is to use a commercial puzzle or APH's Puzzle Form Board Kit. Show the student the "whole" object and then show the parts that make the whole piece. Toys with parts, such as building blocks, can be used to show the difference between parts and whole. Similarly, the APH Fractional Parts of Wholes Set can be used as a manipulative for teaching this concept.

After the student understands the tactile objects, it is important to incorporate more abstract concepts. The student should understand that she is a "part" of the "whole" class or that students only go to school for "part" of a "whole" day. Integrate the terminology into everyday conversation.

Connections: Provide the student additional opportunities to practice identifying parts and wholes with "Parts of a Whole" in Issues 1 and 2 of *Squid* magazine.

F K-2
Fractions

Objective: The student will demonstrate fractional parts as equal parts or fair shares.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Suggested Materials:

- APH Puzzle Form Board Kit
- APH Fractional Parts of Wholes Set
- Wikki Stix
- Straws
- Paper cups
- Pencils

Worksheet F K-2

Strategies: The purpose of this objective is for the student to gain an understanding of the basic principle of equal parts which leads to the concept of division.

The concept of fair shares is the basic premise of division. Begin by assessing the student's prior knowledge by discussing fair shares. Ask the student:

- What do you do when you share something?
- What kind of things do you share at home?
- What is a fair share?
- Name some things you have shared.

Give the student an even number of objects and have him divide them equally among a peer group.

- Give the student four pencils and have him divide them among four students. The student should determine that each student gets a "fair share" of one pencil.
- Provide each student in the group with a cup. Give the student a set of straws and have the student give each of the students in the group a "fair share" of straws. This activity can be extended with the use of other objects.

To teach equal parts, use any object that can be cut into equal parts. This could include food items (pizza, pies, cakes, fruit, etc.) or other math manipulatives that can be divided into equal parts (APH Puzzle Form Kit or Fractional Parts of a Wholes Set). It is important that the student be provided with multiple examples and that he develops an understanding of "equal" parts.

Cut shapes of squares and circles out of heavy paper. Fold some in half and some in unequal parts. Have the student identify which shapes show equal parts or halves.

Another option for teaching equality is to provide the student with tactile objects and have the student use Wikki Stix to divide the object into equal halves.

Complete worksheet F K-2.

Connections: Read the book *Rabbit and Hare Divide an Apple* by Harriet Ziefert. Because both Rabbit and Hare insist on having the larger piece of the apple, they lose the whole thing to a sly skunk but learn an important lesson in the process. Discuss with the student the concept of "fair share."

F K-3
Fractions

Objective: The student will use half and whole in real life.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Suggested Materials:

- Paper cups
- Modeling clay
- Fruit

Strategies: The purpose of this objective is to introduce the common fraction terminology of half and whole. The goal is for the student to use the term "half" and "whole" appropriately.

Half: Object has two equal parts.
Whole: Object consists of one part.

This activity is an extension of F K-1 and F K-2 because it combines the concepts of equal

shares and fractional parts in a real-life context. Provide the student with multiple examples of whole objects to explore. Then, have the student divide the object into halves. Use objects in the student's environment that can be easily divided into halves.

- Provide the student with any type of food that can be divided into halves such as a piece of fruit. Have the student compare the whole object to the two separate halves.
- Provide the student with two cups. Fill the cups with a drink (water, milk, or juice): one full and the other half-full. Have the student compare the amount of liquid in the two cups.
- Provide the student with a ball of modeling clay. Have the student separate the ball into two equal pieces.

Have the student explore her environment and find other objects or containers that can either be whole (full) or half (half-full) such as a toy box, buckets, etc.

Connections: The concept of whole versus half is used in many independent living skills, especially cooking. During class activities where simple cooking is involved, such as making pudding or gelatin, have the student measure ingredients and use the proper terminology (e.g., one full cup of water and one-half of a cup of sugar).

Read the book *Give Me Half* by Stuart J. Murphy. The book introduces the concept of halves using a simple rhyming story about a brother and sister who do not want to share their food. A little boy sits down to enjoy a pizza, saying, "I have one whole pizza. . . and it's all for me!" When his sister comes home the sparring begins: "I'm going to get some pizza—just you wait and see."

First Grade

Learning Objectives

First Grade

F 1-1* Identify half of a whole object, picture, and/or fractional part.

F 1-2* Identify one-third and one-fourth of a whole object, picture, and/or fractional model.

F 1-3* Identify half of a set of objects.

* Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to add variety and to give the child more experiences with objects from his or her environment.

APH Fractional Parts of Wholes Set F 1-1, F 1-2
Fruit F 1-1
Modeling clay F 1-1
Paper plates F 1-2
Tactile objects F 1-3

F 1-1
Fractions

Objective: The student will identify half of a whole object, picture, and/or a fractional part.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- APH Fractional Parts of Wholes Set
- Fraction Circles from the kit
- Fruit
- Modeling clay

Worksheet F 1-1

Materials: *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: With this objective the student should demonstrate an understanding of half shown in multiple ways.

Provide the student with a whole object. Any item is sufficient as long as it can be divided into halves. Review the concept of a whole object being divided into two equal parts. Examples could include dividing an apple or having the student divide a ball of modeling clay into two halves.

Using the Fractional Parts of Wholes Set or the Fraction Circles from the kit, provide the student the whole circle to explore. Explain that the circle is a whole circle. Next, provide the student the one-half fraction circle set. Again, allow the student to explore the parts of this fraction circle. Explain that the circle has been divided into two halves and when combined they form one whole circle.

Move to a picture model of shapes or objects that are cut in half. Make sure the student can determine the equality of the halves.

Finally, provide the student with the written form of one-half (1/2) as it would appear to a sighted peer. Students at this level do not have the Braille skills to understand the Nemeth and UEB symbol for 1/2, therefore show the student what the fraction looks like to a sighted person. It is necessary that the student understands that one-half has a one on the top and a two on the bottom with a horizontal line between them. While it is not important to teach the vocabulary of numerator and denominator at this time, the student should be able to understand the concept of the fraction when she hears the discussion in class.

Complete worksheet F 1-1.

Connections: Provide the student with opportunities for additional practice in finding half of an object using *Squid* magazine. "Broken Hearts" in Issue 3, "Parts of a Whole" in Issue 2, and "Two Faced" in Issue 6 provide a fun way to find and match halves.

F 1-2
Fractions

Objective: The student will identify one-third and one-fourth of a whole object, picture, and/or fractional model.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- Paper plates
- APH Fractional Parts of Wholes Set
- Fraction Circles from the kit

Worksheets F 1-2 (a) and F 1-2 (b)

Strategies: The purpose of this objective is to introduce common fraction terminology such as half, third, fourth, and whole.

It is very important that the terms one-third and one-fourth be used to introduce the terminology. Students may have a concept of "a third" or "a fourth" so transferring their vocabulary to proper terms is important.

Half: Object has two equal parts.
Third: Object has three equal parts.
Fourth: Object has four equal parts.
Whole: Object consists of one part.

Begin the lesson by discussing with the student things that are divided into halves, thirds, and fourths. Ask the student how his family cuts fruit, pizza, pie, cake, etc.

Take different sizes of round plates and cut the plates into halves, thirds, fourths, while leaving some whole. Have the student match the plates based on texture and size. When the student finds a set, have him determine how many parts make up the whole plate. Teach the student appropriate vocabulary to describe his findings such as, "I have half a plate" or "My plate is made up of fourths".

As another activity, select the whole, halves, thirds, and fourths from the Fraction Circles or the APH Fractional Parts of Wholes Set. Beginning

with the whole circle, review the size and the shape of the whole and the half of the circle. Now, show the student the three sections that can make up one whole. Explain that one section of the circle is "one-third" of the circle. Help the student understand that all of the "one-third" pieces are equal in size by having the student place the one-third pieces on top of each other to determine that the pieces are equal in size. Repeat with the four pieces of the "fourths" circle.

Providing students with common real life situations is important to this concept. Have the student share half of a snack with a fellow student. The same concept could be used with third and fourth. Most students have had a sandwich cut into fourths.

Complete worksheets F 1-2 (a) and F 1-2 (b).

Connections: Read *Eating Fractions* by Bruce McMillan. The book, available in braille, is an ingenious combination of fractions and food. The boy and girl divide a series of foods into halves, thirds, and fourths. After each division they (sometimes with help from a hungry dog) delightedly devour the whole thing.

F 1-3
Fractions

Objective: The student will identify half of a set of objects.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- Objects to count and separate
- Tactile Tokens from the kit

Worksheet F 1-3

Strategies: Identifying half of a set develops the ability of the student to divide by two. Provide the student with multiple objects such as crayons, pencils, candy, etc. At this point, it is important to provide the student with an even number of objects. Have the student divide the set of objects into two equal parts.

The Tactile Tokens can be used in various ways to explore the concept of half of a set.

- Provide the student with two tokens. Explain to the student that the tokens represent a set and ask her to divide the set into two halves. Next, provide the student with four, six, and then eight tokens and have her repeat dividing the set into two groups.
- Place six tokens in front of the student, two showing yellow/smooth and four showing blue/soft. Ask the student if the whole set is divided into equal parts. The student should determine that the set is not divided evenly. Have the student determine how to "flip" the tokens to have equal parts. In this example, she should flip one blue/soft token over to yellow/smooth. Repeat this exercise with different configurations of even numbered sets.

Complete worksheet F 1-3.

Connections: The activity using tokens has many applications for basic problem solving skills. The student may use the sets of tokens to reinforce the concept of greater than and less than. The tokens may also be used to develop simple addition and subtraction problems.

Read the book *The Doorbell Rang* by Pat Hutchins. The book, available in braille, tells the story of two children and a plate of cookies. Victoria and Sam are just sitting down to a plateful of Ma's cookies when the doorbell rings, and two of their friends arrive to share the feast. The doorbell rings again and again and each time the number of cookies per person dwindles until at last there is only one cookie per person and . . . the doorbell rings again!

Second Grade

Learning Objectives

Second Grade

F 2-1	Use objects and fractional models to identify the whole and the fractional parts of the whole for halves, thirds, and fourths.
F 2-2*	Use objects or a set of pictures to identify the fractional part of a set for halves, thirds, and fourths.
F 2-3	Use objects and fractional models to identify the whole and the fractional parts of the whole to twelfths.
F 2-4*	Use objects or a set of pictures to identify the fractional parts of a set for fractions to twelfths.
F 2-5*	Read fractions 1/2 to 12/12 and associate the written form with the corresponding fractional parts of a whole and fractional parts of a set.
F 2-6	Write fractions from 1/2 to 12/12 from dictation.

* Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to add variety and to give the child more experiences with objects from his or her environment.

APH Puzzle Form Board Kit F 2-1
APH Fractional Parts of Wholes Set F 2-1
APH Wheatley Tactile Diagramming Kit F 2-5
Modeling clay F 2-3
Perkins Brailler F 2-6
Slate and Stylus F 2-6

F 2-1
Fraction

Objective: The student will use objects and fractional models to identify the whole and the fractional parts of the whole for halves, thirds, and fourths.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- APH Puzzle Form Board Kit
- APH Fractional Parts of Wholes Set
- Fraction Circles from the kit
- Fraction Tiles from the kit

Materials: *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: In this lesson the student will review simple fractions. Begin by providing examples of objects that are whole and can be divided into fractional parts. The APH Puzzle Form Board Kit, the APH Fractional Parts of Wholes Set, the Fraction Circles, or the Fraction Tiles are useful to reinforce the difference between whole objects and fractional parts of a whole. Review Lessons F 1-1 and F 1-2 with students who are having difficulty with this concept.

Using the Fraction Circles, begin by providing the student with the whole circle. Allow the student to explore the circle and explain that this represents one entire or whole circle. It may help to explain to the student that the circle could be a pizza or a pie and the whole circle represents the food item before it is cut.

Provide the student with the two halves from the Fraction Circles. Again, allow the student to explore the two halves. Have the student place the two half sections on top of each other to determine that the pieces are equal in size. Have the student place the two halves in the plastic tray. Ask the student what she created when she placed the two halves in the tray. If she answers a circle (or pizza, pie, etc.), ask her how much of the circle. At some point, you want her to say that the two pieces together make one whole circle.

Next, take a one-half piece from the tray and ask the student how much of the circle is left. The student should determine that one-half of the circle is left in the plastic tray. Allow the student to pick up the half in the tray and explain to the student that she has "half of the circle." Repeat this exercise with thirds and fourths.

Once the student has an understanding of objects, use tactile graphics of shapes divided into halves, thirds, and fourths. The student needs to make the connection between the objects and the more abstract tactile graphics.

The concept of a whole versus fractional parts (halves, thirds, and fourths) can also be explored using the Fraction Tiles. The same directions for the Fraction Circles can be used with the Fraction Tiles from the kit. This manipulative provides the student the opportunity to gain a deeper understanding of whole, fractions, and equal fractions.

Connections: Provide the student with a Geoboard and Geobands or rubber bands. Have the student construct a square using the bands. Ask the student to show different ways of dividing

the square in half. Remind the student that the divisions must be equal. Repeat the exercise dividing the square into fourths.

F 2-2
Fractions

Objective: The student will use objects or a set of pictures to identify the fractional part of a set for halves, thirds, and fourths.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- Tactile Tokens from the kit

Worksheets F 2-2 (a), F 2-2 (b), and F 2-2 (c)

Strategies: This objective focuses on parts of a set. The understanding of sets and fractional parts of sets will help the student in future work with operations such as division.

Use the Tactile Tokens that have different textures and colors on either side. Set up two tokens for the student with one on the soft side and one on the smooth side. Ask the student to count the total number of tokens and explain that the total number is the whole set. Next, have the student determine how many tokens are soft and how many are smooth. Explain that each token represents half of the set. Repeat this exercise with four and six tokens.

Have the student count all the tokens in a set (e.g., three tokens total). This provides him with the total set, the whole number, or the denominator. Then, put all the tokens in a cup and have the student pour the tokens on his desk. Have the student explore the tokens and determine how many tokens of each type are on his desk (e.g., one smooth and two soft). The student should understand that "one of the three tokens is smooth". Then have the student count the other tokens (two soft tokens). The student should determine that "two of the three tokens are soft." Repeat this exercise using four tokens.

Any set of objects can be used provided the student can determine differences in the objects. However, the objects should be similar enough so that the student understands that the objects belong in the same set. This activity could be easily conducted using the shapes from the Wheatley Tactile Diagramming Kit as long as the student understands that the set is the total number of shapes.

Next, the student should transition from using real objects to tactile representations of objects on the accompanying worksheets. The worksheets are similar in that they will have the student determine fractional parts of a set in picture form.

Complete worksheets F 2-2 (a), F 2-2 (b), and F 2-2 (c).

Connections: The activity in this lesson closely relates to probability. Refer to lesson 3-10 in the Data Collection, Graphing, and Probability/ Statistics unit. Use the spinner and the activity from this lesson to determine the fractional part of the whole as well as the probability of landing on a certain type of sticker.

F 2-3
Fractions

Objective: The student will use objects and fractional models to identify the whole and the fractional parts of the whole to twelfths.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- Fraction Circles from the kit
- Fraction Tiles from the kit
- Modeling clay

Strategies: As the concepts of whole, halves, thirds, and fourths have been explored, this lesson will provide the student an opportunity to develop an understanding of fifths, sixths, sevenths, eighths, ninths, tenths, elevenths, and twelfths.

Provide the student with the Fraction Tile tray and allow the student to explore the whole bar (the 1 bar). Explain to the student that the bar represents a whole. Review with the student the fractional parts of halves, thirds, and fourths.

Explain to the student that fractions can be divided into even smaller pieces. Provide the student with the Fraction Tiles for fifths. Allow the student to explore the five pieces and ask her how many equal pieces make up the whole. Help the student understand that the block was cut into five equal pieces or fifths. Have the student compare the total length of the five pieces to the whole bar. Explain that one piece represents one-fifth (1/5) of the whole, two pieces represents two-fifths (2/5), three pieces represents three-fifths (3/5), etc. This process should be repeated with sixths, eighths, and tenths using the Fraction Tiles.

For other fractions (sevenths, ninths, elevenths, and twelfths), you can provide the student with a ball of modeling clay. Explain that the ball represents a whole. Divide the ball into seven equal pieces and explain that the whole has been divided into seven equal pieces called sevenths. This process can be repeated with any fraction including ninths, elevenths, and twelfths.

It is important that the student uses the correct fractional terminology and that she understands that a whole can be evenly divided into many different pieces. To reinforce this concept, have the student evenly divide an object (clay, food, etc.) among different numbers of students.

Connections: To help the student understand the relative size of fractions, provide the student with an opportunity to sort fraction cards. Provide the student with a selection of fraction cards such as 1/10, 3/6, 8/10, 1/3, 7/8, 2/5, 3/10, 9/10, 1/8, and 4/8. Have the student sort the cards into three categories: “About zero”, “About 1/2”, “About one.” Have the student check her answers by comparing the corresponding fraction tiles to the whole fraction tile.

F 2-4
Fractions

Objective: The student will use objects or a set of pictures to identify the fractional parts of a set for fractions to twelfths.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students

should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- Tactile Tokens from the kit

Worksheets F 2-4 (a) and F 2-4 (b)

Strategies: The goal of this objective is to expand the set concept from fourths to twelfths.

Provide the student with a set of Tactile Tokens. To begin, provide the student with two tokens. Have the student give you half of the set of tokens. Take this opportunity to explain to the student that the two pieces make a whole set and that he has just given you one-half of the set. Repeat this activity with all sets of fractions up to twelfths (i.e., one-third of three, one-fourth of four, etc.).

As you start to work with more advanced fractions, repeat the activity above focusing on the correct terminology (two-fifths for two tokens, etc.). The activity provided in F 2-2 will work as an excellent way of having the student randomly determine the fractional part of a set.

Worksheets F 2-4 (a) and F 2-4 (b) provide the student with sets of shapes both smooth and textured. Have the student determine the fractional part of the set that is smooth and then determine the fractional part of the set that is textured.

Connections: Read the book *Jump, Kangaroo, Jump* by Stuart J. Murphy. In this picture book based on math principles, Kangaroo and his friends divide themselves into teams to compete in Field Day exercises. Readers will easily follow the concept of fractions when the 12 campers divide into two teams of six for tug-of-war, then three teams of four for a swimming relay race, and four teams of three for a canoe race.

F 2-5
Fractions

Objective: The student will read fractions 1/2 to 12/12 and associate the written form with the corresponding fractional parts of a whole and fractional part of a set.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Curriculum Focal Point

Suggested Materials:

- Fraction Circles from the kit
- Fraction Tiles from the kit
- APH Wheatley Tactile Diagramming Kit

Worksheets F 2-5 (a) and F 2-5 (b)

Strategies: The goal of this objective is for the student to learn to read basic fractions in Nemeth Code or in UEB Code.

Provide the student with a pictorial representation of what fractions look like in print. Using index cards with braille numbers, build fractions by placing one index card above a line and a second index card below the line. This could be done on the Wheatley Tactile Graphing Kit where the horizontal line could be stationary.

It is important at this point to use appropriate vocabulary when teaching fractions. The top number of a fraction is called the *numerator* and bottom number is called the *denominator*. The student should understand these terms after this lesson and use the terminology when appropriate.

Next, introduce the student to the Nemeth or UEB Code. As with many braille symbols, fractions have an indicator to "open" the fraction. For Nemeth the dot 1-4-5-6 is used as the opening fraction indicator. Then the numerator is written without a numeral indicator. The dot 3-4 is used as the horizontal bar, and then the denominator is written without a numeral indicator. Since the fraction was "opened," it also has to be closed. The closing fractional indicator is the dot 3-4-5-6.

Nemeth Example:

$\frac{1}{2}$ 

$\frac{1}{3}$ 

$\frac{3}{4}$ 

$\frac{7}{8}$ 

$\frac{11}{12}$ 

However, if the numerator and denominator are written in print on the same line with a diagonal slash such as twenty four slash six, the fraction indicators are not used. Instead, the numeric indicator is used and slash (dots 3-4-5 followed by dots 3-4) is used. It would look like.

24/6 ⠼⠃⠙⠸⠌⠼⠋

In UEB a simple numeric fraction is one whose numerator and denominator contain only digits, decimal points, commas or separator spaces and whose fraction line in print is drawn between the two vertically arranged numbers.

In such a case a numeric fraction line symbol dot 3-4 may be used between the numerator and denominator.

UEB Example:

$\frac{1}{2}$ ⠼⠁⠌⠼⠃

$\frac{1}{3}$ ⠼⠁⠌⠼⠉

$\frac{3}{4}$ ⠼⠉⠌⠼⠙

$\frac{7}{8}$ ⠼⠛⠌⠼⠓

$\frac{11}{12}$ ⠼⠁⠁⠌⠼⠁⠃

The numeric fraction line is not used when the print is expressed linearly using an ordinary slash the dot 4-5-6-3-4 with the numeral indicators is used in this case. If the numerator or denominator is not entirely numeric as defined above, then the general fraction indicators should be used. The numeric indicator is used with the numerator followed by the simple numeric fraction line and the denominator numeral. The simple numeric fraction line continues numeric mode therefore the numeric indicator is not repeated with the denominator in a simple fraction. After the opening indicator the numerator expression is written, then the general fraction line symbol dot 4-6-3-4, then the denominator expression and finally the closing indicator. Both numerator and denominator may be any kind of expression, including fractions of either simple numeric or general type. In UEB technical the dot 1-2-3-5-6 is used as the opening fraction indicator and the dot 2-3-4-5-6 is used as the closing fraction indicator.

When two digits are written on the same line of print with a diagonal slash between them the expression is written as it appears in print using the forward slash. The forward slash is formed with two cells; dots 4 -5- 6- 3-4. The forward slash terminates numeric mode therefore the numeric indicator is repeated with the second numeral.

20/20

⠼⠃⠚⠌⠼⠃⠚

After explaining the parts of fractions in Nemeth or UEB, have the student read fractions from 1/2 to 12/12. Begin by having the student read the Nemeth or UEB Code found on the Fraction Circles and Fraction Tiles. This will provide an opportunity to not only read the fractions but review the concept of fractional parts.

It is important to include fractions such as 2/2, 3/3, 4/4, etc. Explain to the student that fractions that have the same numerator and denominator make a whole and are equal to one.

Complete worksheets F 2-5 (a) and 2-5 (b).

Connections: Provide the student with an opportunity to practice reading fractions while playing a card game. Make a simple set of playing cards on 3 x 5 index cards. Make two cards for each fraction and add an *Old Maid* card. Play the game as you would play *Old Maid*.

F 2-6
Fractions

Objective: The student will write fractions from 1/2 to 12/12 from dictation.

NCTM Standard: Number and Operations for Pre-K - 2 – Understanding numbers, ways of representing numbers, relationships among numbers, and number systems. All students should understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Suggested Materials:

- Perkins Brailler
- Slate and Stylus

Strategies: The purpose of this lesson is to have the student write fractions using Nemeth or UEB Code. Begin by going over the construction of fractions in Nemeth or UEB Code. Then have the student write the fractions. In the dictation, provide the student with as many different combinations between 1/2 and 12/12 as possible.

Take this opportunity to review with the student the concept that fractions such as 3/3 are equal to 1. Explain that if you have three

equal pieces of a cookie and you combine them, they make one whole cookie. The same is true with fractions.

Once the student has an understanding of how to construct fractions using Nemeth Code or UEB Code, use any of the worksheets with divided shapes such as F 2-4 and have the student write the answers using appropriate Nemeth Code or UEB.

Connections: Music has a direct correlation to fractions. The student should be familiar with whole notes, half notes, and quarter notes. Discuss with the student the different types of notes and how they are used in music class.

Third Grade

Learning Objectives

Third Grade

F 3-1* Use an object, a picture, or a fraction model to identify the fractional part of a whole for halves to twelfths.

F 3-2* Use a set of objects or a set of pictures to identify the fractional part of a set for halves to twelfths.

F 3-3* Read and write fractions for 1/2 to 12/12 and associate the written form with the corresponding fractional part of a whole or fractional part of a set.

F 3-4* Compare simple fractions (halves, thirds, and fourths) represented by an object, a picture, or a fractional model.

F 3-5* Identify and read mixed numbers involving fractions for halves to twelfths and associate the written form with the corresponding fractional part of a whole or fractional part of a set.

F 3-6 Write mixed numbers involving halves to twelfths (i.e. in Nemeth Code, or in UEB no mixed number indicators are used) out of sequence from dictation.

F 3-7 Show quantities in decimal tenths and hundredths represented by manipulatives.

F 3-8* Read numerals containing decimal tenths or hundredths.

F 3-9 Write numerals containing decimal tenths or hundredths.

F 3-10* Compare decimals (tenths and hundredths) represented by an object, a picture, or a model.

F 3-11 Identify the relationship of simple fractions (halves, fourths, fifths, and tenths) to their decimal equivalent.

F 3-12* Solve addition and subtraction problems involving simple fractions with like denominators.

F 3-13* Solve addition and subtraction problems involving decimal numbers with tenths or hundredths with no regrouping.

F 3-14 Solve addition and subtraction problems involving decimal numbers with tenths and hundredths on a calculator.

* Worksheet included

Materials Suggested for Lessons

A limited number of manipulatives are included in the kit that accompanies this unit. Additionally, you may want to use the following items to add variety and to give the child more experiences with objects from his or her environment.

APH Hundreds Board F 3-7
Dimes F 3-7
Pennies F 3-7
Perkins Brailler F 3-6, F 3-9, F 3-10
Slate and Stylus F 3-6, F 3-9, F 3-10
Talking calculator F 3-14

F 3-1
Fractions

Objective: The student will use an object, a picture, or a fraction model to identify the fractional part of a whole for halves to twelfths.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

NCTM Curriculum Focal Point

Suggested Materials:

- Fraction Circles from the kit
- Fraction Tiles from the kit

Worksheets F 3-1 (a) and F 3-1 (b)

> ***Materials:*** *Listed materials are only a suggestion. Feel free to substitute other appropriate materials including those from other math programs.*

Strategies: When reviewing fractions with the student, it is important to begin with real objects before moving to more abstracts concepts such as models, pictures, and eventually, written fractions.

Refer to the first grade objectives as well as objective F 2-1 and F 2-3 when introducing fractional objects for one-half, one-third, and one-fourth. The activities in these lessons may be expanded to fractions up to twelfths.

Provide the student with an object that can be easily divided such as a chocolate bar or an orange. Give the student parts of a whole such as three pieces of an eight piece chocolate bar and have the student determine the fractional part (three-eighths). This should be repeated with multiple examples beginning with real objects and then using manipulatives.

As in objectives F 2-1 and F 2-3, use the Fraction Circles and Fraction Tiles to identify the fractional part of a whole. Begin by providing the student with an example of a whole circle or whole tile. Then review halves and progress through the fractions ensuring that the student connects the concept of fractional parts to the whole.

When reviewing the concept of fractional parts, it

is also important to reinforce the concept of whole objects. The student needs to understand that two-halves, three-thirds, four-fourths, etc. are all equal to one. The student needs to understand that if the numerator and denominator are the same numbers, then the fraction equals one.

Complete worksheets F 3-1 (a) and F 3-1 (b).

Connections: The third grade is an opportune time to begin intense instruction on the multiple uses of the Cranmer abacus. While other topics such as setting numerals, addition, and subtraction will be covered in other activities, this is the appropriate time to introduce the concept of setting fractions on the abacus. The following book can be helpful in explaining how to set fractions on an abacus:

The Abacus Made Easy APH Cat No. 4-00100-00

F 3-2
Fractions

Objective: The student will use a set of objects or a set of pictures to identify the fractional part of a set for halves to twelfths.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

NCTM Curriculum Focal Point

Suggested Materials:

- Tactile Tokens from the kit

Worksheet F 3-2

Strategies: The purpose of this activity is to reinforce the concept of sets. It is important that the student understands fractions as part of a set as this develops multiple concepts including division. The basic concepts have been addressed in objectives F 1-3 and F 2-2 but need to be expanded to smaller fractions up to twelfths.

Look for common sets to use as examples for the student. Some examples:

Five basketball players for fifths

Six pack of soft drinks for sixths

Seven days in a week for sevenths

Eight planets in the solar system for eighths

Nine players on a baseball field for ninths

Ten pennies in a dime for tenths

A dozen baked goods (buns, doughnuts, cookies, etc.) for twelfths

Refer to objectives F 2-2 and F 2-4 and complete the Tactile Token activities found in these objectives. Again, the premise of these objectives is to have the student correctly determine the fractional part of a set.

Complete worksheet F 3-2.

Connection: Read the book *One Hungry Cat* by Joanne Rocklin. This is a simple, funny story combined with some basic math concepts. Tom the cat likes "to bake yummy things," and he begins by making a dozen chocolate cookies. He invites friends over to enjoy his treats, but devours the cookies before they arrive. The story proceeds in a predictable way as Tom continues to bake goodies, which he carefully divides to share fairly, and ends up eating them also.

F 3-3
Fractions

Objective: The student will read and write fractions for 1/2 to 12/12 and associate the written form with the corresponding fractional part of a whole or fractional part of a set.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

Curriculum Focal Point

Suggested Materials:

- Fraction Circles from the kit
- Fraction Tiles from the kit

Worksheet F 3-3

Strategies: Once the student has an understanding of fractional parts of a whole and fractional parts of a set, it is important for the student to read and write fractions. The directions

for writing fractions in Nemeth Code and UEB Code are found in F 2-5. Review the Nemeth or UEB Code for fractions as part of this lesson.

Provide the student with a fraction model, object, or tactile illustration and ask the student to orally provide the fraction name represented. Then provide the student with the written form of the fraction. Using the Fraction Circles or Fraction Tiles, have the student read the Nemeth or UEB Code on the manipulatives. Next, have the student read the fractions on the Worksheet F 3-3.

Once the student has a demonstrated understanding of how to read fractions, provide guided practice in writing fractions. Provide the student with fractional models such as Fraction Circles or Fraction Tiles and have the student write the fractions in Nemeth or UEB Code. Have the student write the answers using Nemeth or UEB Code for the previous worksheet F 3-2.

Connections: Provide the student with an opportunity to practice reading fractions while playing a card game. Make a simple set of playing cards on 3 x 5 index cards. Make two cards for each fraction and add a *Monster Card*. Play the

game as you would *Old Maid* except the winner is the person left holding the *Monster Card*.

F 3-4
Fractions

Objective: The student will compare simple fractions (halves, thirds, and fourths) represented by an object, a picture, or a fractional model.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

Suggested Materials:

- Fraction Circles from the kit
- Fraction Tiles from the kit

Worksheets F 3-4 (a) and F 3-4 (b)

Strategies: To compare halves, thirds, and fourths, begin by providing the student with the Fraction Circles. Ask the student to take a one-

half, a one-third, and a one-fourth piece. Have the student compare the shapes and decide which piece is the largest and which piece is the smallest. Next, complete the same activity using the Fraction Tiles. Explain that as the denominator gets larger, the piece of the whole gets smaller. Thus, one-half is the largest of the three, then one-third, and one-fourth would be the smallest piece.

Complete worksheets F 3-4 (a) and F 3-4 (b).

Connections: Number lines are a critical concept for students to understand in the elementary school. As a connection activity, provide the student with the APH Number Line Device and have the student use the fraction lines to determine where one-half, one-third, and one-fourth are located on the number line. This will reinforce multiple concepts including fractions as part of a whole, comparison of fractions, and the use of a number line.

F 3-5
Fractions

Objective: The student will identify and read mixed numbers involving fractions for halves

to twelfths and associate the written form with the corresponding fractional part of a whole or fractional part of a set.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

Suggested Materials:

- Fraction Circles from the kit
- Fraction Tiles from the kit

Worksheet F 3-5

Strategies: Mixed numbers are numbers that include both whole numbers and fractions such as 3 1/2 or 5 1/4. The student should be able to identify and read mixed numbers involving fractions.

Begin with a fractional model to demonstrate the concept that a set can be more than a whole using either the Fraction Circles or Fraction Tiles.

To demonstrate mixed numbers using the Fraction

Tiles, give the student a one-half tile and have the student place the tile next to the whole bar in the plastic tray. Ask the student what fractional part she has. She should respond one-half. Then give the student another half and again have her place the tile next to the whole bar in the tray. Ask the student how much she has now. She should respond one or a whole. If she responds that she has two halves, make sure to discuss how two halves equal one whole. Next, give the student another fractional piece such as the one-third tile and ask her how much she has now. If she has difficulty with this concept, explain that she now has one whole and one-third. Thus, she has one and one-third. Repeat this process with either the Fraction Circles or the Fraction Tiles using different fractions.

For advanced students, provide different types of tiles that add up to a whole such as 1/2 plus 1/4 plus 1/8 plus 1/8. This can lead into a discussion on how smaller fractions add up to make larger fractions, a concept taught later.

The next step is for the student to be able to read mixed numbers. Begin by going over multiple examples of mixed numbers while explaining the new Nemeth symbols. Then provide the student with multiple examples of mixed numbers and have the student read the numbers to you.

The Nemeth Code for writing mixed numbers has some extra indicators. To write a mixed number, begin by writing the numeral indicator then the whole number. The next indicator, dots 4-5-6, is used to denote that the whole number is connected to the fraction. Then write the fraction using the fraction indicator. When closing the fraction, the dot 4-5-6 indicator needs to be included followed by the simple closing fraction indicator. The mixed number indicators are ⠼ ⠸⠌

Here are some examples Nemeth:

$5\frac{1}{2}$: is ⠼⠑⠸⠌⠼⠁⠸⠌⠼⠃

$4\frac{3}{5}$: is ⠼⠙⠸⠌⠼⠉⠸⠌⠼⠑

$7\frac{5}{12}$: is ⠼⠛⠸⠌⠼⠑⠸⠌⠼⠁⠃

In the UEB Code mixed numbers do not include indicators and should be treated as two unspaced numeric items.

Examples: UEB

$5\frac{1}{2}$: is ⠼⠑⠼⠁⠌⠃

$4\frac{3}{5}$: is ⠼⠙⠼⠉⠌⠑

$7\frac{5}{12}$: is ⠼⠛⠼⠑⠌⠁⠃

Complete worksheet F 3-5.

Connections: Read the book *Fraction Action* by Loreen Leedy. In this book, Miss Prime teaches her class about fractions in five brief chapters. Concepts include dividing geometric shapes into fractions, dividing sets of objects into equal parts, cutting fruit into equal shares, and comparing the value of fractions. This book will provide a basic review in a lighthearted setting.

F 3-6
Fractions

Objective: The student will write mixed numbers involving halves to twelfths (i.e., in Nemeth Code, using mixed number indicators) out of sequence from dictation.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will use models, benchmarks, and equivalent forms to judge the size of fractions.

Suggested Materials:

- Perkins Brailler
- Slate and Stylus

Strategies: Once the student is able to identify and read the mixed numbers, the next step is for the student to write the mixed numbers. Refer to F 3-5 for the Nemeth Code and UEB Code used in writing mixed numbers.

For this activity, begin by providing the student with mixed numbers and have the student read them. As the student reads the mixed numbers, discuss the unique Nemeth or UEB Code that is used to write mixed numbers.

Next, ask the student to write a few simple fractions such as 1/2, 1/3, 3/5, etc. Make sure the student remembers how to write simple fractions and that the student does not add the mixed number indicators (dots 4-5-6). Next, ask the student to write a simple mixed number such

as 1 2/3. Ask the student to explain what he is writing as he goes through the steps. Provide the necessary feedback as the student writes the mixed numbers. Give the student multiple mixed numbers involving fractions up to twelfths.

Examples:

1 1/2
8 2/3
3 3/4
9 5/6
5 3/8
2 7/9
4 11/12
7 1/10
6 2/5

Connections: Along with learning to read and write mixed numbers, this is also a perfect time to teach the student how to set mixed numbers on the Cranmer abacus. Again, there are multiple texts that discuss methods for teaching students how to use an abacus. Please refer to the following text and use this opportunity to connect the abacus to class work.

The Abacus Made Easy APH Cat No. 4-00100-00

F 3-7
Fractions

Objective: The student will show quantities in decimal tenths and hundredths represented by manipulatives.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

Suggested Materials:

- APH Hundreds Board
- Pennies and dimes

Strategies: The student has learned parts of a whole through the lessons on fractions. The student will now be introduced to another way of representing parts of a whole: decimals. At this point, the student may not make the connection between fractions and decimals but future objectives will focus on this issue.

As with fractions, begin the exploration of decimals by demonstrating how decimal tenths and hundredths can be represented by manipulatives. The most obvious manipulatives to use at first are coins.

Provide the student with 10 pennies and one dime. Explain to the student that 10 pennies equals one dime. Thus a dime is made up of 10 parts, or pennies. Explain that one penny is one-tenth of a dime, two pennies are two-tenths of a dime, three pennies are three-tenths of a dime, etc. Have the student determine how much of a dime is represented by seven, eight, or nine pennies as you discuss this concept. It is also possible to use 10 dimes to equal one dollar for more advanced students.

The same activity can be used to explain hundredths using pennies for decimal hundredths. Even though this could be a messy activity, providing the student with 100 pennies will solidify the concept of decimal hundredths. Again, explain that one penny is one-hundredth of a dollar because it takes 100 pennies to make a dollar.

Because this is a very abstract concept, it is advisable to use other manipulatives such as the APH Hundreds Board or other commercially available manipulatives.

Using the APH Hundreds Board, begin exploring tenths by using the bottom row of the board. Remind the student that, as with fractions, the 10 pieces in the row equals one whole. Place one marker on the board and explain that the marker represents 0.1 or one-tenth of the whole. Repeat this with 0.2 or two-tenths. Add the third marker and allow the student to answer. Repeat this

exercise until the entire row is full representing a whole or one.

Next, repeat this exercise using the entire board. Explain to the student that a hundredth is smaller than a tenth. Using the entire board, each space represents one of 100 pieces that is equal to one. You may need to make the connection back to the penny activity. Provide the student with a random number of markers and have the student determine the decimal represented.

Example: Place markers on 24 of the spaces. Have the student count the 24 markers. Ask the student how much of the board is covered with markers. The student should respond 24 out of 100, which is 0.24.

Connections: U.S. money was the first currency in the world to be based totally on the decimal system. Provide the student with a shopping opportunity or an electronic shopping trip to purchase small items. Have the student identify the decimal tenths and hundredths of the price of each item and in the shopping total. Have the student correlate the coins to the decimal equivalent.

F 3-8
Fractions

Objective: The student will read numerals containing decimal tenths or hundredths.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

Suggested Materials:

Worksheet F 3-8

Strategies: Once the student has an understanding of decimals, the next step is to have the student read numerals containing decimal tenths and hundredths.

Writing decimals in Nemeth Code is quite simple. The decimal point is the dot 4-6 with no extra indicators.

Example: Nemeth

2.6 is ⠼⠃⠨⠋

3.78 is ⠼⠉⠨⠛⠓

.5 is ⠨⠑

In UEB the decimal point is dot 2-5-6

2.6 is ⠼⠃⠲⠋

3.78 is ⠼⠉⠲⠛⠓

.5 is ⠲⠑

You will notice that even without a whole number, there is no special indicator or treatment necessary.

Begin by providing the student with an example of a decimal tenth and discuss the Nemeth or UEB Code symbol for the decimal point. Provide the student with multiple examples of how to read both decimal tenths and hundredths.

It is also important that the student learn to read the decimals correctly. It is common practice for the decimal 3.5 to be read as "three point five." While this is acceptable, it is not the only way that a decimal can be read. When reading numbers that include decimals, the decimal point is read as "and" and the decimals are read according to their place value. Here are some examples:

2.3 is read as "two and three tenths"

1.6 is read as "one and six tenths"

4.94 is read as "four and ninety-four hundredths"

0.75 is read as "seventy-five hundredths"

While this is not the most common way of reading decimals, it is still important for the student to learn the formal way of reading decimals.

Complete worksheet F 3-8.

Connections: Calculators are now commonplace in the mathematics classroom, and talking calculators are available at competitive prices. Take the opportunity to introduce the talking calculator to the student, and make sure the student is able to find the decimal point and use it correctly.

F 3-9
Fractions

Objective: The student will write numerals containing decimal tenths or hundredths.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.

Suggested Materials:

- Perkins Brailler
- Slate and Stylus

Strategies: Begin by providing the student with examples of decimals written using Nemeth or UEB Code. Make sure to go over specific parts including the whole number, the decimal, and the decimal numbers. Ensure that the student understands that the dot 4-6 represents the decimal in Nemeth Code and dot 2-5-6 represents the decimal in UEB Code. It is also advisable to explain to the student with visual impairments how decimals look in print.

After the student has seen multiple examples of decimals, have the student write decimals with tenths and hundredths using appropriate Nemeth and UEB Code. It is important to vary the types of decimals that are written. Some examples include:

1.2
3.14
0.5
0.98
.4
.32
19.99
3.07
6.0
8.00

Provide the student with equivalent decimals such as 2.5 and 2.50. Explain that when working with decimals, zeros at the end of the decimals (as in 2.50) can be ignored.

Connections: This is the appropriate time to teach the student how to set decimal tenths and decimal hundredths on the Cranmer abacus. Please refer to one of the following for detailed

instructions on using the abacus.

The Abacus Made Easy APH Cat No. 4-00100-00

Using the Cranmer Abacus for the Blind
APH Cat No. 4-27110-00

F 3-10
Fractions

Objective: The student will compare decimals (tenths and hundredths) represented by an object, a picture, or a model.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will recognize and generate equivalent forms of commonly used fractions, decimals, and percents.

Suggested Materials:

- Decimal Tiles from the kit
- Perkins Brailler
- Slate and Stylus

Worksheet F 3-10

Strategies: Comparing decimals is another important concept for the student to understand. While not extremely difficult, decimals do provide a "twist" to the comparison of numbers.

Begin by providing the student with a few simple comparisons of whole numbers such as comparing 2 to 5. The student should have a basic understanding of comparing whole numbers.

Using the Decimal Tiles, have the student compare the lengths of 0.25 to 0.50. Have the student compare 0.75 (3 of the 0.25 tiles) to 0.80 (four of the 0.20 tiles). This will provide the student with a basic understanding that some decimals are larger than others.

Next, provide the student with two numbers that have decimal tenths such 2.4 and 5.8.

It is important to teach the systematic process of comparing decimals. There are multiple ways of teaching this concept, and here are two methods:

Method A: Have the student write the first number on his paper. Then demonstrate to the student how to write the second number underneath the first number, making sure the decimal points are aligned. Alignment of the

decimal points is critical. Next, have the student compare the number on the first line with the number on the second line moving from the left to the right. Explain to the student that he can find which one is bigger by looking at the numbers from left to right and comparing the numbers. The student should first compare the unit (ones) number, then the decimal tenths, and then the decimal hundredths if necessary.

Example 1: 3.45
2.98

The student compares the columns and determines which number is larger or smaller moving from left to right. In this example the number on the first line, 3.45, is greater.

Example 2: 0.72
0.75

In the second example, the numbers in the ones place are equal. Moving to the next column to the right, the numbers in the tenths place are also equal. Moving to the next column, the student can now compare the 2 and the 5 and determine that 0.75 is greater than 0.72.

Method B: Have the student write the two decimals on the same line. Explain to him that he needs to compare the two numbers starting with the units (or ones) place value. If those numbers are equal, then move to the right and compare the numbers in the tenths place. If those numbers are equal, then move to the right and compare the numbers in the hundredths place. This is a more abstract concept than Method A, but it is the final goal in the process of comparing decimals.

Have the student compare a variety of decimals.

Complete worksheet F 3-10.

Connections: Provide the student with an opportunity to explore decimals. Using the decimal tiles, have the student determine different combinations of tiles that will equal one whole. Have the student place the tiles in the tray above the “one whole” of the fraction tile set to determine if he is correct.

F 3-11
Fractions

Objective: The student will identify the relationship of simple fractions (halves, fourths, fifths, and tenths) to their decimal equivalent.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will recognize and generate equivalent forms of commonly used fractions, decimals, and percents.

NCTM Curriculum Focal Point

Suggested Materials:

- Decimal Tiles from the kit
- Fraction Tiles from the kit

Strategies: Up to this point, the activities have addressed fractions and decimals as two separate concepts. In this lesson, the objective is for the student to connect simple fractions with their decimal equivalents. The simple fractions used in this lesson also have applications to money.

These are the connections that will be addressed:

0.5 = 1/2
0.20 = 1/5
0.25 =1/4
0.75 = 3/4
0.1 = 1/10

0.2 = 2/10
0.3 = 3/10 etc.

Begin by discussing that fractions and decimals are different ways of showing parts of numbers. The student will be learning the most common relationships.

Tenths are the easiest parts of a whole to begin with because both the decimal and the fraction are stated the same way (one-tenth, two-tenths, etc.). Refer back to previous lessons on teaching tenths as both fractions and decimals. Provide the student with the 1/10 fraction tile and the 0.1 decimal tile. Have the student compare the two tiles to determine that they are the same length. Have the student read the numbers on each tile to discover that although one is written as a fraction and other is written as a decimal, they still represent the same number.

Using the Decimal and Fraction Tile Sets, provide the student with a 1/2 fraction tile and a 0.5 fraction tile. Ask the student to compare the two tiles with the expectation that the student will determine that they are equal. Have the student read the numbers on each tile to determine that one is written as a fraction and one is written as a decimal. Unlike the “tenths” the numbers

are significantly different in the way they are pronounced. However, the student should understand that the two numbers are equal.

Another way to explain this concept is to use coins. Provide the student with 100 pennies and have the student divide the pennies into 2 groups of 50. Have the student put the pennies in penny wrappers. Explain that each roll of pennies is equal to 50 cents and can be written as $0.50. Then explain that one roll, while being 0.5, is also 1/2 of a dollar. Make the connection that 0.5 is equal to 1/2.

Give the student the 1/5 fraction tile and the 0.20 decimal tile. Have the student compare the two tiles noting that the tiles are the same size but the numbers on the tiles are written and pronounced differently.

The most difficult concept for the student may be fourths and three-fourths. Give the student one quarter and explain that a quarter is equal to 25 pennies. Explain to the student that a quarter can be written as $0.25. Next, give the student two quarters and explain that two quarters are equal to $0.50 or half a dollar. Next, give the student another quarter and explain that three quarters are equal to $0.75 or 75 pennies. Finally, give the

student another quarter, making four quarters, and explain that the four quarters equal 100 pennies or $1.00.

Provide the student the 1/4 fraction tile and the 0.25 decimal tile. Have the student compare the two tiles noting that the tiles are the same size but the numbers on the tiles are written and pronounced differently.

Provide the student with three of the 1/4 fraction tiles. Have the student count the 1/4 fraction tiles by fourths: 1/4, 2/4, 3/4. Provide the student with three of the 0.25 decimal tiles. Help the student count the decimal tiles: 0.25, 0.50, 0.75. Remind the student how to skip count by 25. Help the student skip count the decimal tiles using the appropriate names for the decimals. Have the student compare the two sets of tiles noting that the total lengths of the tiles are the same but the names for the totals of the tiles are written and pronounced differently.

Connections: Number lines can be used to demonstrate that fractions and decimals can be equivalents. Use the APH Number Line Device to show the student how decimal tenths are noted on the number line. Use the decimal tenths

number line and the fraction number line to show the relationship between fractions and decimals.

F 3-12
Fractions

Objective: The student will solve addition and subtraction problems involving simple fractions with like denominators.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals.

Suggested Materials:

Worksheets F 3-12 (a) and F 3-12 (b)

Strategies: The student has been counting fraction tiles in previous lessons. Provide the student with a selection of the 1/10 fraction tiles. Help the student count the fraction tiles beginning with 1/10, 2/10, 3/10 etc. Explain to the student that adding fractions is very similar to counting fraction tiles.

Explain to the student that there are rules to use when adding and subtracting fractions. Go over the rules and make sure the student can repeat the rules to you.

Rule 1: We will only be adding and subtracting fractions that have the same denominators in this lesson. It is important to say "in this lesson" because this rule will disappear in later grades.

Rule 2: When adding and subtracting fractions, only the numerators are actually added or subtracted.

Rule 3: The denominator will remain the same in the answer.

After going over the rules, provide the student with a simple example such as 1/5 + 3/5. First ask the student if the denominators are the same. Once the student has determined that the denominators are the same, have the student add the numerator, 1 + 3 = 4. Then remind the student that the answer will have the 4 as a numerator but the denominator, or the bottom, will stay the same. Reinforce using the fraction

tiles if needed. Provide the student with other fraction problems using addition.

It is important to include problems such as 1/2 + 1/2 so that the student will get answers such as 2/2. Remind the student that when the numerator and the denominator are the same then the fraction is always equal to 1.

Complete similar examples with subtraction problems. Have the student place three of the 1/10 fraction tiles on the desk. Have the student move a 1/10 tile to the side. Ask the student what fraction was moved. What fraction is left? How can you write a number sentence to show this? Repeat with different fraction tiles. When the student has an understanding of the concept of subtraction, provide oral problems for the student to solve.

It is advisable to use only simple fractions. For addition problems, make sure that the answers will be equal to or less than 1. For subtraction problems, make sure to put the larger fraction first such as 3/5 – 1/5 = 2/5. If you reverse the order in this example, the answer would be a negative fraction. This may lead to confusion in later grades.

Complete worksheets F 3-12 (a) and F 3-12 (b).

Connections: Provide the student with an opportunity to explore adding fractions. Using the fraction tiles, have the student determine different combinations of tiles that will equal one whole. Have the student place the tiles in the tray above the "one tile" to determine if he is correct.

F 3-13
Fractions

Objective: The student will solve addition and subtraction problems involving decimal numbers with tenths or hundredths with no regrouping.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals.

Suggested Materials:

Worksheets F 3-13 (a) and F 3-13 (b)

Strategies: There are two methods for teaching addition and subtraction involving decimal numbers.

For most learners, the most appropriate way to teach addition and subtraction of decimal numbers is to begin by explaining to the student that she will have to write the numbers vertically. Similar to the method for comparing decimals, the decimal point must line up vertically. It may be appropriate to practice setting up the problems before actually completing the calculations.

Example:

```
  0.45
+ 0.52
```

After the numbers have been lined up, have the student add each column moving from the right to the left.

Provide the student with multiple problems for practice. For addition problems, make sure that the student does not need to regroup. For subtraction problems, make sure the problems do not require "borrowing." It is important to ensure the student has a good understanding of adding and subtracting decimals.

After the student has mastered the vertical problems, then the next step is for the braille users to write the problems horizontally as follows: 0.45 + 0.52 = __. To begin, provide the student with a simple problem involving only tenths such as 0.4 + 0.3 = __. Ask the student to write the problem on one line. Next, ask the student to explore the problem and tell you the units number in each decimal (in this example they should say "zero" for both). Next, ask the student to tell you the tenths digit for both decimals (four and three). Explain to the student that you should always add like things, units with units, tenths with tenths, hundredths with hundredths. Remind the student that you will add from right to left. Thus, for this answer the student would add 4 + 3 = 7 and 0 + 0 = 0. Explain to the student that she must write the two numbers while putting the decimal in the correct position (0.7).

Complete worksheets F 3-13 (a) and F 3-13 (b).

Connections: It is appropriate at this time to teach the student how to add and subtract decimals using the Cranmer abacus. Please refer to one of the following for detailed instructions on using the abacus.

The Abacus Made Easy APH Cat No. 4-00100-00

Using the Cranmer Abacus for the Blind
APH Cat No. 4-27110-00

F 3-14
Fractions

Objective: The student will solve addition and subtraction problems involving decimal numbers with tenths and hundredths on a calculator.

NCTM Standard: Number and Operation for 3 - 5 – Understand numbers, ways of representing numbers, relationships among numbers, and number systems. All students will use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals.

Suggested Materials:

- Talking calculator

Strategies: The calculator is a valuable tool for adding and subtracting decimals and the student with visual impairment needs explicit instruction in how to use a talking calculator.

Begin by reintroducing the talking calculator to the student and go over the numeric keypad. Show the student how the center key often has an indicator. After the student understands where the numbers are, show him where the decimal and "repeat" buttons are located. Ask the student to type in various numbers using both the decimal and repeat keys.

Once the student demonstrates an understanding of the numeric keys, show him where the addition and subtraction keys are located. Begin with addition and subtraction problems that do not include decimals. Once the student becomes proficient, give him problems that include decimals.

Caution: It is not advisable to put Nemeth or UEB Code labels on the keys unless addressed in the IEP as a need. Students need to be able to use the numeric keypad and should learn to use it without special adaptations from the beginning.

Connections: Talking calculators come in various sizes and models. If you have different types of calculators, allow the student to explore the calculators and determine the differences. After the student has a solid understanding of one calculator, give the student a different calculator and allow him to "discover" the location of the keys.

Assessment Check List

Objective	Date/Rating Notes
Kindergarten	
F K-1 Recognize whole objects and discriminate them from like objects that are not whole.	
F K-2 Demonstrate fractional parts as equal parts or fair shares.	
F K-3 Use half and whole in real life.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance
2 = Developing level of performance
3 = Accomplished/Mastery level of performance

Objective	Date/Rating Notes
First Grade	
F 1-1 Identify half of a whole object, picture, and/or fractional part.	
F 1-2 Identify one-third and one-fourth of a whole object, picture, and/or fractional model.	
F 1-3 Identify half of a set of objects.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance
2 = Developing level of performance
3 = Accomplished/Mastery level of performance

Objective	Date/Rating Notes
Second Grade	
F 2-1 Use objects and fractional models to identify the whole and the fractional parts of the whole for halves, thirds, and fourths.	
F 2-2 Use objects or a set of pictures to identify the fractional part of a set for halves, thirds, and fourths.	
F 2-3 Use objects and fractional models to identify the whole and the fractional parts of the whole to twelfths.	
F 2-4 Use objects or a set of pictures to identify the fractional parts of a set for fractions to twelfths.	

Objective	Date/Rating Notes
F 2-5 Read fractions 1/2 to 12/12 and associate the written form with the corresponding fractional parts of a whole and fractional parts of a set.	
F 2-6 Write fractions from 1/2 to 12/12 from dictation.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance
2 = Developing level of performance
3 = Accomplished/Mastery level of performance

Objective	Date/Rating Notes
Third Grade	
F 3-1 Use an object, a picture, or a fraction model to identify the fractional part of a whole for halves to twelfths.	

Objective	Date/Rating Notes
F 3-2 Use a set of objects or a set of pictures to identify the fractional part of a set for halves to twelfths.	
F 3-3 Read and write fractions for 1/2 to 12/12 and associate the written form with the corresponding fractional part of a whole or fractional part of a set.	
F 3-4 Compare simple fractions (halves, thirds, and fourths) represented by an object, a picture, or a fractional model.	
F 3-5 Identify and read mixed numbers involving fractions for halves to twelfths and associate the written form with the corresponding fractional part of a whole or fractional part of a set.	

Objective	Date/Rating Notes
F 3-6 Write mixed numbers involving halves to twelfths (i.e., in Nemeth Code, using mixed number indicators) or in UEB Code without mixed number indicators. and as two unspaced numerals. out of sequence from dictation.	
F 3-7 Show quantities in decimal tenths and hundredths represented by manipulatives.	
F 3-8 Read numerals containing decimal tenths or hundredths.	
F 3-9 Write numerals containing decimal tenths or hundredths.	
F 3-10 Compare decimals (tenths and hundredths) represented by an object, a picture, or a model.	

Objective	Date/Rating Notes
F 3-11 Identify the relationship of simple fractions (halves, fourths, fifths, and tenths) to their decimal equivalent.	
F 3-12 Solve addition and subtraction problems involving simple fractions with like denominators.	
F 3-13 Solve addition and subtraction problems involving decimal numbers with tenths or hundredths with no regrouping.	
F 3-14 Solve addition and subtraction problems involving decimal numbers with tenths and hundredths on a calculator.	

Use the following rating scale to indicate the student's current level of performance of each objective:

1 = Beginning level of performance
2 = Developing level of performance
3 = Accomplished/Mastery level of performance

Appendix A

Appendix A
Related Math Materials available from American Printing House for the Blind

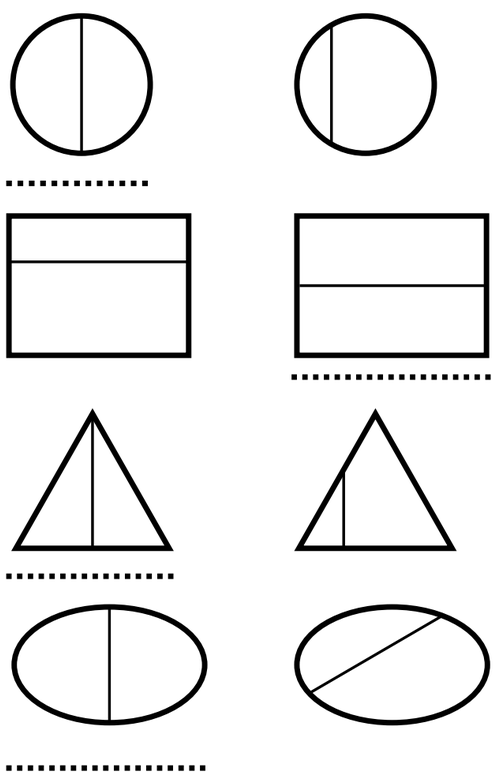
APH Product	Catalog Number
Aluminum Diagramming Foil	1-04090-00
APH Number Line Device	1-03480-00
Chang Tactual Diagram Kit	1-03130-00
Cranmer Abacus	1-03150-00
DRAFTSMAN Tactile Drawing Board	1-08857-00
Embossed Graph Sheets	1-04069-00
Fractional Parts of Wholes Set	1-03290-00
Picture Maker Accessories: Textured shapes	61-151-168
Puzzle Form Board Kit	1-03721-00
Tactile Graphics Kit	1-08851-00

Answer Key for Worksheets

Please Note: All student work and all braille teacher answer sheets will use the horizontal fraction line. The print teacher answer sheets show a diagonal fraction line to maintain the size of the font.

F K-2 Fractions

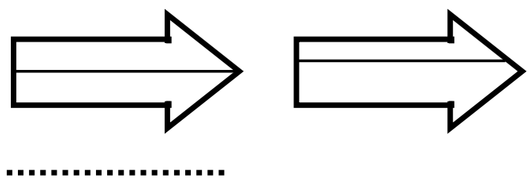
Find the shape that is divided into equal parts.



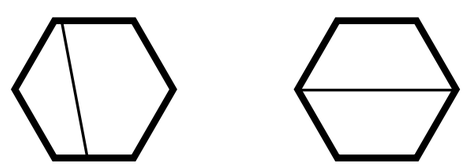
F 1-1 Fractions

Mark the shape that is divided into equal parts.

1.

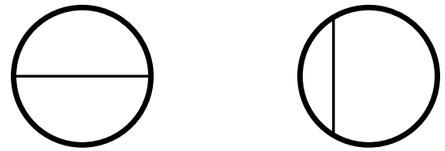


2.



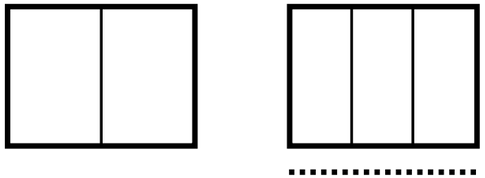
3.

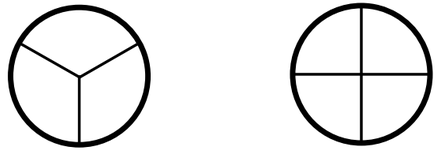
4.

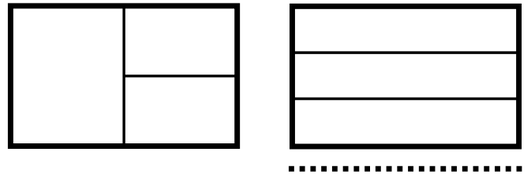


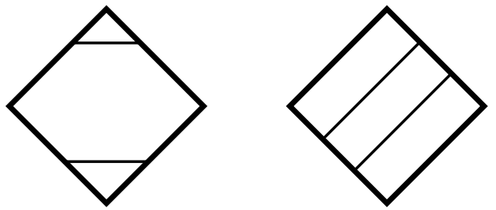
F 1-2 (a) Fractions

Mark the shape that shows thirds.

1. 

2. 

3. 

4. 

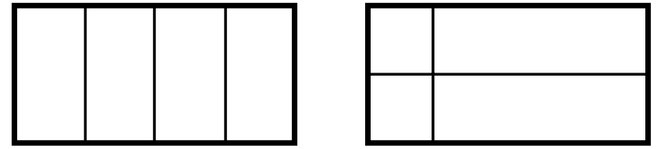
F 1-2 (b) Fractions

Mark the shape that shows fourths.

1. 

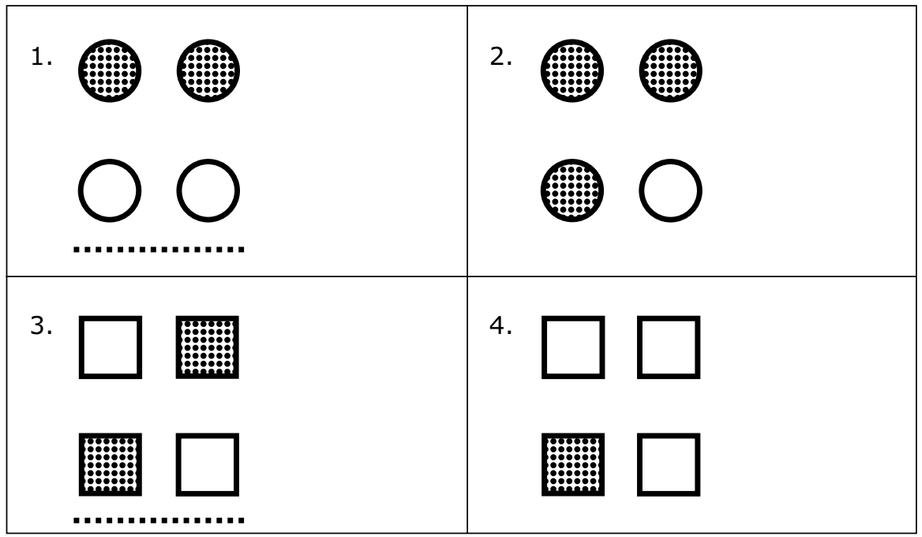
2. 

3. 

4. 

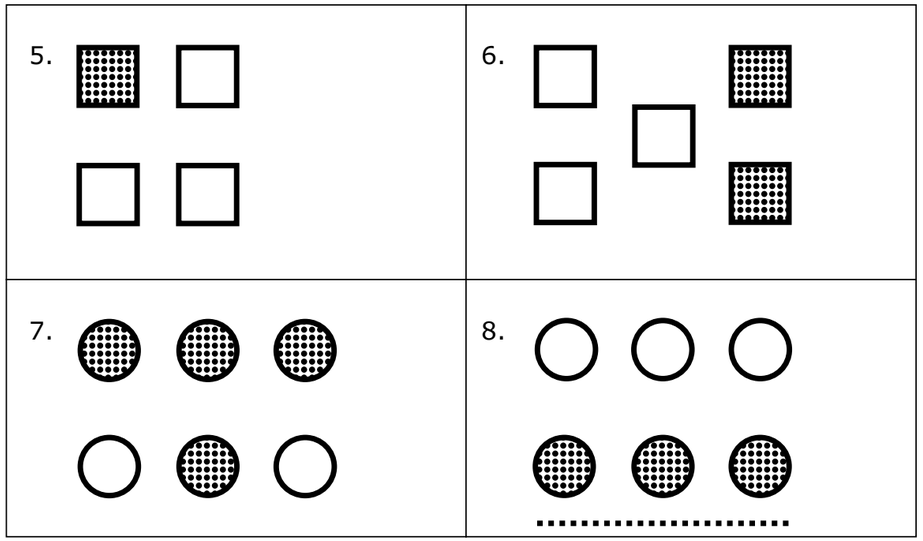
F 1-3 Fractions (1 of 2 sheets)

Mark the box that shows one-half of the set textured.



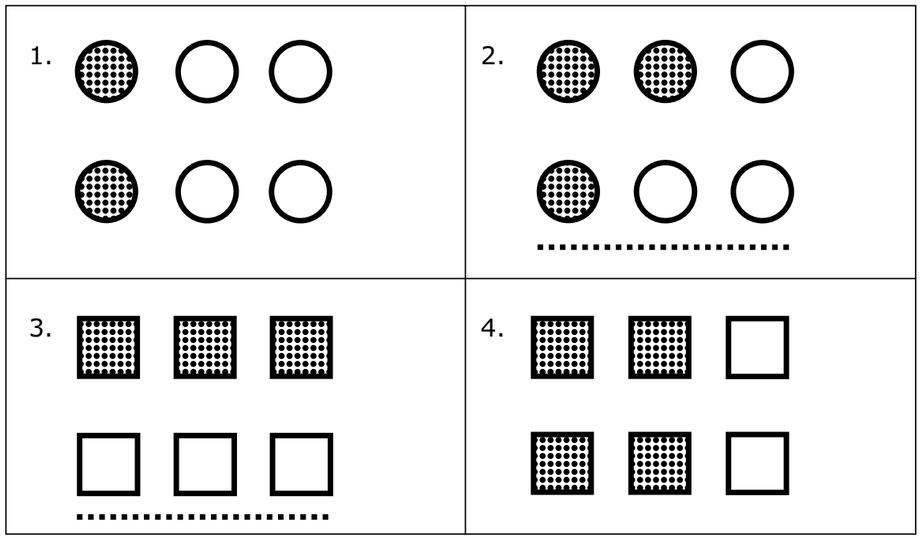
F 1-3 Fractions (2 of 2 sheets)

Mark the box that shows one-half of the set textured.



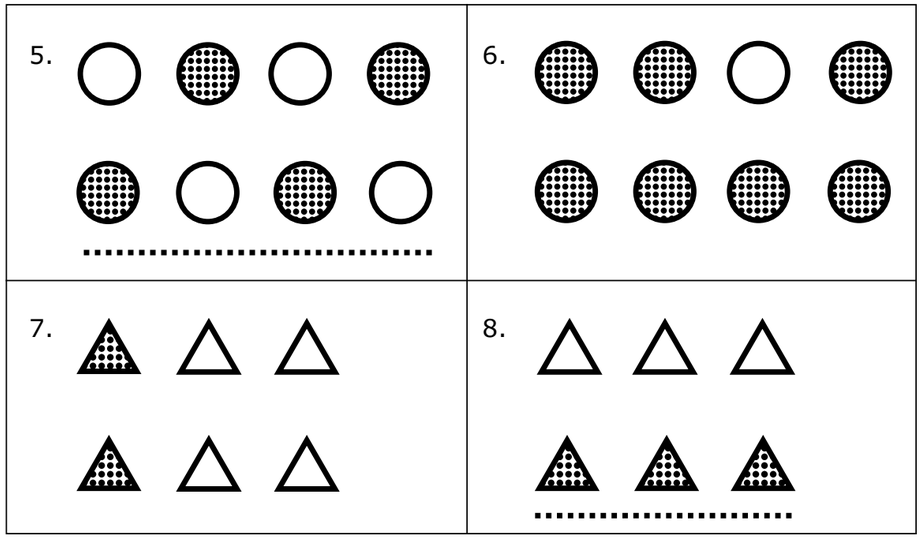
F 2-2 (a) Fractions (1 of 2 sheets)

Mark the box that shows one-half of the set textured.



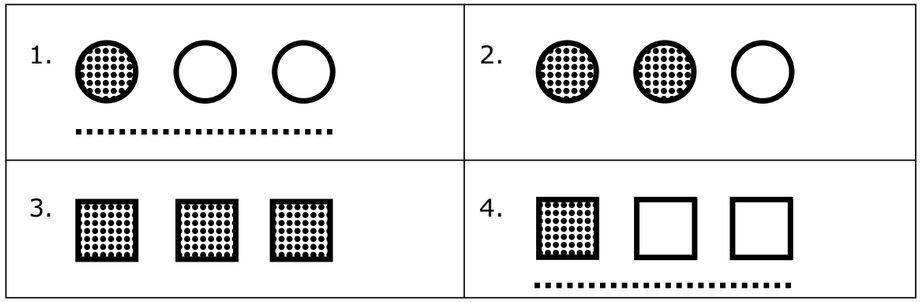
F 2-2 (a) Fractions (2 of 2 sheets)

Mark the box that shows one-half of the set textured.



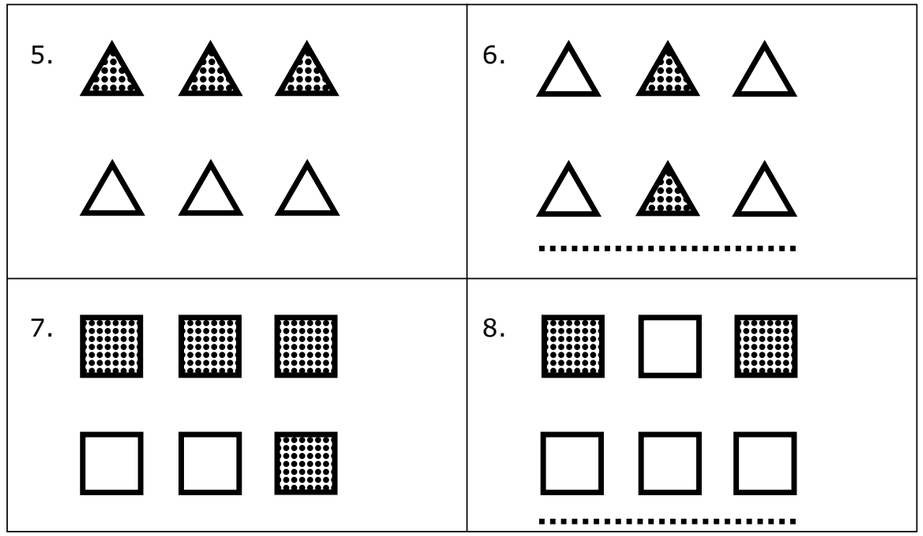
F 2-2 (b) Fractions (1 of 2 sheets)

Mark the box that shows one-third of the set textured.



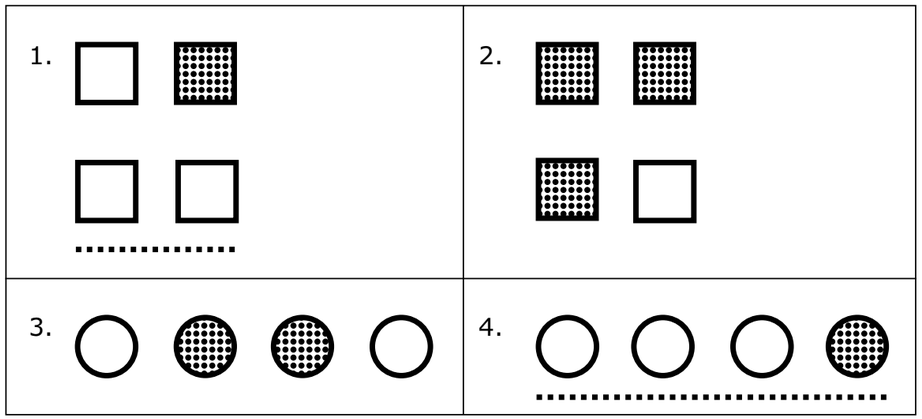
F 2-2 (b) Fractions (2 of 2 sheets)

Mark the box that shows one-third of the set textured.



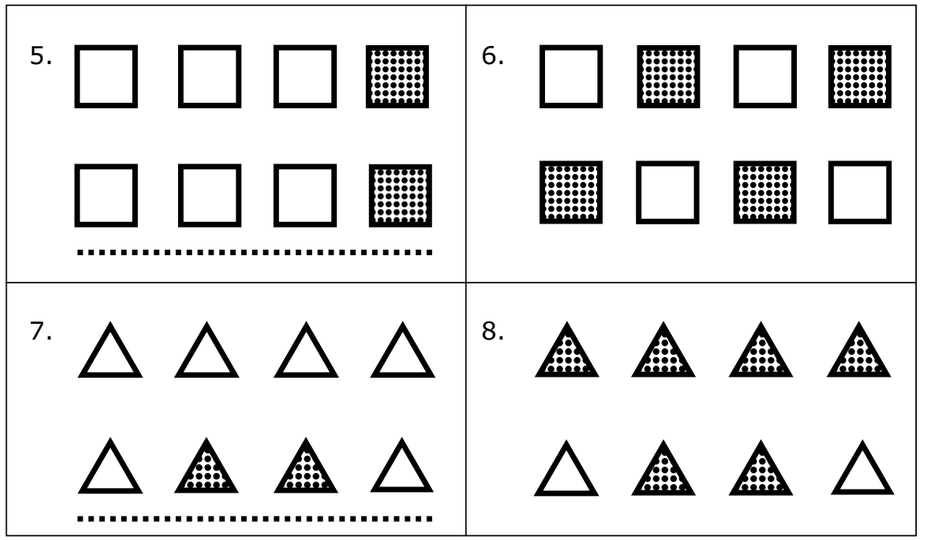
F 2-2 (c) Fractions (1 of 2 sheets)

Mark the box that shows one-fourth of the set textured.



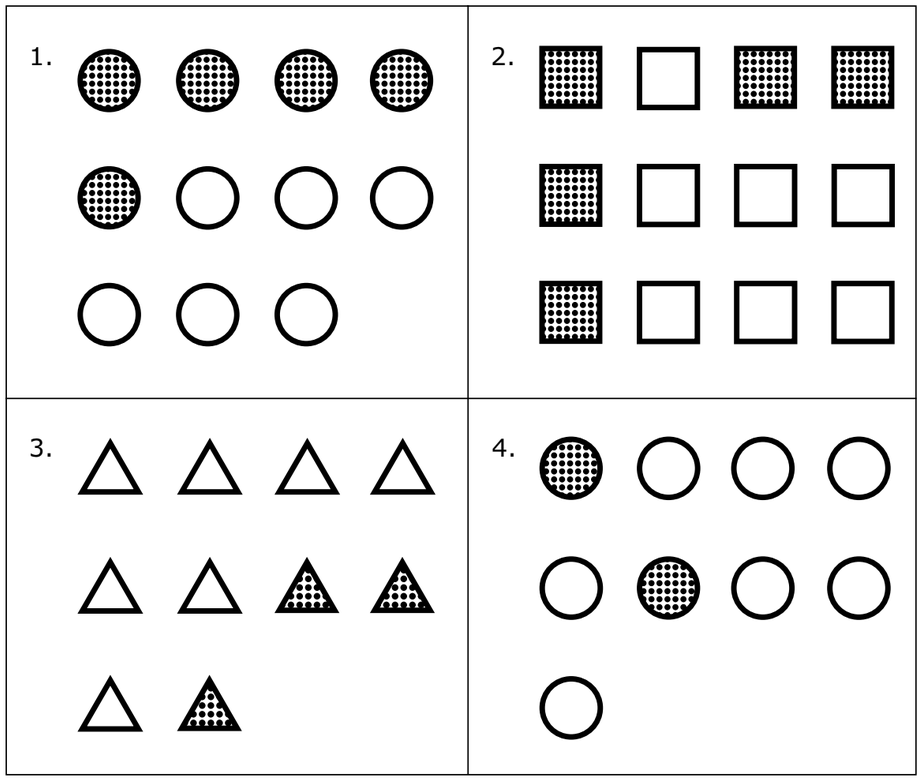
F 2-2 (c) Fractions (2 of 2 sheets)

Mark the box that shows one-fourth of the set textured.



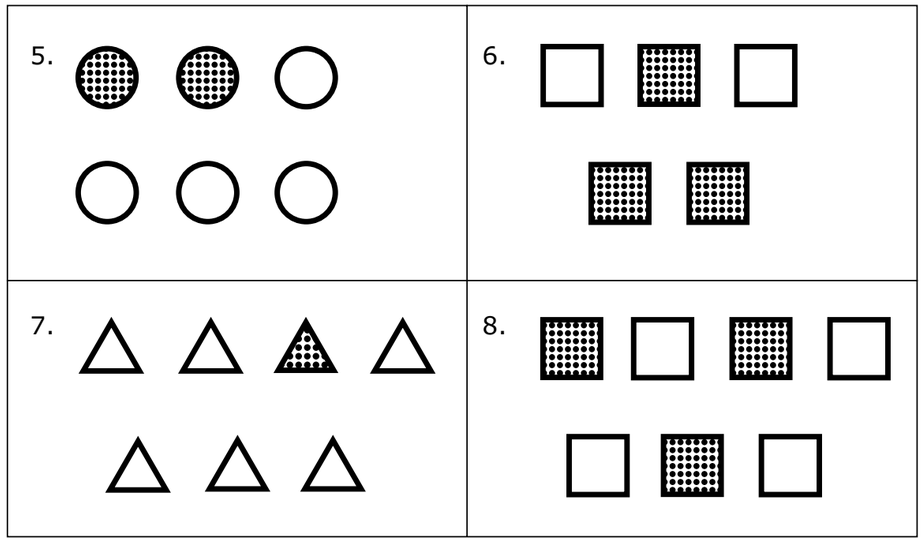
F 2-4 (a) Fractions (1 of 2 sheets)

For each set of figures, tell the fractional part that is textured. Tell the fractional part that is smooth.



F 2-4 (a) Fractions (2 of 2 sheets)

For each set of figures, tell the fractional part that is textured. Tell the fractional part that is smooth.

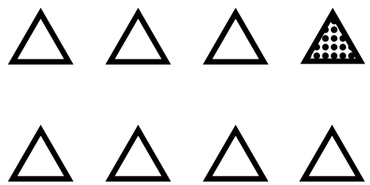


1. T 5/11, S 6/11
2. T 5/12, S 7/12
3. T 3/10, S 7/10
4. T 2/9, S 7/9
5. T 2/6, S 4/6
6. T 3/5, S 2/5
7. T 1/7, S 6/7
8. T 3/7, S 4/7

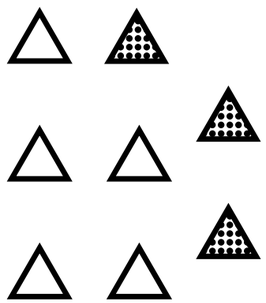
F 2-4 (b) Fractions (1 of 3 sheets)

For each set of figures, tell the fractional part that is textured. Tell the fractional part that is smooth.

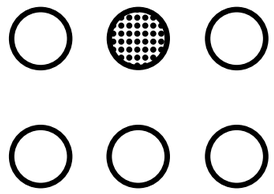
1.



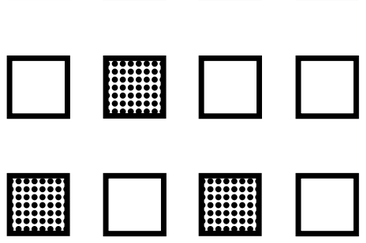
2.



3.



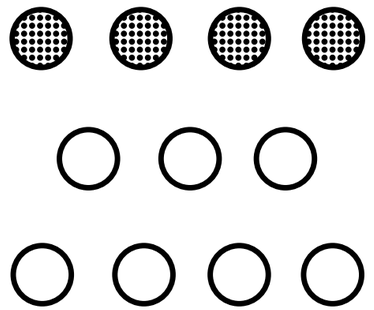
4.



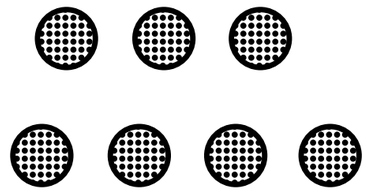
F 2-4 (b) Fractions (2 of 3 sheets)

For each set of figures, tell the fractional part that is textured. Tell the fractional part that is smooth.

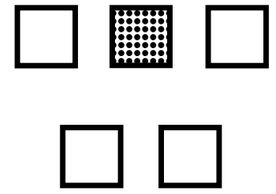
5.



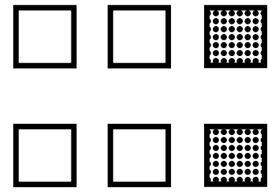
6.



7.



8.



F 2-4 (b) Fractions (3 of 3 sheets)
For each set of figures, tell the fractional part that is textured. Tell the fractional part that is smooth.

1. T 1/8, S 7/8
2. T 3/8, S 5/8
3. T 1/6, S 5/6
4. T 4/12, S 8/12
5. T 4/11, S 7/11
6. T 7/7 or 1
7. T 1/5, S 4/5
8. T 2/6, S 4/6

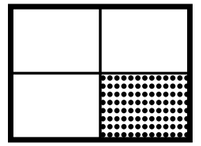
F 2-5 (a) Fractions
Read the fractions.

1. 1/2
2. 2/3
3. 4/5
4. 4/6
5. 3/4
6. 1/3
7. 3/7
8. 2/6
9. 4/4
10. 5/6
11. 4/7
12. 2/5
13. 1/4
14. 1/7
15. 3/6
16. 2/2
17. 3/5
18. 5/7
19. 1/6
20. 2/7

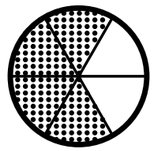
F 2-5 (b) Fractions
Read the fractions.

1. 1/8
2. 3/10
3. 5/12
4. 9/11
5. 2/9
6. 12/12
7. 4/8
8. 3/11
9. 9/10
10. 5/9
11. 3/8
12. 7/12
13. 10/11
14. 7/10
15. 1/9
16. 2/11
17. 3/12
18. 7/8
19. 8/9
20. 7/11

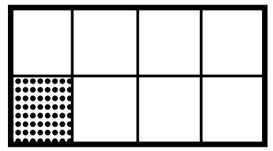
F 3-1 (a) Fractions
On a separate sheet of paper write the fraction that tells what part of each shape is textured.

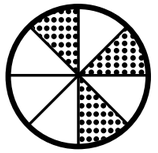
1. 

2. 

3. 

4. 

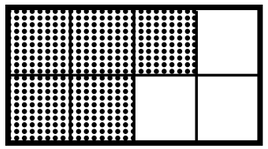
5. 

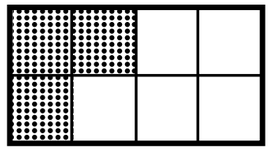
6. 

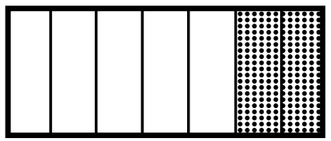
1. 1/4
2. 2/4
3. 4/6
4. 2/6
5. 1/8
6. 3/8

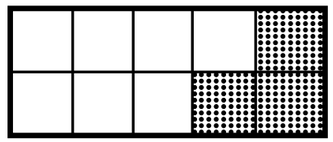
F 3-1 (b) Fractions

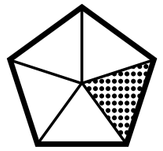
On a separate sheet of paper write the fraction that tells what part of each shape is textured.

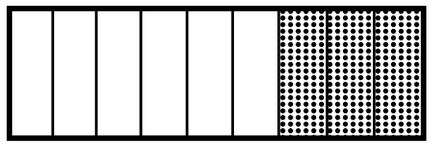
1. 

2. 

3. 

4. 

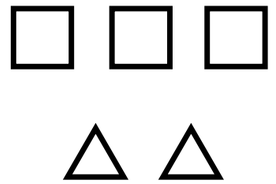
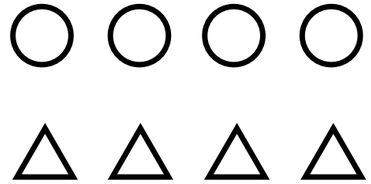
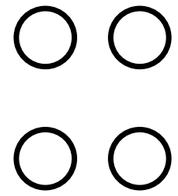
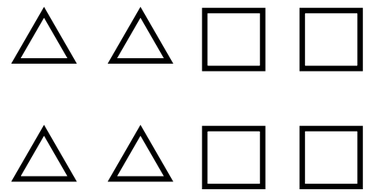
5. 

6. 

1. 5/8
3. 2/7
5. 1/5
2. 3/8
4. 3/10
6. 3/9

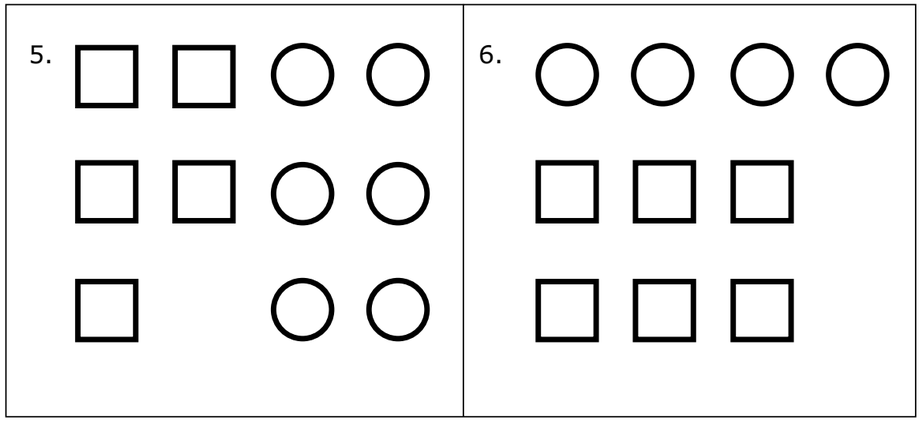
F 3-2 Fractions (1 of 2 sheets)

Tell the fractional parts of each of the different types of shapes that make up the set. Write your answer on a separate sheet of paper (ex. squares 1/2 and circles 1/2).

1. 	2. 
3. 	4. 

F 3-2 Fractions (2 of 2 sheets)

Tell the fractional parts of each of the different types of shapes that make up the set. Write your answer on a separate sheet of paper (ex. squares 1/2 and circles 1/2).



1. square 3/5, triangle 2/5
2. circle 4/8, triangle 4/8
3. circle 4/4 or 1
4. triangle 4/8, square 4/8
5. square 5/11, circle 6/11
6. circle 4/10, square 6/10

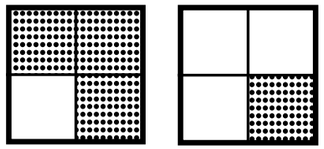
F 3-3 Fractions

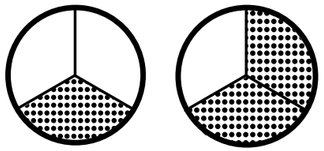
Read the fractions.

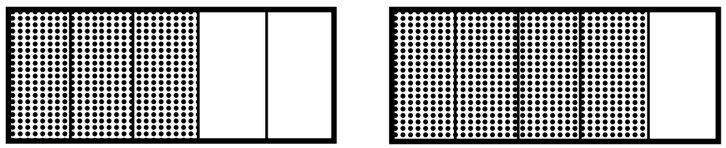
1. 3/3
2. 2/4
3. 7/7
4. 1/5
5. 5/6
6. 4/10
7. 5/8
8. 4/9
9. 6/11
10. 11/12
11. 1/2
12. 2/6
13. 5/10
14. 3/12
15. 3/9
16. 3/4
17. 6/7
18. 4/5
19. 9/12
20. 4/8

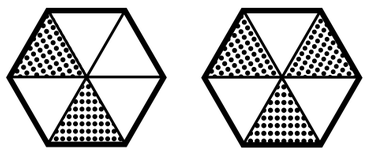
F 3-4 (a) Fractions

In each row, mark the shape that shows the largest fractional part textured.

1. 

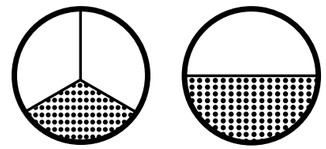
2. 

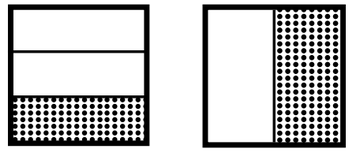
3. 

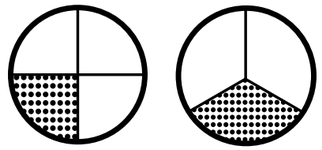
4. 

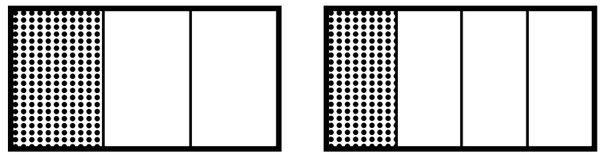
F 3-4 (b) Fractions

In each row, mark the shape that shows the largest fractional part textured.

1. 

2. 

3. 

4. 

F 3-5 Fractions

Read the following numbers.

1. 4 1/2
2. 2 3/8
3. 7 9/10
4. 2 2/3
5. 8 11/12
6. 6 3/4
7. 5 7/8
8. 1 1/4
9. 3 7/11
10. 12 1/3
11. 6 5/6
12. 7 2/5
13. 4 3/5
14. 8 3/8
15. 2 5/12
16. 9 3/10
17. 3 2/9
18. 7 2/7
19. 5 9/11
20. 2 7/10

F 3-8 Fractions

Read the following numbers.

1. 2.5
2. 3.4
3. 7.02
4. 1.9
5. 0.75
6. 0.8
7. 9.76
8. 4.19
9. 0.56
10. 2.35
11. 11.02
12. 7.32
13. 9.99
14. 0.04
15. 2.80
16. 1.00
17. 5.50
18. 3.98
19. 19.97
20. 1.05

F 3-10 Fractions

Mark the largest number.

1.	<u>0.6</u>	0.5
2.	0.2	<u>0.9</u>
3.	<u>3.5</u>	2.1
4.	7.6	<u>7.8</u>
5.	0.04	<u>0.14</u>
6.	0.03	<u>0.08</u>
7.	4.01	<u>4.10</u>
8.	<u>10.53</u>	5.35
9.	<u>1.9</u>	1.15
10.	4.1	<u>4.18</u>

F 3-12 (a) Fractions

Solve the addition problems. Write your answer on a separate sheet of paper.

1. 1/2 + 1/2 = 1
2. 2/4 + 1/4 = 3/4
3. 1/5 + 3/5 = 4/5
4. 2/7 + 3/7 = 5/7
5. 1/9 + 5/9 = 6/9
6. 1/3 + 1/3 = 2/3
7. 8/11 + 1/11 = 9/11
8. 5/10 + 4/10 = 9/10
9. 2/5 + 2/5 = 4/5
10. 7/12 + 3/12 =10/12
11. 4/7 + 1/7 = 5/7
12. 2/8 + 4/8 = 6/8
13. 2/9 + 3/9 = 5/9
14. 5/11 + 2/11 = 7/11
15. 1/12 + 3/12 =4/12
16. 5/6 + 1/6 = 6/6 or 1
17. 1/7 + 3/7 = 4/7
18. 4/12 + 3/12 = 7/12
19. 2/12 + 2/12 = 4/12
20. 2/6 + 1/6 = 3/6

F 3-12 (b) Fractions

Solve the subtraction problems. Write your answer on a separate sheet of paper.

1. 1/2 - 1/2 = 0
2. 2/3 - 1/3 = 1/3
3. 3/4 - 1/4 = 2/4
4. 7/12 - 4/12 = 3/12
5. 3/3 - 2/3 = 1/3
6. 5/11 - 4/11 = 1/11
7. 7/8 - 5/8 = 2/8
8. 5/6 - 2/6 = 3/6
9. 2/9 - 1/9 = 1/9
10. 5/9 - 3/9 = 2/9
11. 9/11 - 2/11 = 7/11
12. 11/12 - 5/12 = 6/12
13. 3/4 - 2/4 = 1/4
14. 6/9 - 2/9 = 4/9
15. 10/12 - 6/12 = 4/12
16. 3/3 - 2/3 = 1/3
17. 4/5 - 1/5 = 3/5
18. 9/10 - 3/10 = 6/10
19. 3/5 - 2/5 = 1/5
20. 4/7 - 2/7 = 2/7

F 3-13 (a) Fractions

Solve the addition problems. Write your answer on a separate sheet of paper.

1. 0.5 + 0.4 = 0.9
2. 1.2 + 1.7 = 2.9
3. 3.0 + 2. 5 = 5.5
4. 1.80 + 0.15 = 1.95
5. 0.45 + 0.34 = 0.79
6. 0.04 + 0.03 = 0.07
7. 5.00 + 2.33 = 7.33
8. 2.80 + 0.15 = 2.95
9. 1.98 + 0.01 = 1.99
10. 3.35 + 0.14 = 3.49
11. 0.3 + 0.09 = 0.39
12. 0.03 + 0.1 = 0.13
13. 5.25 + 1.74 = 6.99
14. 0.03 + 0.15 = 0.18
15. 4.1 + 5.18 = 9.28

F 3-13 (b) Fractions

Solve the subtraction problems. Write your answer on a separate sheet of paper.

1. 5.25 - 1.10 = 4.15
2. 2.45 - 1.22 = 1.23
3. 0.5 - 0.4 = 0.1
4. 0.55 - 0.45 = 0.10
5. 8.99 - 0.89 = 8.10
6. 0.80 - 0.70 = 0.10
7. 0.66 - 0.55 = 0.11
8. 6.45 - 2.35 = 4.10
9. 0.99 - 0.47 = 0.52
10. 3.50 - 0.40 = 3.10
11. 2.35 - 1.35 = 1.00
12. 5.55 - 0.55 = 5.00
13. 9.10 - 1.10 = 8.00
14. 7.13 - 2.10 = 5.03
15. 1.90 - 0.80 = 1.10

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