At RPDP, we support educators through professional development. Professional development can occur in a variety of ways: Entire staff trainings, grade level meetings, one-on-one support, etc. We collaborate with administrators and teachers regarding the developing and strengthening math content knowledge, use of best practices in the classroom, we model lessons, and provide support for the use of quality instructional materials.

Providing educators with quality resources in regards to instructional materials is a continuous priority. We provide this support through math content overviews, the use of instructional materials, further practice/skill development materials, and through quality assessments/tasks. As we work to create these resources for educators, we may recommend other quality resources from time to time.

In recent years, some states have received funds to create quality instructional materials for ALL educators for ALL states to access. We have selected some of those materials that we believe support our vision of quality instructional materials that support teachers in providing a solid mathematical foundation for students. For more elementary math resources please visit Rpdp.net .

Exploring Fractions

Grade 3 Mathematics



This unit contains 8 lessons and 2 Curriculum Embedded performance assessments. The focus of the unit is developing an understanding of fractions, especially fractions with numerators of 1 (unit fractions). This is Critical Area 2 in the Massachusetts Mathematics Curriculum Frameworks for grade 3. The standards addressed are 3.NF.1, 3.NF.2 and 3.G.2. The unit uses visual fraction models to represent fractions on a number line and word problems that connect fractions to real world applications.

These Model Curriculum Units are designed to exemplify the expectations outlined in the MA Curriculum Frameworks for English Language Arts/Literacy and Mathematics incorporating the Common Core State Standards, as well as all other MA Curriculum Frameworks. These units include lesson plans, Curriculum Embedded Performance Assessments, and resources. In using these units, it is important to consider the variability of learners in your class and make adaptations as necessary.

Table of Contents

Stage 1 Desired Results

ESTABLISHED GOALS

G

CONTENT STANDARDS:

3.NF.1

Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.

3.G.2

Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.

3.NF.2

Understand a fraction as a number on the number line; represent fractions on a number line diagram.

a. Represent a fraction $\frac{1}{b}$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size $\frac{1}{b}$ and that the endpoint of the part based at 0 locates the number $\frac{1}{b}$ on the number line.

b. Represent a fraction $\frac{a}{b}$ on a number line diagram by marking off a lengths $\frac{1}{b}$ from 0. Recognize that the resulting interval has size $\frac{a}{b}$ and that its endpoint locates the number $\frac{a}{b}$ on the number line.

Transfer

Students will be able to independently use their learning to apply mathematical knowledge to analyze and model mathematical relationships in the context of a situation in order to make decisions, draw conclusions, and solve problems.

T

Meaning

UNDERSTANDINGS **U**

Students will understand that…

U1 fractions are numbers.

U2 fractions show the relationship between the whole and its parts.

U3 fractions, in general, are built out of unit fractions (a fraction with a numerator of 1).

U4 a fraction can be represented in different ways. (i.e., number line, visual fraction models)

ESSENTIAL QUESTIONS **Q**

Q1 Why do we need fractions?

Q2 How do we use fractions in our everyday lives?

Q3 How do models help us understand fractions?

Acquisition

Students will know… **K**

K1 unit fractions are formed by partitioning a whole or set into equal parts.

K2 the greater the number of parts, the smaller the unit fraction**.**

K3 The numerator represents the total number of equal parts in the whole and the denominator represents the number of parts being addressed.

K4 the size of a fractional part is relative to the size of the whole.

K5 the value of a fraction as represented on a number line.

K6 Academic vocabulary: fraction, part,

Students will be skilled at… **S**

S1 partitioning a whole or set into equal parts.

S2 creating and using visual fraction models.

S3 writing fractions in number and word form.

S4 naming how many unit fractions make up the whole

S5 find and name a fractional location on a number line

STANDARDS FOR MATHEMATICAL PRACTICE: **SMP2:** Reason abstractly and quantitatively. **SMP 4:** Model with Mathematics. **SMP6** Attend to precision. **SMP7:** Look for and make use of structure.	fractional parts, unit fraction, numerator, denominator, equal parts, equal share, half, halves, model, number line, open number line, partition, interval, end-point	

Stage 2 - Evidence

Evaluative Criteria	Assessment Evidence
See CEPA rubrics	TRANSFER TASK(S): • CEPA #1: Cake Attack! (administered at the end of Lesson 4) • CEPA #2: (administered at the end of the unit—after lesson 8)

OTHER EVIDENCE:
-Lesson pre-assessments -Verbal questioning
-Student observation -Lesson Independent Practice
-Lesson Post-assessments

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

1. Working in cooperative groups, create posters showing the relationship between the "whole" and a unit fractional part. **(Lesson 1)**
2. Use fraction circles to model fractional parts greater than a unit fraction. Record answers in a table and look for patterns. **(Lesson 2)**
3. Using Cuisenaire rods as a model, students show fractions of different size wholes. **(Lesson 3)**
4. Using Pattern Blocks as a model, students build wholes given a fractional part of the same whole. **(Lesson 4)**
5. Share sets of objects that can be evenly divided among sharers using square tiles and counters as models. Identify a unit fractional part of a set and identify a set if a unit part is given. **(Lesson 5)**

6. Students use Cuisenaire Rods to model fractional parts of the distance 1 whole on number lines. **(Lesson 6)** 7. Using Cuisenaire Rods as a model for fractional intervals of length, students build a length of "1 whole". **(lesson 7)** 8. Using Cuisenaire Rods, students model fractions that are greater than 1 whole on an open number line. **(lesson 8)**
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Lesson 1: Naming Unit Fractions

Brief Overview: Working in cooperative groups, students create posters showing the relationship between the "whole" and a unit fractional part. The lesson focuses on the use of precise mathematical language (SMP.6 *Attend to precision)* by students and teachers. The teacher initially uses modeling then provides on-going scaffolding as students communicate understandings to each other. It is critically important for teachers to promote the use of precise language by students throughout the lesson. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required: Students are able to partition circles and rectangles into two, three, or four *equal* shares. Students can recognize and describe equal shares using the terms equal, halves, thirds, etc.

Estimated Time: 60 minutes

Resources for Lesson:

- ✓ Square paper cut die cuts (all one color)
- ✓ Rectangular paper strips (all one color)
- ✓ Circular paper cut outs (all one color)
- ✓ Large chart paper
- ✓ Scissors
- ✓ Glue sticks
- ✓ Marker

Content Area/Course: Grade 3 Fractions
Unit: Exploring Fractions
Time (minutes): 60 Minutes
Lesson #: 1 ***Naming Unit Fractions***

Objectives*:*

-Students will create, name, and write unit fractions by partitioning a whole into equal parts.
-Students will understand the purpose of the numerator and denominator when writing a fraction in number form.

Language Objectives:
Student will define and explain a unit fraction by creating a poster that illustrates the relationship between the whole, the unit fraction, and the numerator/denominator.

Essential Questions addressed in this lesson:

Why do we need fractions?

Standard(s)/Unit Goal(s) to be addressed in this lesson:
3.NF.1 Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.
SMP.6 Attend to precision.
SL 3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

Anticipated Student Preconceptions/Misconceptions:

-Students may reverse the numerator and denominator

Pre-Assessment:
See attachment.

What students need to know and are able to do coming into this lesson:

Students are able to partition circles and rectangles into two, three, or four *equal* shares.
Students can recognize and describe equal shares using the terms equal, halves, thirds, etc.

Lesson Sequence and Description
Teacher notes and student supports:
All academic vocabulary words need to be posted with illustrations or graphics.

fractional parts
unit fraction
half and halves
equal parts
equal share
model

NOTE: Numerator and Denominator are NOT key vocabulary terms for this lesson. Yet, they are key terms that have cognates in other languages.

1. Background Knowledge: (Link to student experience): Teacher **may** bring in an apple (or other piece of fruit) and *role play* with a student cutting it in half and sharing the fraction. No explanation of specific vocabulary is needed. This is only used to engage students and to scaffold for students who may need to tap prior knowledge.

Introduction and Engagement Activity: (15 minutes)

2. Introduce the unit to the students: *Today we are going to start a new unit. We will be studying fractions.*
   Turn to your partner and discuss the following questions:

   What is a fraction?
   What do fractions mean to you?
   Why do we need fractions?

Stop and Jot: Teacher or students will jot down ideas/answers to questions.

Have one or two students share what they talked about with their partners.

3. Tell students: "A fraction is a number that represents a part of a shape or object. Fractions can also represent distance, length, and capacity. You are going to use what you know about creating equal parts of shapes to name and write fractions for these parts".

4. Give the directions: "You will be working in teams of three or four. Each team will create a poster that shows the whole, fractional parts, and unit fraction for each number of equal shares. Each team will present their poster to the class. Not every group will have the same whole. The different fractional parts that you will create are: halves, fourths, eighths, thirds, and sixths.

5. Have students arrange into their groups and distribute blank paper charts.

Note: Create a model of a fraction poster when explaining directions. It is best to use one color for all fractional parts during this introductory lesson to avoid students associating the color to the fractional part. Let students know that most of the time the bar is written horizontally but sometimes the fraction bar is written slanted.

The directions for the posters should also be written out either on the board or for each group.

Rotate Roles: Assign numbers to students in their groups and rotate through roles (i.e. #1: Cutter, #2: Paste, #3: Recorder)

Guided Practice: (15 minutes)

1. Distribute materials to each team – each team will be assigned one of the following die cut shapes to represent their whole: circle, square, rectangle, or hexagon. Each time they create new fractional parts, they will need 2 die cuts of their shape, one to fold and one to cut. (depending on the number of students, some groups may have the same shape as their whole)

Teacher note: The next several steps in this learning experience focuses on *SMP6: Attend to precision.* The subtle but important differences between halves and one half, and the meaning between the numerator and denominator must be emphasized both in teacher explanations and students' responses.

2. Guide students through completing the "halves" row on their poster (see example poster attachment):
    a. Turn and talk to your partner: *what are halves?* (*2 equal parts*) Solicit student responses to share with class.
    b. Take one of your shapes and fold it into halves then open it again.

c. Trace on the fold to show where you would cut it to make halves. How many equal parts did you make?(*2*)
d. Fold another whole into halves, and cut on the fold. What number is one of these equal parts?(*1/2*) Explain: *this is a model of one whole divided into two equal parts.*
e. Paste the first whole with the traced folds in the "fractional parts" column to show halves, and paste one of the cut parts in the "one part" column to show one half.

3. Say to students: *How do you write the number to show this part?* (Have students make suggestions and a student writes ½ in the unit fraction column.)

4. *Why is there a two on the bottom of the fraction? The bottom of the fraction is called the denominator. Why is there a one on the top of the fraction? The top of the fraction is called the numerator.* (Turn and Talk: share ideas)

5. Explain that a fraction is a special kind of number that is written using two numbers. It is a quantity (a number, or unit of measure.) The number on the top of the fraction (numerator) describes how many parts you have. The number on the bottom of the fraction (denominator) is the number of equal parts into which the whole is divided. The numbers are separated by a horizontal line.

Independent Practice: (30 minutes)

1. Let students know they will now work on the posters in their groups. Explain that teams should take turns in the roles of cutting, pasting, and recording. Each time they complete a row, check their work before distributing the next two paper cut-outs of their whole.

2. As students complete the posters, have them answer the following questions with their groups:
   a. What patterns do you notice in your poster?
   b. How does the numerator relate to the part?
   c. How does the denominator relate to the part?

Teacher Note: Be sure to have students use precise mathematical language (SMP6 Attend to *precision*).

Closure (5 minutes)

Outcome: *Students defined and explained a unit fraction by creating a poster that illustrates the relationship between the whole, the unit fraction, and the numerator/denominator.*

MUSEUM WALK: Students will rotate through the posters and observe how each group created their fractions.

SMALL GROUP DISCUSSION: In their small groups, students will each share out 1-2 observations about the other team's posters.

1. When the groups are finished, have them tape the posters in the front of the room.
2. Ask each group to share one pattern/relationship they noticed from their poster about the numerators and denominators.
3. Ask: "For groups with the same whole, did anyone create different shape fractional parts for that whole?"
4. Define denominator as the total number of equal parts in the whole.
5. Define numerator as the total number of equal part represented by the fraction.
6. Say: "You just created a poster of unit fractions, what do you notice about all of the unit fractions?"
7. Define a unit fraction as a fraction with a numerator of one, or one part of the whole.
8. If students notice that the ½ on one poster is larger than the ½ on another poster, praise their thinking and tell them this idea will be discussed further in lesson 3.

Preview outcomes for the next lesson: *Lesson #2: Naming Fractional Parts:* Prompt: Tonight think about what each number means in this fraction ½. During our next lesson we'll learn what each number means in a fraction. Be ready!

Turn and Talk and Embedded Formative Assessment Check: (See "Ask" Section 2.a). Students will tell a partner what a half is. Teacher will choose the other partner to explain to the class what a half is (using explanation from partner) OR using small white boards, students can write or illustrate what a half is. Students will hold up white board for quick check by teacher.
End the lesson with a brief discussion on the essential question:

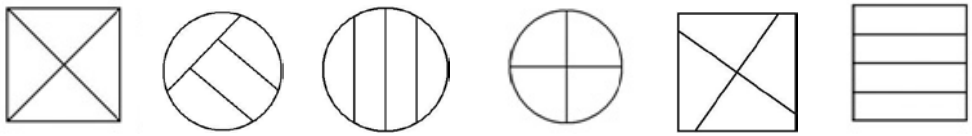
Lesson 1 Resources:

Sample Poster:

One whole	Fractional parts	One part	Unit fraction
	halves 		½
	fourths		
	eighths		
	thirds		
	sixths		

Lesson 1: Pre-Assessment

1. The shapes below are divided in four parts.



Which shapes show fourths? Explain how you know.

_____
_____
_____
_____

2. Shade the rectangle below to show 5 sixths.

Explain why you shaded it that way.

_____
_____
_____
_____

3. Can you shade the rectangle to the right to show 5 sixths? _____

Explain why or why not.

_____
_____

4. Draw lines to show where you would cut the pizza to the right to make

eighths.

5. Shade part of the pizza below to show ¾ (three fourths).

Explain how you know this is ¾.

_____
_____
_____

Lesson 2: Naming Fractional Parts

Brief Overview: Students will work with fraction circles to model fractional parts greater than a unit fraction, record answers in a table, and look for patterns. This lesson focuses on looking for and making use of structure (SMP 7 *Look for and make use of structure).* Through the use of visual models and a recording table, students will see repetitions in the structure of unit fractions and other fractions. Students will use this structure to discover that fractions can be built from unit fractions. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required: Students are able to create, name, and write unit fractions by partitioning a whole into equal parts. Students understand the purpose of the numerator and denominator when writing a fraction in number form.

Estimated Time: 60 minutes

Resources for Lesson: Fraction circles, Fraction Mat template, Recording Sheet for independent practice

Content Area/Course: Grade 3 Fractions

Unit: Exploring Fractions

Time (minutes): 60 Minutes

Lesson #2 ***Naming Fractional Parts***

Objectives:

-Students will understand that fractions are built from unit fractions.
-Students will recognize that the greater the number of parts, the smaller the unit fraction.

Language Objectives:

Students will name and record a fractional part of a whole that is greater than the unit fraction.

Essential Questions addressed in this lesson:

How do models help us understand fractions?
How do we use fractions in our everyday lives?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

3.NF.1 Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.

SMP7 Look for and make use of structure.

Anticipated Student Preconceptions/Misconceptions:
- Students may have trouble remembering the meanings of the numerator and the denominator or reverse them.
- Students may not understand why the fractional parts get smaller as the number of parts increase.

Pre-Assessment:
See attachment.

What students need to know and are able to do coming into this lesson (including language needs):

Students are able to create, name, and write unit fractions by partitioning a whole into equal parts.
Students understand the purpose of the numerator and denominator when writing a fraction in number form.

Lesson Sequence and Description

Introduction and Engagement Activity: (20 minutes)

Academic Vocabulary:

Fractional parts
Unit fraction
Numerator
Denominator
Model

NOTE: For all students, but especially for English Language Learners, use illustrations/photos and model appropriate use of vocabulary from the unit whenever possible. Also use Term/Definition/Example sheets for any multiplication vocabulary.

1. Say to students: "In the last lesson we divided shapes into equal parts and wrote unit fractions. Today, we will be using materials that are already divided into parts and we will name parts larger than the unit fraction. You will use fraction circles to show fractions, name fractions, and write fractions as numbers."
2. Have students consider the following problem: *A pizza is cut into eighths. If you eat 2 slices. What fraction of the pizza did you eat?*
3. Show a model of the pizza using the fraction circles. And use the questions listed in Teacher Notes as you walk them through the problem:

TEACHER NOTES:

**Have students use paper "pizzas" models divided into eighths. Working with a partner, they share their answer with each other. Students can also answer each letter (a-e) with their partner or in small groups*

   a. Into how many equal pieces is this pizza model cut? (eight)
   b. Can you tell me the unit fraction? (1/8)
   c. Will someone show me how much pizza was eaten using the fraction circle parts? (2 parts)
   d. How much is one part again? (1/8)
   e. So if 2 parts were eaten and each part is 1/8, how many eighths were eaten? (2/8)

4. Present the problem again but change the question to ask: What fraction of the pizza was left?

Guided Practice: (20 minutes)

1. Distribute fraction circles. Please note: fraction circles can be purchased or teacher made materials. They should show circles in a variety of colors. Each color is divided into a different number of equal parts. For example, there might be two pink halves, three yellow thirds, etc. The circles represent the same size whole. Purchased fraction circles are typically plastic and teacher made fraction circles are typically made on tag board.

2. Give the students 5 minutes to explore the fraction circles (it is a natural tendency for students to sort the shapes by color, which will result in wholes of the same color. It is important that students always have an opportunity to *explore* new materials if they have not had prior experience with them).
3. Ask students to share their observations about the fraction circles. (Example responses: When all the pieces of one color are put together, they make a whole circle; each color has different size pieces, etc.)
4. Ask students to identify the whole.
5. Have students place the red whole circle and 2 orange parts on their mats, and ask the following three questions:
    a. What fractional parts do the orange pieces represent?
    b. Write the unit fraction that represents 1 orange piece.
    c. Write the fraction for the two orange pieces.
6. Discuss the solution as a whole class.

Note: This learning activity focuses on SMP7 (*Look for and make use of structure)*. Students will begin to see repetitions in the structure of unit fractions and other fractions.

7. Repeat the same questioning (a –b above) for 3 yellow pieces (students should model it on their work mat)
8. Discuss the solution as a whole class.

Independent Practice: (20 minutes)
Note: This learning activity focuses on SMP7 (*Look for and make use of structure)*. Students will begin to see that the unit fraction is a building block for other fractions with the same sized parts, and they will use this structure to build fractions from unit fractions.

1. Pass out recording sheets
2. Students will work individually or with a partner to model and answer the questions about each fractional part.
3. Discuss solutions as a whole class.

Closure:
Review outcomes of this lesson: In the large group, students will turn and talk and discuss what a unit fraction is and give an example of a fraction built from a unit fraction (teacher will rotate and listen in as students discuss.)

Preview outcomes for the next lesson: Lesson 3: Using Cuisenaire Rods to Model Fractions as Parts of a Whole: Think about… (teacher to show Cuisenaire rods on the overhead projector) How can we use Cuisenaire Rod models to make fractions? (Teachers to revisit this prompt at the beginning of lesson #3). Think about how models help us understand fractions.

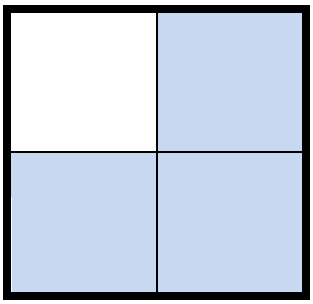
Extended Learning/Practice: (homework) See Fraction dominoes (attached): Students can use the domino sheets to illustrate each fraction.

Lesson 2 Resources:

Fraction Mat:

Whole	Part

Lesson 2: Pre-Assessment



1) What fractional parts has this square been divided into?

_____

2) Write the unit fraction that represents each equal part. _____

3) Write the fraction for the shaded part of the square. _____

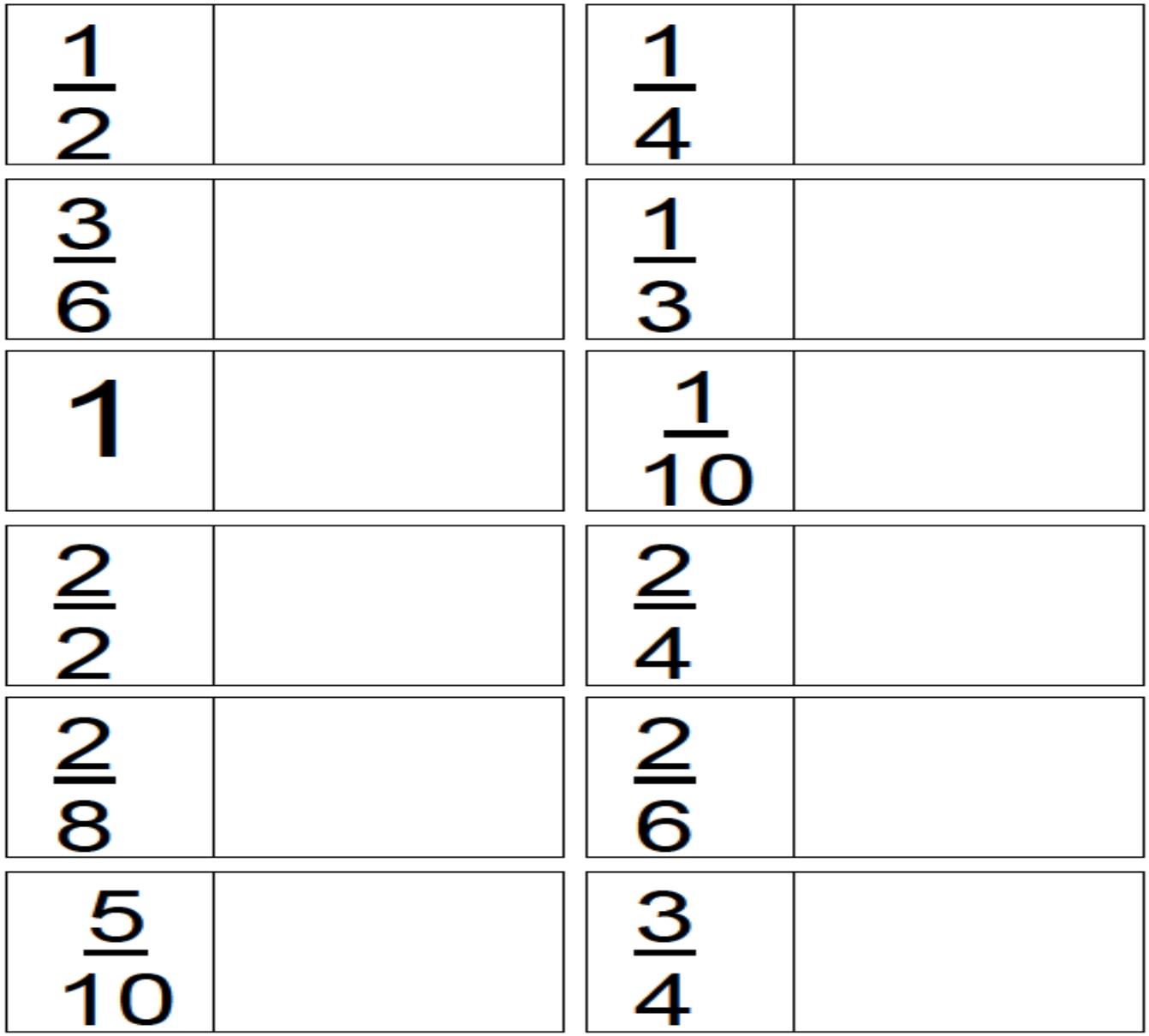
Independent Practice Recording Sheet Lesson 2

Complete the chart below by writing the fractional parts, the unit fraction and the fraction shown.

Pieces	Fractional parts	Unit Fraction	Fraction
(example) ***2 orange***	*thirds*	*1/3*	*2/3*
3 orange			
2 yellow			
4 yellow			
2 green			
3 green			
4 green			
2 aqua			
3 aqua			
6 aqua			
12 aqua			

Lesson #2 Extension/Homework

Show each fraction below by dividing and shading the right side of the rectangles. For example:



Lesson 3: Using Cuisenaire Rods to Model Fractions

Brief Overview:

Using Cuisenaire Rods as a model, students will show fractions of different size wholes. This lesson focuses on SMP2 (*Reason abstractly and quantitatively*). Students must decontextualize the quantities of Cuisenaire Rods into a numerator and denominator as parts of a fraction in relationship to the given whole. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required: Students are able to create, name, and write fractions.

Estimated Time: 60 minutes

Resources for Lesson: Math journals/pencils/colored pencils/markers, Cuisenaire Rods, Overhead projector or Document Camera, Worksheet

Content Area/Course: Grade 3 Fractions

Unit: Exploring Fractions

Time (minutes): 60 Minutes

Lesson #3: Using Cuisenaire Rods to Model Fractions

Content Objectives:

-Students will understand that fractions are built from unit fractions.
-Students will understand that the size of a fraction is relative to the size of the whole.

Language Objectives:

-Students will explain how to build fractions from unit fractions using Cuisenaire rods by reasoning about the relationship between the unit fraction and whole.
-Students will explain how the size a fraction depends on the size of the whole.

Essential Question addressed in this lesson:

How do models help us understand fractions?
How do we use fractions in our everyday lives?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

3.NF.1 Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.
SMP2 *Reason abstractly and quantitatively*
SMP7 *Look for and make use of structure*.

Anticipated Student Preconceptions/Misconceptions: Students may have trouble remembering the meanings of the numerator and the denominator.
NOTE: Students have been introduced to numerator & denominator in Lesson 2.

Pre-Assessment: See attachment.

What students need to know and are able to do coming into this lesson (including language needs):

Students are able to create, name, and write unit fractions by partitioning a whole into equal parts.
Students understand the purpose of the numerator and denominator when writing a fraction in number form.

Lesson Sequence and Description

Academic Vocabulary:
Fractional parts
Unit fraction
Numerator
Denominator
Model

LITERARY Connection:
Eating Fractions: Bruce McMillan: This book has clear photos and examples of basic fractions

TECHNOLOGY ALTERNATIVE: *Students will model solutions using Cuisenaire rod applet:*
http://nrich.maths.org/4348

Introduction and Engagement Activity: (10 minutes):

1. Say to students: "In our last two lessons, the whole was always the same for all of our fractions. Today we will explore fractions of different sized wholes."
2. Show them a picture of a full size Hershey Bar model with the wrapper on. Ask: "If you were sharing this chocolate bar among 4 people, how much would each person get?" (*one-fourth*)
3. Ask a student come to show on the document camera or overhead how to fold and cut the picture into 4 equal parts, and label each part with the unit fraction.
4. Next, show a picture of a Hershey's miniature chocolate bar. Ask a student come to show on the document camera how to fold and cut the picture into 4 equal parts, and label each part with the unit fraction.

5. Ask students: How can the parts of the big candy bar model and the parts of the miniature candy bar model both equal ¼ and not be the same size? Have students turn and talk about this with a partner.

Guided Practice (30 minutes)

TALKING POINTS: The denominator or bottom number tells the number of equal parts in the whole and the numerator or top number tells how many parts we are describing.

TEACHING NOTES: Teacher will guide the whole group in exploring the use of rods to visually see how fractional parts can be modeled.

Do not introduce improper or mixed fractions. You can explain letters f and g in the following manner: 3/2 is the quantity you get by combining 3 parts together when the whole is divided into 2 equal parts.

1. Distribute a bag of Cuisenaire Rods to each student. Allow for 2-3 minutes for students to explore the Cuisenaire Rods.

Note: This lesson focuses on both SMP2 (*Reason abstractly and quantitatively*) – the ability to contextualize the numerator and denominator of the fractions- to understand what they refer back to in the Hershey bar and also the meaning of the numerator and denominator of the fractions. Students are required to consider the meaning of the quantities in the symbolic representation of a fraction, and SMP 7 (*Look for and make use of structure*).

2. Ask: If the purple rod represents one whole, which rod can you use to show halves or two equal parts, explain? (*red, because 2 red rods are equal to one purple rod*)

3. Explain that in this case the "unit fraction" is one half, written ½. NOTE: A unit fraction is where the numerator is 1.

4. Students will use their math journals to draw the above fraction (they can trace the Cuisenaire Rods). For example, trace the purple rod (color or write one whole) and draw/trace the red rods directly underneath the purple rod. Write in the fraction ½ on each part. LABEL the numerator and denominator and explain the meaning of each.

5. Continue with the examples listed below. Students must model using rods then draw in their math journals. Note: *The whole will be different for each example.*
   a. If the blue rod represents one whole, what fraction is represented by one green rod? *(1/3*)
   b. If the brown rod represents one whole, what fraction is represented by one red rod? (*1/4*)
   c. If the dark green rod represents one whole, what fraction is represented by one white rod? (*1/6*)
   d. If the orange rod represents one whole, what fraction is represented by one yellow rod? (*1/2*)
   e. *If the orange rod represents one whole, what fraction is represented by two yellow rods? (*2/2*)

f. *If the orange rod is one whole, what fraction is represented by three yellow rods? (*3/2*)

Note: SMP 2 & 7: Students will discern patterns such that if it takes three equal blocks to make a whole block, then each block is a third. Students are required to decontextualize the quantities of blocks into a numerator and denominator as parts of a fraction in relationship to the whole.

Independent Practice: (20 minutes) Students will work with an elbow partner to practice building fractions from unit fractions using the Cuisenaire Rods.

1. If the blue rod represents one whole:
   a. Write a fraction that is represented by two light-green rods. Draw and label (*2/3)*
   b. What is the denominator? (3 *because 3 light greens makes the whole*)
   c. What is the unit fraction? (*1/3*)
   d. What is the numerator? (*2, because we are showing 2 thirds*)

1. If the orange rod represents one whole:
   a. Write a fraction that is represented by four red rods. Draw and label (*4/5*)
   b. What is the denominator? (*5*) What is the unit fraction? (*1/5*)
   c. What is the numerator? (*4*)

2. (Challenge) If the black rod represents one whole:
   a. Write a fraction that is represented by one yellow. Draw and label (*4/7*)
   b. What is the denominator? (*7*)
   c. What is the unit fraction? (*1/7*)
   d. What is the numerator? (*4*)

Closing: Take another look at the Hershey bar opening question: How can the parts of the big candy bar model and the parts of the miniature candy bar model both equal ¼ and not be the same size? (*The size of the unit fractions are different because the size of the wholes are different*). (Note: Attend to precision with students' responses)

Extended Learning/Practice (homework)
See closing prompt above-students may answer in journal.

Lesson 3 Resources:

Fraction Mat:

Whole	Part

Lesson 3: Pre-Assessment

If 1 whole is 

Write a fraction for the picture below: _____

Independent Practice Recording Sheet Lesson 3

1. If the blue rod represents one whole:
    a. Write a fraction for two light-green rods. _____
    b. Draw a picture and label.

    c. What is the denominator? ____
    d. What is the unit fraction? ____
    e. What is the numerator? ____

2. If the orange rod represents one whole:
    a. Write a fraction for four red rods. ____
    b. Draw a picture and label.

    c. What is the denominator? ____
    d. What is the unit fraction? ____
    e. What is the numerator? ____

3. (Challenge) If the black rod represents one whole:
    a. Write a fraction for one yellow. ____
    b. Draw a picture and label.

    c. What is the denominator? ____
    d. What is the unit fraction? ____
    e. What is the numerator? ___

Lesson 4: Using Pattern Blocks to Model Wholes

Brief Overview: Using Pattern Blocks as a model, students build wholes given a fractional part of the same whole. This lesson focuses on SMP2 (*Reason abstractly and quantitatively*). Students will be required to contextualize the numerator and denominator of the fraction and consider the meanings of their quantities in relationship to the whole. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Students are able to create, name, and write fractions.
- Students are able to build and name a fraction by reasoning about the relationship between the unit fraction and the whole.

Estimated Time: 60 minutes

Resources for Lesson:

- ✓ pencils/colored pencils/markers
- ✓ Pattern Blocks
- ✓ Pattern block graphing paper
- ✓ Overhead projector or document camera

Content Area/Course: Grade 3 Fractions
Unit: Exploring Fractions
Time (minutes): 60 Minutes
Lesson #4: ***Using Pattern Blocks to Model Wholes***

Objectives:

-Students will understand that fractions are built from unit fractions.
-Students will understand that the size of the whole is relative to the size of the unit fraction.

Language Objectives:

-Students will explain how to build a whole from unit fractions using Pattern Blocks.
-Students will justify the size of a whole given a visual representation for a fractional part of the same whole using Pattern Blocks.

Essential Questions addressed in this lesson:

How do models help us understand fractions?
How do we use fractions in our everyday lives?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

3.NF.1 Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.
SMP2: Reason abstractly and quantitatively.
SMP6: Attend to precision.
SMP7: Look for and make use of structure.

Anticipated Student Preconceptions/Misconceptions:

Students may have trouble identifying the unit fraction.

Pre-Assessment:

See attachment.

Curriculum Embedded Performance Assessment 1 (CEPA 1):

CEPA 1 is administered following this lesson.

What students need to know and are able to do coming into this lesson (including language needs):

Students are able to create, name, and write unit fractions by partitioning a whole into equal parts.
Students understand the purpose of the numerator and denominator when writing a fraction in number form.

Lesson Sequence and Description

Academic Vocabulary:
Fractional parts
Unit fraction
Numerator
Denominator

Technology Enhancement Alternative*:* Students will model solutions using Pattern Block applet on The National Library of Virtual Manipulatives at:

http://nlvm.usu.edu/en/nav/category_g_2_t_3.html

Introduction and Engagement Activity: (10 minutes)

1. Present the following problem: Some of a candy bar was eaten. There is now ¾ of the candy bar left. If ¾ looks like this:

   What did the whole candy bar look like?
2. Have students turn and talk about possible solutions with a partner.

Guided Practice:(10 minutes)

TEACHING NOTES: *Students may have difficulty with this type of questioning. Guide them step by step to reason about the whole using unit fractions.*

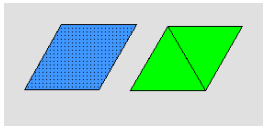
Teacher will guide whole group in exploring using pattern blocks to visually see how fractional parts can be modeled.

1. Distribute a bag of Pattern blocks to each student.

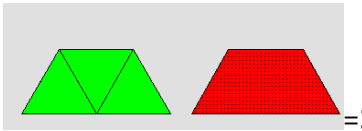
2. Ask: If the blue rhombus is 2/3, show 1 whole.

Note: In this activity students are required to reason abstractly and quantitatively (SMP2) by contextualizing the numerator and denominator of the fraction and considering the meanings of their quantities with relationship to the whole.

   a. Have students place a blue rhombus in front of them, then ask them to identify the "unit fraction". (*one third*)
   b. Ask students how many thirds they need to build 2/3. (*two*)
   c. Have students show the same area as the blue rhombus using 2 parts. (*2 green*)

 = 2/3

   d. Ask: Since we have made 2/3, how can we make3/3? Have students share their thinking then explain they can make 3/3 or 1 whole by adding one more third. Therefore, the whole can be the red trapezoid, three triangles, or another combination with the same area.

 =3/3 or whole

3. Students will trace pattern blocks to draw the solution to each problem. Student drawings should include the pieces used. For example, if the rhombus is the whole, the student should draw a line to show the triangles that make up the rhombus.

Independent Practice: (20 minutes)

Note: Students will see that the unit fraction is a building block for other fractions with the same sized parts including those that are equivalent to the whole. They will use this structure to build a whole from unit fractions. (SMP7 *Look for and make use of structure)*.

1. Students may work alone or in pairs to model and draw out solution to the following problems:

    a. If the green triangle represents 1/3, build 1 whole.
    b. If red trapezoid represents 3/4 , build 1 whole.
    c. If the yellow hexagon represents 1/2, build 1 whole.
    d. If the red trapezoid represents 3/8, build 1 whole.
    e. If the rhombus represents 1/6, build 1 whole.

Note: Periodically through the closing, students will be required to use *precise mathematical language* (SMP 6) to explain their answers and use precision when modeling with blocks or pictorial representation.

2. Return to whole group to show solutions on overhead/document reader. Discuss strategies used.

Closing:
Turn and Talk:

Teacher Guidance: With a partner, discuss these questions using precise mathematical language. Be ready to share your answers with another set of partners (or share out with entire group).

How do you know that a fraction is built from a unit fraction? Give your partner an example.
What does it mean that the size of the whole is relative to the size of the unit fraction (you can draw a picture or use pattern blocks for your partner to explain your reasoning.)

Extended Learning/Practice (homework*):* Write and solve two problems similar to what was done is class. For example: "if a red trapezoid represents three-fourths, build one whole.

Lesson 4 Resources:

Fraction Mat:

Part	Whole

Lesson 4: Pre-Assessment

The picture below shows 2/3 of a candy bar.

Draw the whole candy bar below:

Independent Practice Recording Sheet Lesson 4

Directions: For each problem, trace the pattern blocks to show your answer.

1. If the green triangle represents 1/3, build 1 whole.

2. If red trapezoid represents 3/4 , build 1 whole.

   Trace the pattern blocks to show your answer with a picture:

3. If the yellow hexagon represents 1/2, build 1 whole.

   Trace the pattern blocks to show your answer with a picture:

4. If the red trapezoid represents 3/8, build 1 whole.

   Trace the pattern blocks to show your answer with a picture:

5. If the rhombus represents 1/6, build 1 whole.

   Trace the pattern blocks to show your answer with a picture:

CEPA #1 Student Instructions:

Cake Attack! – Your mom made a delicious chocolate frosted sheet cake for your 9th birthday. However, after you snuck a look under the lid to check it out, you noticed that someone has been eating it! There could only be one culprit (but we will talk about that later)

This is the cake now:

You are very upset and you really want to know how it looked before it was attacked. So you decide to do some investigative work…

Using the picture above (from the scene of the crime) explore the following scenarios:

<u>Scenario #1:</u> 1/4 of the cake is left.

- Draw a picture of the cake before it was attacked. Label your picture.
- How much of the cake was eaten? Explain.

<u>Scenario #2:</u> 5/8 of the cake if left.

- Draw a picture of the cake before it was attacked. Label your picture.
- How much of the cake was eaten? Explain.

CEPA #1 Rubric:

Did Not Demonstrate (0 points)	Emerging (1 points)	Meeting (2 points)
☐ There was little or no evidence that the student made use of structure. The unit fraction did not appear to be considered when the whole cake was drawn.	☐ There was some evidence that the student made use of structure. The unit fraction appeared to be considered when the whole cake was drawn but the labels were incomplete /incorrect.	☐ The student made use of structure through labeling the picture of the whole cake in a way that shows a full understanding of how to build fractions out of unit fractions.
☐ The student's explanation showed little or no evidence of reasoning about the numerator, denominator, unit fraction, or whole.	☐ The student's explanation showed some evidence of reasoning about the numerator, denominator, unit fraction, or whole.	☐ The student's explanation showed evidence of reasoning about the numerator, denominator, unit fraction, or whole.
☐ Little or no precise mathematical language was used in the explanation.	☐ Some precise mathematical language was used in the explanation.	☐ Precise mathematical language was used in the explanation.
Total: ___ /6	Comments:	

Lesson 5: Ready, Set: Fractions as Equal Shares of a Set

Brief Overview: Students explore sharing sets of objects that can be evenly divided among sharers using square tiles and counters as models. Students also identify a unit fractional part of a set and identify a set if a unit part is given. This lesson focuses on SMP2 (*Reason abstractly and quantitatively*). Students must decontextualize the quantities of groups/parts formed by the whole set of square tiles into a numerator and denominator as parts of a fraction in relationship to the given whole set. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Students can find a fraction of a whole and find a whole given a fraction.
- Students understand the relationship between a fraction, the unit fraction, and the whole.

Estimated Time: 60 minutes

Resources for Lesson: Text: Hershey Milk Chocolate Bar Fraction Book: Jerry Pallotta, overhead of chocolate bars (with divisions)or copies for document camera, Square tiles, Large Hershey bar, packs of Smarties candies per pair of students (this extension activity can be optional or modified to replace candy with dot stickers or any other collections of colored objects.)

Content Area/Course: Grade 3 Fractions

Unit: Exploring Fractions

Time (minutes): 60 Minutes

Lesson #5: ***Ready, Set: Fractions as Equal Shares of a Set***

Objectives:

- Students will identify a fraction of a set.

-Students will understand that a set can represent a whole.

Language Objectives:

-Students will name part of a set.

-Given a description using fractions, students will create a set.

Essential Question addressed in this lesson:

How do models help us understand fractions?

How do we use fractions in our everyday lives?

Standard(s)/Unit Goal(s) to be addressed in this lesson :

3.NF.1 Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.
SMP2: Reason abstractly and quantitatively.

Anticipated Student Preconceptions/Misconceptions:

Students may confuse the fraction and the actual quantity of objects in the set or fraction of the set.

Pre-Assessment:

See attachment.

What students need to know and are able to do coming into this lesson (including language needs):

Students are able to create, name, and write unit fractions by partitioning a whole into equal parts.
Students understand the purpose of the numerator and denominator when writing a fraction in number form.

Lesson Sequence and Description

Academic Vocabulary:

Fractional parts
Unit fraction
Numerator
Denominator

Introduction and Engagement Activity: (15 minutes)
Note: It is important that both teacher and student responses are precise when discussing the groups/parts formed by the whole set of square tiles into a numerator and denominator. (SMP6: Attend to precision)

1. Explain to students that in the previous lessons they found fractions by dividing a single shape or object into equal parts. Now, they will be finding fractions by using a set as the whole.
2. Show them a Hershey Bar (get a giant one if possible…just to entice….) Use the overhead template that shows the division (12 sections).
3. Pose the following discussion prompts: How many squares would each person get if you were sharing among 2 people? What if there we 3 people? 4 people?

4. Have students turn and talk: Why is this important?
5. Read aloud: The Hershey Milk Chocolate Bar Fraction Book by: Jerry Pallotta
6. Have students write 2-3 things (in math journals or on sticky notes) that they learned about fractions from the book.
7. Ask students to share ideas with an "elbow friend" then add the new information learned from your friend to your list.

TEACHING NOTES:

The guided practice consists of 3 tasks where students will create a set that has a given fraction of certain color tiles. Although, there may be more than one way to name a fraction in these examples, we simply want to expose the idea of naming part of a group, not teach about equivalent fractions. The discussion should really be about the number of equal parts (which determines the unit fraction) they subdivided the set into.

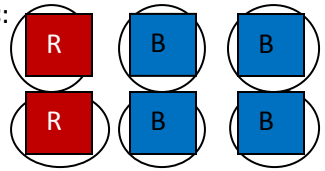
Guided Practice: (15 minutes)

Students must decontextualize the quantities of groups/parts formed by the whole set of square tiles into a numerator and denominator that represent the parts of a fraction in relationship to the given whole set. Note: SMP2 (*Reason abstractly and quantitatively*).

1. Distribute square tiles to students(about 5 of each color: red, blue, green, yellow)
2. Present task #1: Create a set containing 2 red tiles and 4 blue tiles.
3. Ask students to turn to an elbow partner and discuss the answers to the following questions:
    a. How are your sets the same or different?(*students will have various arrays)*
    b. What fraction of your set is red? How do you know?
    c. Could you name the red part another way?

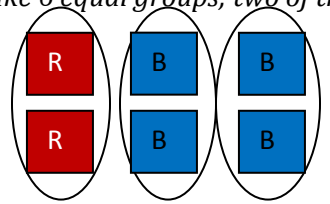
Possible answers:

2/6



"I can make 6 equal groups; two of the groups are red. So 2/6 of the set are red"

1/3



"I can make 3 equal groups; one of the groups is red. So 1/3 of the set is red"

4. Present task #2: Create a new set that has 6 red tiles, 4 blue tiles, and 2 yellow tiles.

5. Ask the students to turn to an elbow partner and discuss the answers to the following questions:
    i. What fraction of your set is red?
    ii. What fraction of your set is blue?
    iii. What fraction of your set is green?
    iv. Could you name any of these color parts another way?

6. Present task #3: Create a set with 12 tiles. The set must be ½ yellow, 1/3 blue, and 1/6 green.

7. Draw a picture of the set and label the fractional parts.

Independent Practice: (20 minutes)

Present the following story problems for students to solve individually or in pairs.

1. You have an 8 section Hershey bar. You eat 4 sections. What fraction did you eat?
2. You have a 12 section Hershey bar. You eat 4 sections. What fraction did you eat?
3. You open a mini bag of M&M's. There are twelve M&M's in the bag. 1/3 are red, 1/4 are green, 1/3 are yellow, and 1/6 are blue. How many M&M's are red? green? Yellow? Blue? Explain.
4. Create your own "fraction of a set" word problem.

Closing: Select several students to share their own word problems for the whole class. Discuss solutions.

Extended Learning/Practice (homework*):*

See attached "Smarties" problem sheet (or "Dot Stickers" if you do not wish to use candy.)

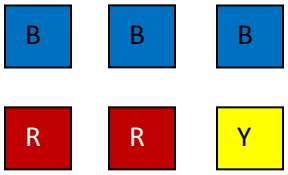
Lesson 5 Resources:

Fraction Mat:

Part	Whole

Lesson 5: Pre-Assessment

Nathan has the following set of 6 tiles.



a. What fractions of his tiles are blue?

b. What fraction of his tiles are yellow?

Alyssa also has a set of 6 tiles. If 1/3 of her set is blue, what could her set look like? Draw one possible set below.

Independent Practice Recording Sheet Lesson 5

1. You have an 8 section Hershey bar. You ate 4 sections.
    a. What fraction did you eat?
    b. Draw a picture to model your answer.

2. You have a 12 section Hershey bar. You ate 4 sections.
    a. What fraction did you eat?
    b. Draw a picture to model your answer.

3. You open a mini bag of M&M's. There are twelve M&M's in the bag. 1/3 are red, 1/4 are green, 1/3 are yellow, and 1/12 are blue.

a. How many M&M's are red?

b. Green?

c. Yellow?

d. Blue?

e. Explain.

4. Create your own "fraction of a set" word problem.

Extension/Homework Lesson 5 Name: _____

Smarties!!

Directions: *Work with a partner! Look at your pack of Smarties candy to answer the following questions. When you are finished with question 8, you may eat your candy!*

1. How many Smarties does it take to make one pack? _____
2. What is the fraction name for one piece of this candy? _____
3. How many different colors are there in your pack? _____
4. Tell the fraction name for each color: Blue_____ Pink_____ Yellow___ Orange___ Green___ Purple___ White___
5. What is the largest fraction you wrote in question 4? _____
6. What is the smallest fraction you wrote in question 4? _____
7. What is the fraction name for the whole pack of Smarties? ____ This is another name for what number? _____
8. You may share the pack of Smarties with your partner, but first tell what the fraction name is for how much you will get to eat! ____

(Do question 8 before you eat your Smarties!)

Extension/Homework Lesson 5 Name: _____

Dot Stickers

Directions: *Work with a partner! Look at your pack of dot stickers to answer the following questions.*

1. How many dot stickers does it take to make one pack? _____
2. What is the fraction name for one dot sticker? _____
3. How many different colors are there in your pack? _____
4. Tell the fraction name for each color: Blue_____ Pink_____ Yellow___ Orange___ Green___ Purple___ White___
5. What is the largest fraction you wrote in question 4? _____
6. What is the smallest fraction you wrote in question 4? _____
7. What is the fraction name for the whole pack of dot stickers? ___ This is another name for what number? _____
8. You may share the pack of dot stickers with your partner, but first tell what the fraction name is for how much you will get. ____

Lesson 6:
Making Jumps: Identifying Fractional Parts on a Number Line

Brief Overview: Students use Cuisenaire Rods to model fractional parts of the distance 1 whole on number lines. This lesson incorporates modeling with mathematics. (SMP4). Students will apply the mathematics they know to solve problems in the context of real life situations involving fractions of a distance. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Students should be able to partition a whole into equal sized parts and name a fractional part of the whole.
- Students should be able to recognize and understand fraction notation.
- Students should have an understanding of the terms: fraction, whole, part, numerator, denominator.

Estimated Time: 60 minutes

Resources for Lesson: Masking tape,

- Cuisenaire Rods
- Handouts: Note: These may need to be scaled (resized) on the copier so the Cuisenaire rode fit the spaces accurately.
  - "Fraction Number Lines with Units" and
  - "Fraction Number Lines without Units"
  - "Open Fraction Number Lines"

Content Area/Course: Grade 3 Fractions

Unit: Exploring Fractions

Time (minutes): 60 Minutes

Lesson #6: ***Making Jumps: Identifying Fractional Parts on a Number Line***

Objectives:

-Students will partition the interval between 0 and 1 on a number line into b equal parts and label the fractional parts of the number line.
-Students will recognize that intervals and locations on the number line are two different things**.**

Language Objectives:

-Students will explain how to partition intervals and label fractional parts of a number line.

Essential Question addressed in this lesson:

How do models help us understand fractions?
How do we use fractions in our everyday lives?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

3.NF.2 Understand a fraction as a number on the number line; represent fractions on a number line diagram.
SMP2: Reason abstractly and quantitatively.
SMP 4: Model with mathematics.
SMP6 Attend to precision.

Anticipated Student Preconceptions/Misconceptions:
Students may confuse the intervals and the end points. Examples of this misconception might include:

- Students may draw four "hash-marks" instead of three to divide a whole into fourths.

- Students may struggle to understand that each interval is one-fourth in size, but only the first endpoint represents the number ¼.

Pre-Assessment:

See attachment.

What students need to know and are able to do coming into this lesson (including language needs):

Students are able to create, name, and write unit fractions by partitioning a whole into equal parts.

Students understand the purpose of the numerator and denominator when writing a fraction in number form.

Lesson Sequence and Description

Academic Vocabulary:

Open number line
Unit fractions
Partition
Equal lengths
Interval
End-point
Cuisenaire rods

Prior to the lesson mark off a distance (about 2 meters – doesn't need to be exact) with a continuous line of masking tape on the floor.

Introduction and Engagement Activity: (10 minutes)

1. Explain to students that in the previous lessons they found fractions by dividing a single shape, object, or set into equal parts. Now, they will be finding fractions by using a distance as the whole.

Note: Students will apply the mathematics they know to solve problems in the context of real life situations involving fractions of a distance. (SMP4 Model with Mathematics)

2. Present the attached sand pit part 1 situation to students.
3. Discuss with students that the "whole" in the story is the distance across the sand pit and each of the students in the story jumped a fraction of that distance. Note: Students must use precise mathematical language (SMP 6 *Attend to precision).*
4. Read the first question: Amy says that she jumped ¼ of the way across the sand pit. Is she correct? Facilitate a brief discussion with the class to elicit initial student thinking.
5. Explain to the students that you are going to pretend the masking tape on the floor is the distance across the sand pit. Have a volunteer do a jump that looks like Amy's jump then discuss why she jumped ½.
6. Have the volunteer jump another jump the same distance. Ask: How far has the jumped now? Why does jumping 2 times bring her the whole distance of the sand pit? What does this have to do with a numerator of 1 and a denominator of 2 in the fraction ½?

Note: In this learning activity, students are making sense of the quantities and their relationship in the problem situation SMP2 (*Reason abstractly and quantitatively*).

7. Repeat the demonstration and discussion for each of the other students' jumps from the story.
8. Discuss strategies for ensuring the jumps are roughly equal, such as dividing into half and then dividing each half into halves. Have students mark the spots with a post-it or tape marker.

Guided Practice: (15 minutes)

NOTE: Depending on your printer, the handouts might need to be scaled so that the Cuisenaire rods fit the spaces accurately.

1. Using the modeling template from "Fraction Number Lines…" handouts, ask students: "*How could you use Cuisenaire rods to model the jumps from the story? What color rods would you use to show four equal jumps?"* (light green rod = 3 units = ¼ of whole)

2. Demonstrate how to mark and label the end-points of the intervals
   - Label the end-point of the first interval 1/4 and the end-point of the second interval 2/4.
   - Solicit student feedback about how to label the end-point of the 3rd interval.
   - Ask: "*Can we label the 0 and 1 in any other way?* " (0/4, 4/4). If students do not offer solutions, ask: How many fourths is 1? How many fourths is 0?
   - Explain that the spaces between each of the points on the number line are called "intervals". In this diagram, each interval is 1/4. The end points of each interval are marked with fractions that represent how far they are from 0.

3. Remove Cuisenaire rods and ask students: *"How do we know that the number line is divided into fourths?"* (Encourage discussion that focuses on the fact that there are 4 parts of equal size.)

4. If students appear to be struggling or if time allows, repeat this exercise with jumps of different sizes.

Independent Practice: (20 minutes)

Give students "Fraction Number Lines with Units" as well as the "Fraction Number Lines without Units" handouts and ask them to use the Cuisenaire rods to partition and label the number lines into the given fractional parts.

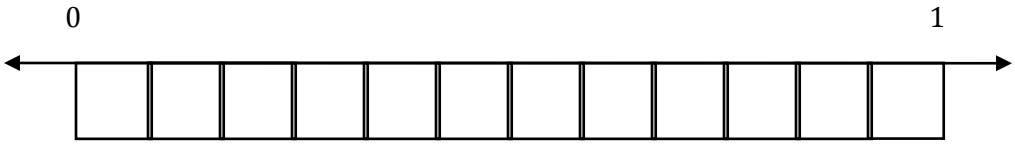
Closure (15 minutes)

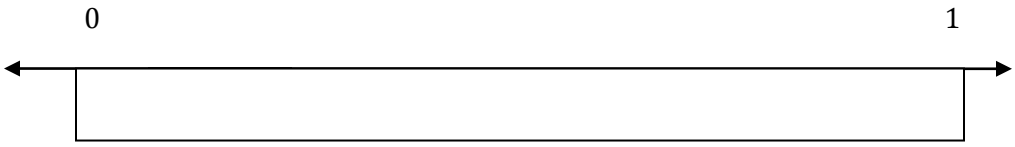
Review outcomes of this lesson:
Discuss which number lines were easiest and most difficult to partition and label. Share student strategies. If, while working, students discovered the relationship between halves and fourths (i.e., fourths are "half of a half") as well as the relationship between thirds and sixths ("sixths are half of a third") have selected students explain their reasoning to the class as a whole. If no students reached this awareness, probe with questioning: *"How are halves and fourths related? If you had trouble drawing fourths, how could you use your halves to help you?"* Repeat for the relationship between thirds and sixths.

Preview outcomes for the next lesson: *Tomorrow we will use Cuisenaire rods to find the size of a whole if you are given one of the parts.*

Lesson 6 Resources:

Modeling template from **"Fraction Number Lines…"** handout





Lesson 6: Pre-Assessment

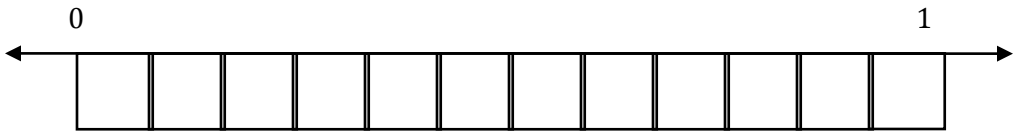
Ask students to give two different examples of something that has been divided into fourths and then answer the following questions:

1) What do your examples of fourths have in common?

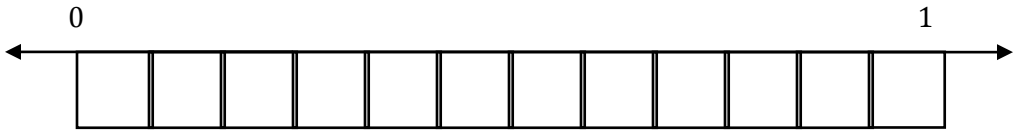
2) What is different about your examples of fourths?

Fraction Number Lines with Units

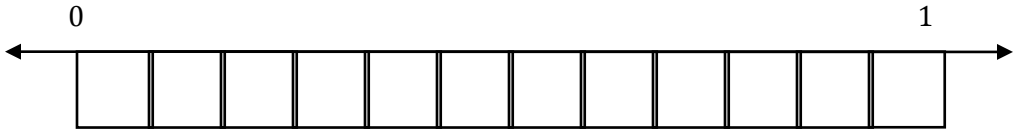
Directions: Use the Cuisenaire rods to divide each of the following number lines into the fraction parts that are listed. Make sure to mark the intervals and label each fractional part.



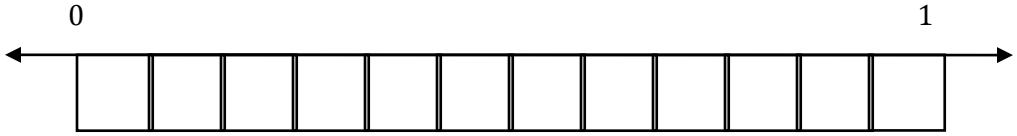
halves



fourths



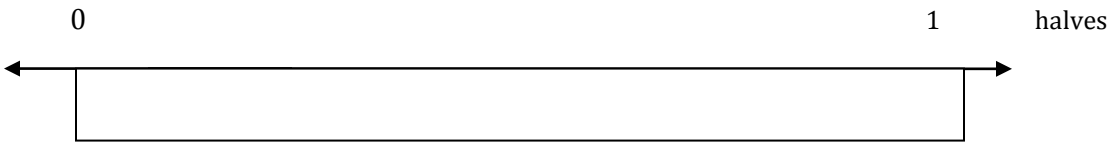
thirds

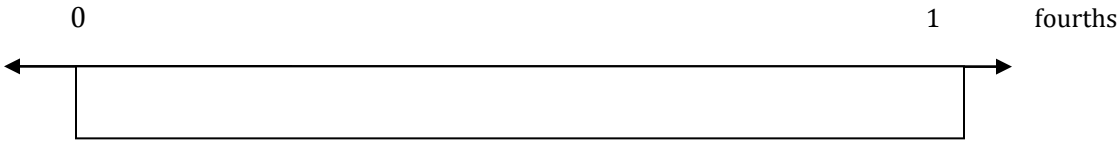


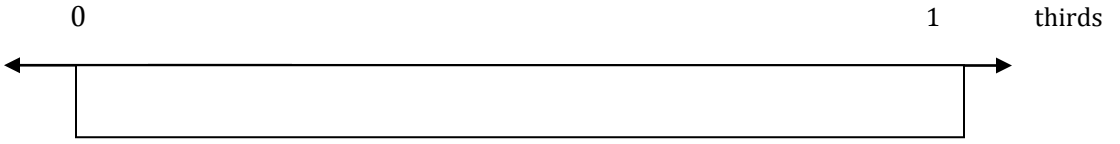
sixths

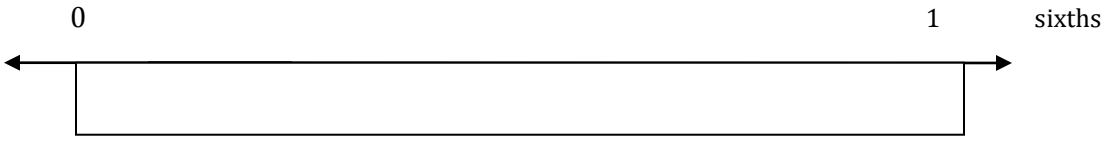
Fraction Number Lines without Units

Directions: Use the Cuisenaire rods to divide each of the following number lines into the fraction parts that are listed. Make sure to mark the intervals and label each fractional part.









Open Fraction Number Lines

Directions: Divide each of the following number lines into the fraction parts that are listed. Make sure to mark the intervals and label each fractional part.

0 1 halves

0 1 fourths

CHALLENGE:

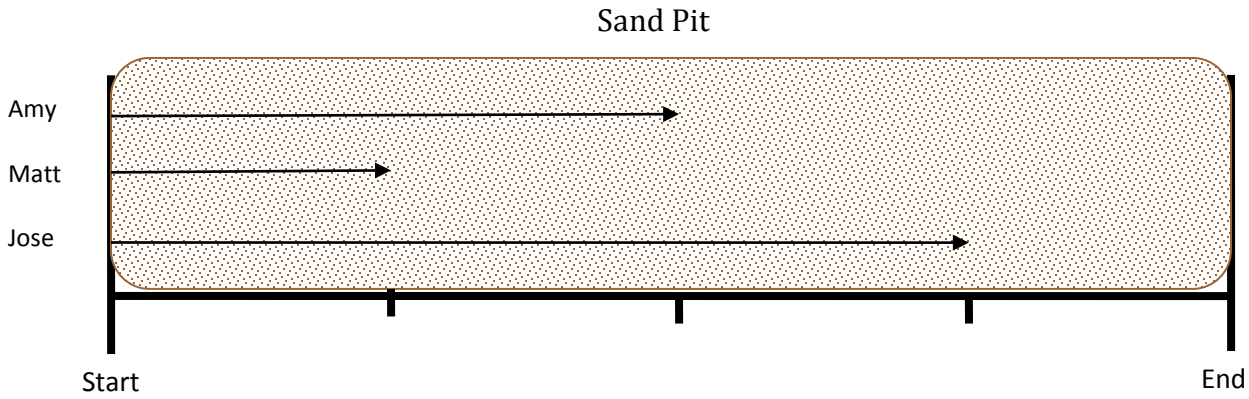
0 1 eighths

0 1 thirds

0 1 sixths

Sand Pit Part 1:

Last week in gym class, the students did the long jump. The picture below shows the sand pit they used to make their jumps. The start and end of the pit are labeled. The places where three students landed their jumps are marked.



1. Amy says that she jumped ½ of the way across the sand pit. Is she correct? Explain.

2. Matt says he jumped 1/3 of the way across the sand pit. Is he correct? Explain

3. How far did Jose jump? Explain.

Lesson 7: Making a Leap: Where is the Whole?

Brief Overview: Students use Cuisenaire Rods as a model for *fractional intervals of length* to build a length of *one whole.* Students use their knowledge about partitioning and labeling on a linear model to solve problems in the context of real life situations involving fractions of a distance. (SMP4: *Modeling with Mathematics*). As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Students should be able to partition and label the span from 0 to 1 on a number line into the following fractional parts: halves, fourths, eighths, thirds, and sixths.

Estimated Time: 60 minutes

Resources for Lesson:

- Masking tape
- Cuisenaire rods
- Handout: "Open Number Lines" (make double sided pages with number lines on each side) and "Open Number Lines – Additional Practice" (single sided pages is fine)

Content Area/Course: Grade 3 Fractions

Unit: Exploring Fractions

Time (minutes): 60 Minutes

Lesson #7: ***Making a Lear: Where is the Whole?***

Objectives:

-Given a unit fraction, students will be able to work on an open number line that begins at 0 and use the unit fraction to generate repeated intervals until they reach the whole.

Language Objectives:

-Students will explain how to iterate a unit fraction in order to define and locate the whole on an open number line.

Essential Question addressed in this lesson:

How do models help us understand fractions?
How do we use fractions in our everyday lives?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

3.NF.2: Understand a fraction as a number on the number line; represent fractions on a number line diagram
SMP .4: Model with mathematics.
SMP.6: Attend to precision.
SMP7: Look for and make use of structure

Anticipated Student Preconceptions/Misconceptions:

Students may be confused by the fact that two different sized rods (or two different lengths) can both represent ½ (or another fractional amount) due to a lack of understanding that a fractional part is always defined by its relationship to a whole and that the size of the whole can vary.

Students may have difficulty knowing when to stop (i.e. where to locate 1) because in the previous lesson 1 was always in the same place.

Pre-Assessment:

See attachment.

What students need to know and are able to do coming into this lesson (including language needs):

Students have a basic knowledge about partitioning and labeling on a linear model . Students have worked within a span from 0 to 1 on a number line using the following fractional parts: halves, fourths, eighths, thirds, and sixths.

Lesson Sequence and Description

Academic vocabulary:

Open number line
unit fraction
partition
iterate
equal lengths
interval
end-point
NOTE: leave at least one of the students' tape marks on the floor for tomorrow's lesson.

Introduction and Engagement Activity: (10 minutes)
Note: Students will apply the mathematics they know to solve problems in the context of real life situations involving fractions of a distance. (SMP4 *Model with Mathematics*)

1. Present the attached sand pit part 2 situation to students. Read and discuss.

2. Ask two students (who are likely jump different lengths) to come to the front of the room. Start them at the same point and mark their starting point with a post-it or a small piece of tape. Ask both students to take a jump (if they jump the same length, solicit another student who thinks he or she can jump further than the first – the goal is to have two jumps of significantly different lengths). Mark the length of their jumps in tape on the floor and label them with the students' names.

3. Ask: If each of these students jumped a total of 4 times, where would they end up? Let students make the jumps and label each jump along the way explaining that you are using the unit fraction ¼ because there will be 4 total jumps.

4. Ask: What do you notice about where they ended up? Why did the students end up in different places? What do you notice about the lenght of their jumps? Is it correct to call both of their jumps ¼? Why or why not?

5. Discuss how the demonstration relates to the sand pit part 2 problem. Is Jose correct?

Note: Students must use precise mathematical language here (SMP 6 *Attend to precision)*

Guided Practice: (20 minutes)
Note: Students will see that the unit fraction is a building block for other fractions with the same sized parts including those equivalent to the whole. They will use this structure to build a whole from unit fractions.: SMP7 (*Look for and make use of structure)*.

1. Using "Open Number Lines" handout, ask students to model the following using Cuisenaire rods:
   a. If the red rod = ½, show 1 whole. Mark and label the endpoints on your number line.
   b. If the light green rod = ½, show 1 whole. Mark and label the endpoints on your number line.
   c. Have students turn to their table partner and answer the following question: *"How is it possible that the red rod can be ½ and the light green rod can also be ½?"* (discussion re: different sizes of the whole)

2. Say to students, *"Now let's try to make it more challenging."* (Demonstrate using the purple rod) *"If the purple rod = ½, where is 1 whole? If the purple rod = 1/3, where is 1 whole?"* Discuss and clarify misconceptions.

3. Ask students to model the following using Cuisenaire rods on the open-number line handout with only 0 marked:
   i. If the red rod = 1/3, show 1 whole. Mark and label the endpoints on your number line.
   ii. If the red rod = 1/4, show 1 whole. Mark and label the endpoints on your number line.
   iii. Ask: How is it possible that the red rod = 1/3 on the first number line and 1/4 on the second number line? (discussion re: different sizes of the whole)

Independent Practice: (20 minutes)
On the "Open Number Line" handout, draw the following, using a separate number line for each one:
   a. If the yellow rod is 1/2, show 1 whole. Mark and label the endpoints on your number line.
   b. If the yellow rod is 1/3, show 1 whole. Mark and label the endpoints on your number line.
   c. If the yellow rod is 1/4, show 1 whole. Mark and label the endpoints on your number line.
   d. If the dark green rod is 1/2, show 1 whole. Mark and label the endpoints on your number line.

e. If the dark green rod is 1/3, show 1 whole. Mark and label the endpoints on your number line.
f. If the dark green rod is 1/4, show 1 whole. Mark and label the endpoints on your number line.

g. If the black rod is 1/2, show 1 whole. Mark and label the endpoints on your number line.
h. If the brown rod is 1/2, show 1 whole. Mark and label the endpoints on your number line.
i. If the blue rod is 1/2, show 1 whole. Mark and label the endpoints on your number line.

Closure (10 minutes)

Review outcomes of this lesson: Return to a discussion about the potential misconception that ¼ (or any other size unit fraction) always represents the same distance on a number line. Probe for deeper understanding by discussing examples that students generated (either correct or incorrect) during the independent practice.

Preview outcomes for the next lesson: Tomorrow we will begin to work on number lines that extend past 1.

Extended Learning/Practice (homework):

Students complete "Open Number Lines – Additional Practice" handout. This can also be used as an assessment or extension.

Lesson 7 Resources:

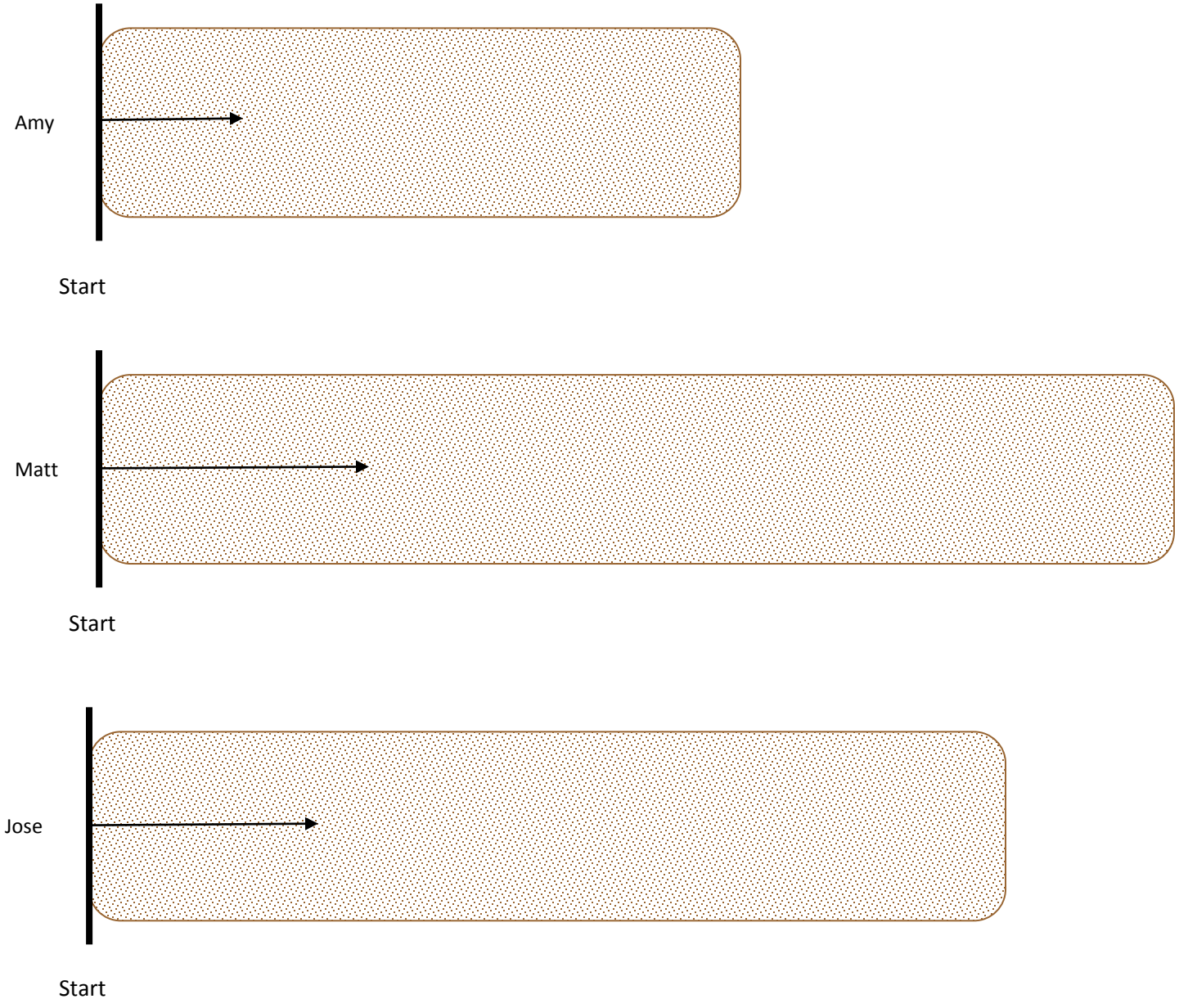
Open Number Lines

Lesson 7: Pre-Assessment

Label the number line below with the following fractions:

$0/4$ $1/4$ $2/4$ $3/4$ $4/4$

Sand Pit Part 2: During Spring vacation, a rain storm washed away the end of the long jump sand pit. Amy, Matt, and Jose each jumped ¼ and used their jump to determine where the end of the pit should be. Amy says the pit was shorter and Matt says it was longer. But Jose says they are all correct. Who do you agree with? Explain.



Open Number Lines – Additional Practice

Directions: For each of the following number lines, find and mark 1 whole. Show or explain your reasoning.

Lesson 8: Jumping on: Moving Past One Whole

Brief Overview: Using Pattern Blocks for modeling, students build a number line that is greater than 1 whole. This lesson focuses on looking for and making use of the structure of fractions (SMP 7 *Look for and make use of structure).* Through the use of visual models students will see repetitions in the structure of unit fractions and their relationship to wholes. Students will use this structure to discover that wholes on a number line continue in a pattern. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Students should be able to partition and label the span from 0 to 1 on a number line into the following fractional parts: halves, fourths, eighths, thirds, or sixths.
- Students should be able to iterate a unit fraction on a number line to find the whole (i.e. use ¼ to label and draw 2/4, ¾, and 1 whole)

Estimated Time: 60 minutes

Resources for Lesson:

- ✓ Masking tape
- ✓ Cuisenaire rods
- ✓ Adding machine tape

Content Area/Course: Grade 3 Fractions

Unit: Exploring Fractions

Time (minutes): 60 Minutes

Lesson #8: *Jumping on: Moving Past One Whole*

Objectives:

-Given a number line from 0 to 3, students will be able to identify the whole and partition and label fractions beyond 1 whole.

-Given an open-number line starting with 0, students will be able to use a unit fraction to generate repeated intervals past 1 whole.

Language Objectives:

-Students will explain how to iterate a unit fraction in order to define and locate a fraction beyond the whole on an open number line.

Essential Question addressed in this lesson:

How do models help us understand fractions?
How do we use fractions in our everyday lives?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

3.NF.2 Understand a fraction as a number on the number line; represent fractions on a number line diagram
SMP.7: Look for and make use of structure

Anticipated Student Preconceptions/Misconceptions:

Students may be confused by the fact that the whole is the span between 0 and 1 (or between any two consecutive whole numbers on the number line) and instead view the whole as the span between 0 and the final end point on the number line.

Pre-Assessment:

See attachment.

What students need to know and are able to do coming into this lesson (including language needs):

-Students have worked within a span from 0 to 1 on a number line using the following fractional parts: halves, fourths, eighths, thirds, or sixths.
-Students use unit fractions to find the location of 1 whole on a number line.

Lesson Sequence and Description

Introduction and Engagement Activity: (10 minutes)

Vocabulary: Open number line, Unit fraction, Partition, Iterate, Equal lengths, Interval, End-point, Cuisenaire rods.

Note: Through the use of visual models, students will see repetitions in the structure of unit fractions and their relationship to wholes. (SMP 7 *Look for and make use of structure).*

1) Go back to the tape marks for one of yesterday's students. Start the same student at the beginning and ask him or her to jump again until her or she reaches yesterday's finish line. If this spot was not labeled "1" yesterday, label it now.

2) Ask: "*If this is (student's name) start and finish line from yesterday, what happens if he or she takes one more leap of the same size?"* NOTE: If necessary, clarify that the student's ending spot from yesterday is represented by 1 (the whole) on the number line. Have the student jump again and mark the landing spot with a piece of tape. Solicit student ideas about how to label the new landing spot. NOTE: some students may notice that this endpoint can also be labeled as 1 ½. If this comes up, recognize that it is correct but don't pursue it. You can tell the students that you will be coming back to this idea.) Possible student confusion would be that the size of the whole has now changed so that the unit fraction should now be 1/5. If this confusion occurs, remind students that the whole was the total distance jumped yesterday.

3) Have the student make several more jumps and mark them with tape. Talk with the class how to label these jumps. Have students turn to a partner and discuss patterns that they notice (e.g. the numerator increases by 1 with each jump; the denominator stays the same). Share out some of these observations with the whole group.

Guided Practice: (15 minutes)

1) Say: "*Let's use the red rod to represent the unit fraction ½. How many red rods will we need to make a whole?"* Have students discuss with a partner and then solicit student responses. Demonstrate on the adding machine tape how to draw an open number line (NOTE: make sure to draw a long number line – it's better for student to have a longer line and not use all of it than for them to have to keep extending the line each time they add on a

unit fraction.) Start by marking an endpoint and labeling it 0, then use the red rod to mark and label the endpoint ½. Ask students to copy your diagram and then mark and label the next endpoint on their own adding machine tape. Discuss how students marked this next endpoint. It is likely that some students labeled it "1" and others labeled it "2/2". If all students labeled it one way, introduce the other notation. Ask students if they think both are ok. Why or why not? Discuss.

2) Ask students to add one more red rod and mark the next end point. Discuss how to label this end point. If students struggle with this idea, encourage students to recognize a pattern by emphasizing that your previous labels have been to indicate the places where you had finished laying down 1 of the halves and 2 of the halves. *"How many halves have been laid down at this point?"* (NOTE: again, some students may notice that this endpoint can also be labeled as 1 ½. If this comes up, recognize that it is correct but don't pursue it for group discussion. You can tell the students that you will be coming back to this idea.)

3) Have students continue to lay down red blocks and continue to mark and label the end points in increments of ½. End when students are becoming comfortable with the pattern.

Independent Practice: (20 minutes)

On new pieces of adding machine tape, have students respond to the following: (NOTE: have students use a new piece for each number line):

1a) If the purple rod represents 1/2, mark and label halves from 0/2 to 9/2. Make sure to find and label the whole.

1b) If the black rod represents 1/2, mark and label halves from 0/2 to 9/2. Make sure to find and label the whole.

2) Use dark green rods to label fourths from 0/4 to 10/4. Where is 1 on your number line? Show or explain how you know.

3) If the brown rod represents the unit fraction 1/3, draw a number line that extends to 12/3. Label all of the intervals.

Challenge extension: Go back to each of the number lines that you've created and find and label 2 wholes, 3 wholes, etc. Show or explain how you know.

Closure (15 minutes)

<u>Review outcomes of this lesson:</u>

Return to a discussion about the potential misconception that extending a number line past 1 leads to a change in the unit fraction. Probe for deeper understanding by discussing examples that students generated (either correct or incorrect) during the independent practice.

Following this discussion, spend a few moments for students to reflect upon the essential questions of this unit. Say to the students: We *have been studying fractions throughout this unit. We have modeled them in many different ways. Turn and Talk to your partner about* these *two questions?*

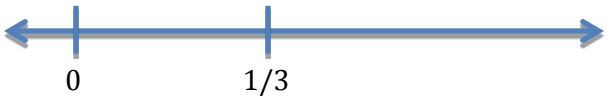
How do models help us understand fractions?
How do we use fractions in our everyday lives?

Preview outcomes for the next lesson (NOTE: Students will work on the CEPA in the next lesson): *Tomorrow you will work on a problem to demonstrate what you have learned about fractions.*

Lesson 8 Resources:

Lesson 8: Pre-Assessment

Jaime looks at the number lines below and says that they can't both be correct because 1/3 is in different places on each line. Do you agree? Why or why not?



Independent Practice Recording Sheet Lesson 8

On new pieces of adding machine tape, complete the following examples.

1.
    a. If the purple rod is 1/2, mark and label halves from 0/2 to 9/2. Make sure to find and label the whole.
    b. If the black rod is 1/2, mark and label halves from 0/2 to 9/2. Make sure to find and label the whole.

2. Use dark green rods to label fourths from 0/4 to 10/4. Where is 1 on your number line? Show or explain how you know.

3. If the brown rod represents the unit fraction 1/3, draw a number line that extends to 12/3. Label all of the intervals.

Challenge extension: Go back to each of the number lines that you've created and find and label 2 wholes, 3 wholes, etc. Show or explain how you know.

Extended Learning/Practice (homework)

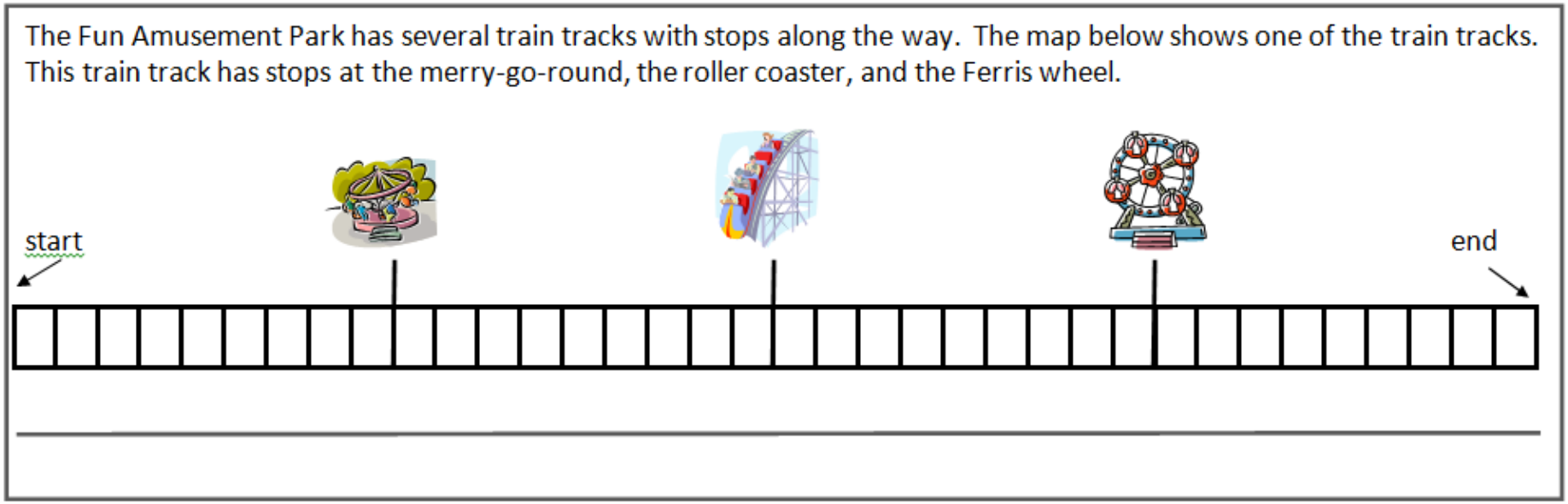
Sora says that the number line below can't be right because 1/2 isn't shown. Do you agree? Why or why not?

Grade 3 Fractions CEPA #2: Park Train

Student Instructions:

Part 1:

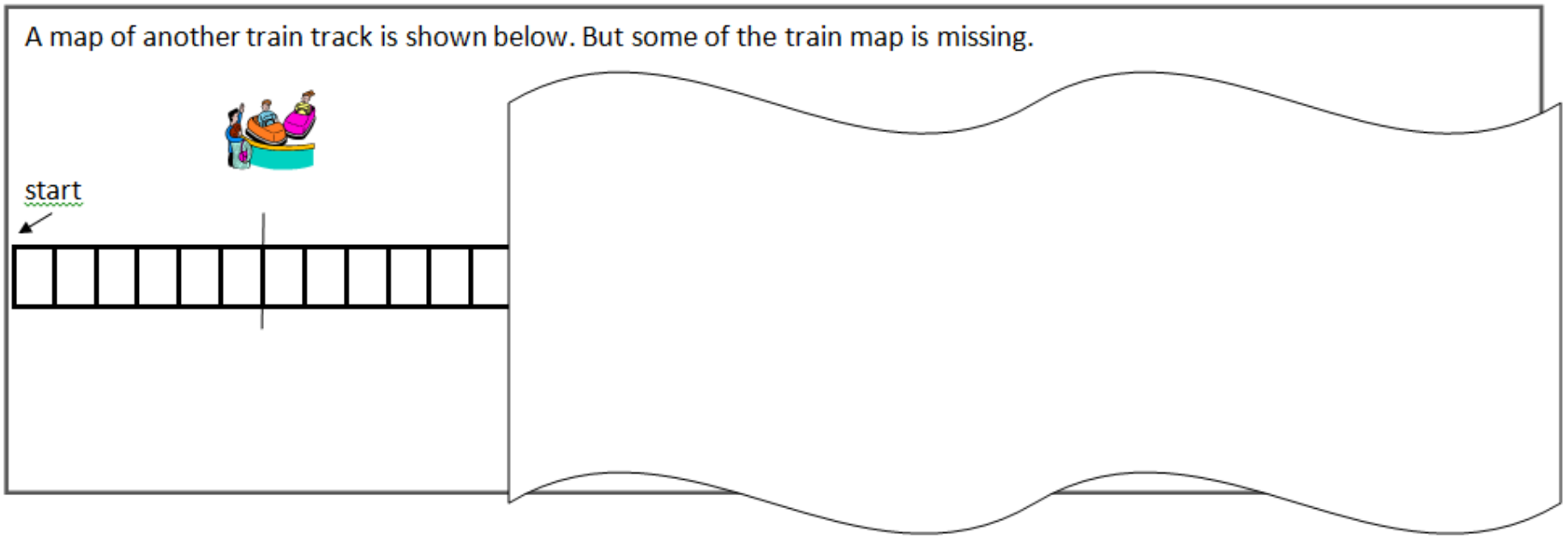
The Fun Amusement Park has several train tracks with stops along the way. The map below shows one of the train tracks. This train track has stops at the merry-go-round, the roller coaster, and the Ferris wheel.



If you rode on the train track above from the start and stopped at the Ferris wheel, what fraction of the track did you travel? Explain.

Use the line under the track on the map to make a fraction number line. Explain.

Part 2:



A ride from the start of the track above to the bumper cars is 1/3 of the track. Draw in the rest of the train track and label the fractional parts and the endpoint.

CEPA #2 Rubric

Did Not Demonstrate (0 points)	Emerging (1 points)	Meeting (2 points)
☐ There was little or no evidence that the student made use of structure. The unit fraction did not appear to be considered when the track was drawn.	☐ There was some evidence that the student made use of structure. The unit fraction appeared to be considered when the rail was labeled/ drawn but the labels were incomplete /incorrect.	☐ The student made use of structure through correctly partitioning the rail and drawing /labeling the rail on a linear model.
☐ The student's explanation showed little or no evidence of reasoning about the numerator, denominator, unit fraction, or whole.	☐ The student's explanation showed some evidence of reasoning about the numerator, denominator, unit fraction, or whole.	☐ The student's explanation showed evidence of reasoning about the numerator, denominator, unit fraction, or whole.
☐ Little or no precise mathematical language was used in the explanation.	☐ Some precise mathematical language was used in the explanation.	☐ Precise mathematical language was used in the explanation.
Total: ___ /6	Comments:	