Fractions: Relating Fraction Equivalencies to Decimal Fractions Grade 4 Formative Assessment Lesson

Designed and revised by the Kentucky Department of Education
Field-tested by Kentucky Mathematics Leadership Network Teachers

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Revised 2017

Relating Fraction Equivalencies to Decimal Fractions Grade 4

Mathematical goals

This lesson unit is intended to help you assess how well students are able identify equivalent decimal fractions.

Students will:

Recognize and generate equivalent fractions.
Use equivalent fractions to add and subtract fractions with like denominators.
Use decimal notation for fractions with denominators 10 and 100.
Use words to indicate the value of the decimal.
Use decimal fractions and locating them on the number line.
Use area models to represent equivalent fractions and decimals.

Kentucky Academic Standards

This lesson involves *mathematical content* in the standards from across the grade, with emphasis on:

4.NF

- **Extend understanding of fraction equivalence and ordering.** *(Note: Ordering of fractions is not addressed in this lesson.)*
- **Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.**
- **Understand decimal notation for fractions, and compare decimal fractions.**

This lesson involves a range of *Standards for Mathematical Practice* with emphasis on:

1. Make sense of problems and persevere in solving them.
3. Construct viable arguments and critique the reasoning of others.
7. Look for and make use of structure.

Introduction

This lesson unit is structured in the following way:

- A day or two before the lesson, students work individually on an assessment task that is designed to reveal their current understandings and difficulties. You then review their work and create questions for students to answer in order to improve their solutions.
- A whole class introduction provides students with guidance on how to engage with the content of the task.
- During the lesson, students work with a partner on a collaborative discussion task to match the fraction and addition problems with fraction and decimal equivalencies, the correct number line that represents the fraction/decimal, and an area model representation. Throughout their work, students justify and explain their decisions to their peers and teacher(s).
- In a final whole class discussion, students synthesize and reflect on the learning to make connections within the content of the lesson.
- Finally, students revisit their original work or a similar task, and try to improve their individual response

Materials required

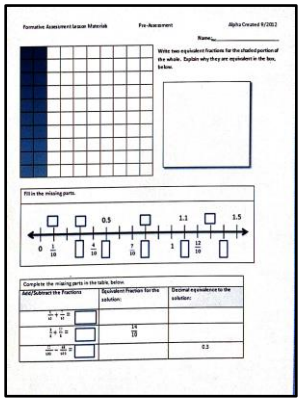
- Each student will need 2 copies of the assessment to use a pre-assessment and a revisit.
- Each pair of students, during the collaborative lesson, will need a packet of Card Set A – G. (Start with Card Sets A and B. After students can demonstrate their reasoning for the matches, give them the next 'layer' of cards. You may want to make copies of the card sets on different color card stock to assist with organization.
- Mini whiteboard, marker, eraser for each student.
- The card sets should be cut up before the lesson.

Time needed

Approximately fifteen minutes for the assessment task, a one-hour lesson, and 15 minutes for the students to review their work for changes. All timings are approximate. Exact timings will depend on the needs of the class.

Before the lesson

Assessment task:



Formative Assessment Lesson Materials Pre-Assessment Alpha Created 9/2012

Name_____

Write two equivalent fractions for the shaded portion of the whole. Explain why they are equivalent in the box, below.

Fill in the missing parts.

0 $\frac{5}{10}$ 0.5 $\frac{10}{10}$ $\frac{7}{10}$ 1 1.1 $\frac{12}{10}$ 1.5

Complete the missing parts in the table, below.

Add/Subtract the Fractions	Equivalent Fraction for the solution.	Decimal equivalence to the solution.
$\frac{3}{12} + \frac{6}{12} =$ ☐		
$\frac{3}{5} + \frac{1}{5} =$ ☐	$\frac{14}{10}$	
$\frac{35}{100} - \frac{25}{100} =$ ☐		0.3

Have the students do this task in class a day or more before the Formative Assessment (collaborative) Lesson. This will give you an opportunity to assess the work and to find out the kinds of difficulties students have with it. Then you will be able to target your help more effectively in the follow-up lesson.

Give each student a copy of *Pre-Assessment.* Introduce the task briefly help the class to understand the problem and its context.

> ***Spend fifteen minutes on your own, answering these questions.***
>
> ***Don't worry if you can't figure it out.***
>
> ***There will be a lesson on this material [tomorrow] that will help you improve your work.***
>
> ***Your goal is to be able to answer these questions with confidence by the end of that lesson.***

It is important that students answer the question without assistance, as far as possible. If students are struggling to get started, ask them questions that help them understand what is required, but do not do the task for them and be conscientious to not lead or provide the thinking for your students.

Assessing students' responses

Collect students' responses to the task. Make some notes on what their work reveals about their current levels of understanding. The purpose of this is to forewarn you of the issues that will arise during the lesson, so that you may prepare carefully.

We suggest that you do not score students' work. The research shows that this is counterproductive, as it encourages students to compare scores, and distracts their attention from how they may improve their mathematics.

Instead, help students to make further progress by asking questions that focus attention on aspects of their work. Some suggestions for these are given on below. These have been drawn from common difficulties anticipated.

We suggest that you write your own lists of questions, based on your students' work, using the ideas below. You may choose to write questions on each student's work. If you do not have time to do this, select a few questions that will be of help to the majority of students. These can be written on the board at the beginning of the lesson.

Common Issues - Suggested questions and prompts:

Common Issues	**Suggested questions and prompts**
Students use the idea of (# shaded) divided by (#total), but cannot find an equivalent fraction. *(Question 1)*	• ***Can you think of a smaller number of total parts than 100 to represent this whole? (10 parts…so 2/10)*** • ***How many rectangles, of the same size of the shaded part, are there in the whole? (5..so 1/5 of the whole is shaded)***
Students incorrectly identify fractional (or decimal) representations on the number line, perhaps by identifying the next missing part as the next number in the pattern, without considering the parts that had been left unidentified. (Question 2)	• ***How can you tell the number of equal divisions there are between 0 and 1 on the number line?*** • ***Can you find ½ on the number line? (anchor fraction)***
Students misapply an algorithm without having understanding of what it means to add fractions (conceptually). Each part of the fraction (numerator/denominator) is treated as a different single-digit whole number. (Question 3)	• ***What is one-tenth plus one-tenth?*** *(This question builds on 3rd grade standard of using unit fractions to accumulate.)*

Suggested lesson outline

Whole-class interactive introduction to frame the lesson (10 minutes)

Give each student a mini-whiteboard, a marker, and an eraser.

Explain to the class that in the lesson they will be working with fractions and decimals and locating them on a number line.

Ask students to write on their mini-whiteboards the answers to questions such as the following. Each time, ask students to explain their method.

> *"Write a fraction which is equivalent to ¾" – ask a few students to explain how they know their fraction is equivalent.*
>
> *"Write a decimal which is equivalent to 7/10" – ask a student to explain how they did this.*
>
> *"Draw a number line to compare 2/5 and 3/10" – ask several students to explain their comparison.*

$\frac{3}{4} =$

$\frac{7}{10} =$

Collaborative Lesson activity (30 minutes)

Strategically partner students based on pre assessment data. Partner students with others who display similar errors/misconceptions on the pre-assessment task. While this may seem counterintuitive, this will allow each student to more confidently share their thinking. This may result in partnering students who were very successful together, those who did fairly well together, and those who did not do very well together.

Introduce the collaborative activity carefully:

> *Today we are going to do continue our work with fractions and decimals. I want you to work with your partner. Take turns matching the expression to the solutions. Each time you do this; explain your thinking clearly to your partner. If your partner disagrees with your match then challenge him or her to explain why. It is important that you both understand why each card is matched with another one. There is a lot of work to do today and you may not all finish. The important thing is to learn something new, so take your time. When you finish with the first card set, raise your hand and I'll come and ask you to explain your thinking before moving on to a new card set.*

Give each pair ***Card Set A: addition/subtraction, Card Set B: solutions*** and ***Card Set C: fraction equivalence***. Depending on how students performed on the pre-test you may want to hold Card Set C until students have started matching and can articulate how they started matching card Set A to Card Set B.

**Important Note: Each card set has a shaded identification number/letter on a subset of the cards. These can be used, initially, and the additional cards for each set can be used for additional practice or support, if needed. If a pair of students struggles with the shaded cards, then they may need more practice with that "layer" and the teacher can give them the rest of the cards for that set. Otherwise, move on to the next Set of cards.*

Explain to students how they should work together, making sure that each student can articulate why the card is placed where it is, even if that student didn't place the card.

While students are working, you have two tasks: to find out about students' work and to support their reasoning.

Find out about students' work – circulate, listen, take notes, keep pairs advancing through card sets
As you move around the room listen to students' explanations.

Your task during the partner work is to make a note of student approaches to the task, to support student problem solving and to monitor progress. Note any difficulties that emerge for more than one pair; these can be discussed later in the lesson.

Be mindful to know when students are ready for ***Card Set D: decimals;*** continue to make notes of student's approaches to the task, to support student's problem solving and to monitor progress. Some students may need ***Card Set G: visual equivalences*** to assist with understanding.

Card Set E: names can be distributed to each pair *with* ***Card Set D***, *if* you have determined through observations and notes that students are ready to use notation and word names at the same time. Some pairs may not be ready for this. Card Set E should be distributed before Card Set F.

Card Set F: number lines brings the lesson together.

Card Set G: Area models. Students should make connections between the area models, number lines, and fractional and decimal representations once the sort is complete.

This lesson format was designed from the Classroom Challenge Lessons intended for students in grades 6 through 12 from the Math Assessment Project.

Whole Class Discussion (15 minutes)

Conduct a whole-class discussion about what has been learned and highlight misconceptions and strategies you want to be revealed. Select students or pairs who demonstrated strategies and misconceptions you want to share with the class. Be intentional about the order of student sharing from least complex to most complex thinking. As selected pairs share, highlight the connections between strategies.

Ask: How does student A's strategy connect to student B's strategy?

Ask students to write on their mini-whiteboards the answers to questions such as the following. Each time, ask students to explain their method.

"Write at least two fractions which are equivalent to ¾" – ask a few students to explain how they know their fractions are equivalent.

"Write two decimals which are equivalent to 7/10" – ask a student to explain how they did this.

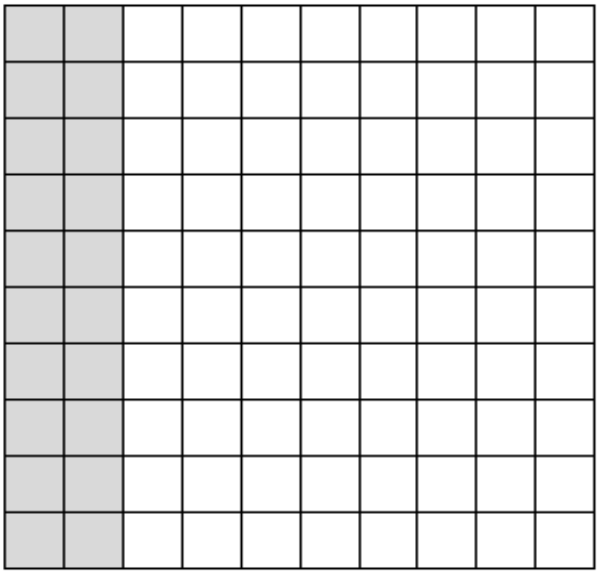
"Draw a number line to compare ½ and 3/5 " – ask several students to explain their comparison.

Conclude the lesson by discussing and generalizing what has been learned. The generalization involves first extending what has been learned to new examples, and then examining some of the conclusions the students come up with.

Ask: *Which cards were easiest/hardest to match? Why?*
What might be a different way to explain?
Did anyone do the same or something different?
How would you explain in words your model?

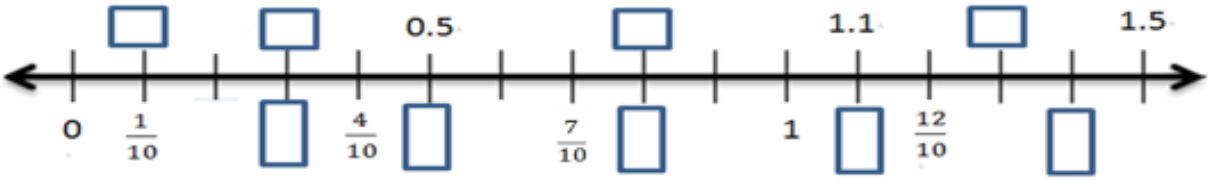
Student Materials Pre Assessment Task

Name:_____



Write two equivalent fractions for the shaded portion of the whole. Explain why they are equivalent in the box, below.

Fill in the missing parts on the number line.



Add/Subtract the Fractions	Equivalent Fraction for the solution:	Decimal equivalence to the solution:
$\frac{1}{10} + \frac{7}{10} = \square$		
$\frac{3}{5} + \frac{4}{5} = \square$	$\frac{14}{10}$	
$\frac{75}{100} - \frac{45}{100} = \square$		0.3

CARD SET A

A1	$\frac{2}{10}+\frac{3}{10}$	A2	$\frac{8}{10}+\frac{2}{10}$
A3	$\frac{1}{5}+\frac{1}{5}$	A4	$\frac{9}{5}-\frac{2}{5}$
A5	$\frac{1}{10}+\frac{1}{10}$	A6	$\frac{10}{10}-\frac{4}{10}$
A7	$\frac{10}{5}-\frac{6}{5}$	A8	$\frac{148}{100}-\frac{38}{100}$
A9	$\frac{72}{100}-\frac{42}{100}$	A10	$\frac{17}{100}+\frac{53}{100}$

CARD SET B

B1 $\frac{5}{10}$	B6 $\frac{110}{100}$
B2 $\frac{4}{5}$	B7 $\frac{7}{5}$
B3 $\frac{2}{5}$	B8 $\frac{10}{10}$
B4 $\frac{2}{10}$	B9 $\frac{70}{100}$
B5 $\frac{30}{100}$	B10 $\frac{6}{10}$

CARD SET C

C1 $\frac{1}{5}$	C2 $\frac{5}{5}$
C3 $\frac{1}{2}$	C4 $\frac{11}{10}$
C5 $\frac{4}{10}$	C6 $\frac{14}{10}$
C7 $\frac{3}{10}$	C8 $\frac{3}{5}$
C9 $\frac{8}{10}$	C10 $\frac{7}{10}$

CARD SET D

D1 *0.2*	D2 *0.6*
D3 *0.8*	D4 *1.0*
D5 *0.5*	D6 *1.1*
D7 *0.4*	D8 *1.4*
D9 *0.3*	D10 *0.7*

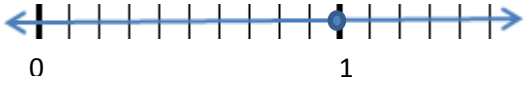
CARD SET E

E1 five-tenths	E2 one
E3 two-tenths	E4 one and four-tenths
E5 three-tenths	E6 six-tenths
E7 eight-tenths	E8 one and one-tenth
E9 four-tenths	E1 seven-tenths

CARD SET F

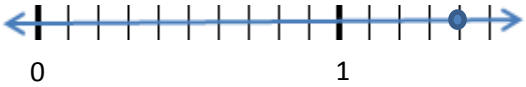
F2

F1



F4

F3



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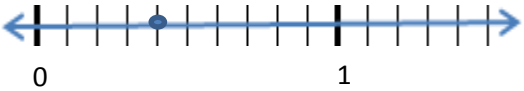

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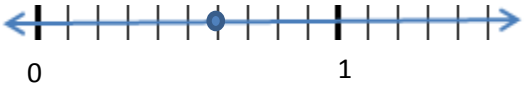
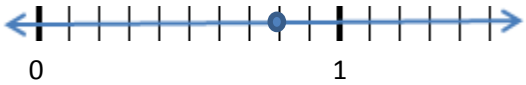


F8



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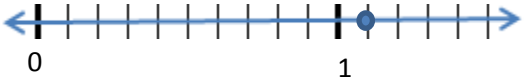

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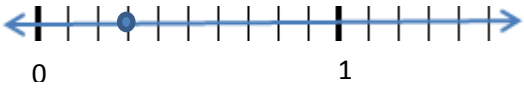

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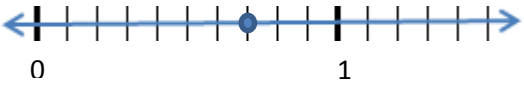
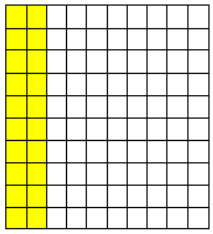
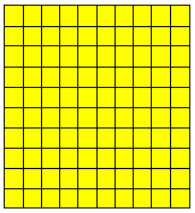


CARD SET G (suggest printing in color)

G1



G2



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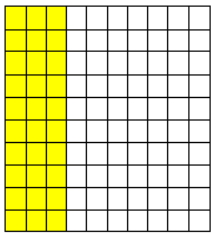

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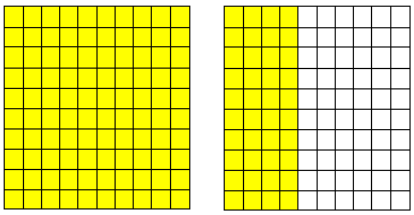

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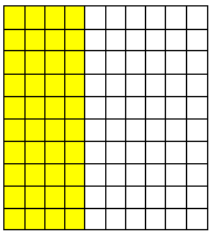

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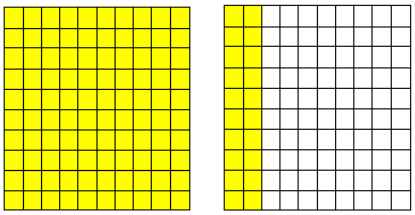

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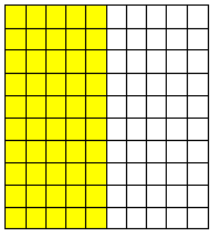

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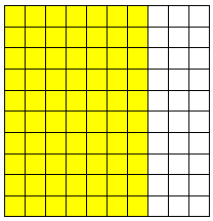

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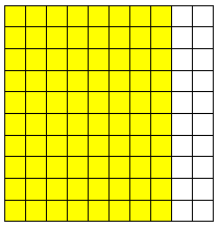
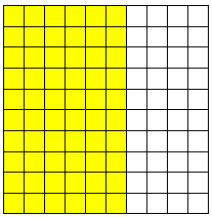
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