CCSS The Amazing Race: Fractions and Decimals
4^{th} Grade Concept Lesson Plan

LESSON OVERVIEW

Student Task:
In this lesson, students convert fractions into decimals and compare decimals by using a number line and other visual models. Students also add fractions with denominators of 10 and 100 and identify decimals on a number line.

Materials:
Concept Lesson, student task sheets (attached)

Optional Materials:
Color tiles, base-10 rods, 100 grids

BIG IDEA:
Number Relationships and Equivalence
Numerical values can be represented in multiple ways.

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ESSENTIAL UNDERSTANDING:
Fractions and decimals are identified and represented as a unique point on a number line.

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- A decimal is another name for a fraction
- Place value can be used to compare and order decimals
- Benchmark quantities can assist in ordering and comparing fractions and decimals.
- Fractions with denominators of 10 and 100 can be added using equivalent fractions

Mathematical Goals of the Lesson:

The mathematical goals of the lesson are for students to:

- deepen their understanding that every fraction and decimal can be represented and compared on a number line.
- deepen their understanding of the number line in terms of using benchmark quantities to assist in locating points; and recognizing that the number line may be divided into any number of equal intervals;
- express fractions as decimals and decimals as fractions
- explore adding fractions with denominators of 10 and 100 using equivalent fractions

Common Core Standards Addressed in the lesson:

Domain: Number and Operations - Fractions
Cluster: Understand decimal notation for fractions, and compare decimal fractions.

4.NF.5 Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100*. (Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators in general is not a requirement at this grade.)

4.NF.6 Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram*.

4.NF.7 Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.

Math Practice 1 (MP1): Make sense of problems and persevere in solving them.
Math Practice 2 (MP2): Reason abstractly and quantitatively.
Math Practice 3 (MP3): Construct viable arguments and critique the reasoning of others.
Math Practice 4 (MP4): Model with mathematics.
Math Practice 5 (MP5): Use appropriate tools strategically.
Math Practice 6 (MP6): Attend to precision.
Math Practice 7 (MP7): Look for and make use of structure.
Math Practice 8 (MP8): Look for and express regularity in repeated reasoning.

Language Objectives:

Students will sequentially explain in writing how they solved or worked through the problem by providing facts and using academic language. Students will ask and answer what, how, and why questions in order to demonstrate their understanding of decimal notation.

Academic Language:
The concepts represented by these terms should be reinforced/developed through the lesson:
• Number line
• Interval
• Decimal
• Tenths
• Hundredths
• Equivalent
• Benchmark fractions

Task Vocabulary: Fitness-gram, pedometer, oval track
It is important not to "teach" the terms prior to the lesson. Instead, use the word wall as a tool to assist students if and when they encounter difficulty with a term.

Connections to the Teaching and Learning Framework:
Standard 3: Delivery of Instruction
Component 3b: Using Questioning and Discussion Techniques
Element 3b1: Quality and Purpose of Questions: Questions are designed to challenge students and elicit high-level thinking.

Universal Access:
Identify strategies that address the needs of diverse learners, including, ELs, SELs, GATE students, students with disabilities, and other students with special needs.

- Where do you see opportunities for students to have instructional conversations, work in cooperative groups, develop academic vocabulary, and use graphic organizers and visual tools?

Some suggestions:

- Highlight what you know (facts) and what you are trying to find out (questions). Highlight names under the pedometer, on the number line, and corresponding times.
- Provide access to manipulatives, for example: hundred grids, student created place-value chart with tenths and hundredths, graphic organizer (ex. Circle Map-ways to represent 8/10), graph paper with colored pencils.
- Vocabulary support may include acting out the race, providing realia, with support for the following: pedometer, represent, circular track, farthest, distance, displayed
- Prompt students to utilize visual word wall
- Students chart information as they solve the problem during collaboration
- Sample sentence frames to support English learners, for example: When I compare (fractions, decimals,), I do ____, because _____.
- Language Frames for Classroom Communication, see Appendix A, and note use in the lesson.

Assumption of prior knowledge/experience:
- Understand the base 10 number system
- Experience with placing fractions on a number line
- Comparing whole numbers
- Express fractions with denominators of 10 or 100 as a decimal
- Adding fractions with like denominators
- Creating equivalent fractions

Organization of Lesson Plan:
- The left column of the lesson plan describes rationale for particular teacher questions or why particular mathematical ideas are important to address in the lesson.
- The right column of the lesson plan describes suggested teacher actions and possible student responses.

Key:
Suggested teacher questions are shown in bold print.
Possible student responses are shown in italics.
Standards for Mathematical Practice are marked with MP and their number.
** Indicates questions that get at the key mathematical ideas in terms of the goals of the lesson

Lesson Phases:
The phase of the lesson is noted on the left side of each page: Set Up, Explore and Share, Discuss and Analyze.

Talk Moves:
Classroom Discussions, by Chapin & O'Connor, cites five productive talk moves: revoicing, asking students to restate someone else's reasoning, asking students to apply their own reasoning to someone else's reasoning, prompting students for further participation, using wait time. Talk moves will be noted in the lesson.

THE LESSON AT A GLANCE

Set Up (pp. 6-8)

Set up the Task:

- Solve the task in as many ways as possible and consider misconceptions students might have.

Linking to prior knowledge:

- Identify the benchmark fractions, 0, $\frac{1}{2}$, and 1 on the number line and interpret them in terms of a decimal.
- Review the relationship between fractions and decimals.

Explore (pp. 9-11)

Provide private think time for students to access the problem.

- Address misconceptions or errors and ask questions to move them towards the concepts of the lesson.

Assess and advance students' learning through questioning:

- Ask student to explain their thinking and reasoning, and then pose questions that further their understanding.
- Ask students to explain the thinking and reasoning of others.
- Press students to use multiple representations and multiple strategies.

Share, Discuss and Analyze (pp. 12-17)

Share different solution paths and connect multiple representations:

- Determine the sizes of decimals and fractions in relation to each other.
- Use benchmark quantities to determine which points on a number line make sense for a set of three numbers.
- Interpret values in both fractional and decimal notation.
- Sequence the solutions to be shared in a purposeful way.
- Students make connections between different representations and different solution paths.

Summarization of the Big Ideas in the Lesson

- Benchmark amounts such as 0, $\frac{1}{2}$, and 1 help us determine the relative positions of fractions and decimals on a number line.
- Number lines may be divided into any number of intervals; however, each interval on a number line must be the same size.
- Number lines can be used to compare decimals and fractions.
- Every fraction has a decimal equivalent and every decimal has a fraction equivalent.
- Fractions with denominators of 10 and 100 can be added using equivalent fractions.

THE LESSON

Phase	RATIONALE	SUGGESTED TEACHER QUESTIONS/ACTIONS AND POSSIBLE STUDENT RESPONSES
S E T U P S E T U P S E T U P	**HOW DO YOU SET UP THE TASK?** • Solving the task prior to the lesson is critical so that: - you become familiar with strategies students may use. - you consider the misconceptions students may have or errors they might make. This will allow you to better understand students' thinking and prepare for questions they may have or that you might ask. • It is important that students have access to solving the task from the beginning. The following strategies can be useful in providing such access: -strategically pairing students whose skills and abilities complement each other. -providing manipulatives or other concrete materials. (MP5) -identifying and discussing vocabulary terms that may cause confusion. (MP6) -posting vocabulary terms on a word wall, including the definition and, when possible, a drawing or diagram. (MP6) **SETTING THE CONTEXT FOR THE TASK** Linking to Prior Knowledge It is important that the task have points of entry for students. By connecting the content of the task to previous mathematical knowledge, students will begin to make the connections between what they already know and what we want them to learn. (MP1) • Pressing students to use the language "six tenths" and	**HOW DO YOU SET UP THE TASK?** • Solve the task prior to the lesson. • Make certain students have access to solving the task from the beginning by: -pairing students to work with a partner. -displaying the problem so that it can be referred to as the problem is read. -referencing the previously known vocabulary and vocabulary that will be used in the task: *number line *interval *decimals *tenths *hundredths *equivalent *benchmark fractions Mark additional vocabulary as it arises in the context of the task. **SETTING THE CONTEXT FOR THE TASK** Linking to Prior Knowledge • Ask students if they have heard of or have an older sibling that has participated in the grade 5 Fitness-gram. Explain to students that by the end of the school year in 5th grade, one of the physical education expectations that they are expected to meet is to be able to run 1 mile in 10 minutes or less. Explain to students that in this lesson, two students are competing against each to see who can run the farthest in 10 minutes. A pedometer is a tool that measures

Phase	RATIONALE	SUGGESTED TEACHER QUESTIONS/ACTIONS AND POSSIBLE STUDENT RESPONSES
S E T U P S E T U P S E T U P	"four tenths" vs. point 6 and point 4 for decimals provides a connection to the base ten system and to the fact that decimals have fraction equivalents. (MP7) Using talk moves like restating allows students to hear and say the same idea in many different ways, thus allowing for greater understanding. (MP3) • When referring to decimals and fractions, the teacher may have students orally express or write the fraction in word form and make connections to a place value chart. (MP5) • The teacher should also ensure that students understand that the number of digits to the right of the decimal point indicates the number of zeroes in the denominator.	distance, not time, for example: the fit-bit app on your phone, or device that clips on your belt and measures how far you walked. Have a student read Part A of the task, you may want to chunk it out by question. Ask others to follow along: *PART A* *Sujin and Dan decide to have a race to see who can run the farthest distance in 10 minutes. They both run along the same circular track. At the end of 10 minutes, Sujin's pedometer shows that she has run .6 miles and Dan's pedometer shows that he has run 4/10 of a mile.* *1. Represent the distance that Dan ran on a number line. Now represent the distance that Sujin ran on the same number line.* *2. If Dan changed his pedometer to display decimals like Sujin's pedometer, what decimal would be displayed? Label your number line with that decimal.* *3. Who ran the furthest in 10 minutes? Express your answer using* >, =, < *and justify your answer in two ways.* • Ask clarifying questions: **What do we know? What are we trying to find out?** Have a student(s) read the remainder of the task. Ask others to follow along in Part B: *PART B* *The next day, Sujin and Dan decide to run again for 10 minutes to see if they can run further than they did yesterday. Sujin runs first and Dan times her. At the end of 10 minutes, Sujin's pedometer shows that she has run 8/10 of a mile. Dan runs second and Sujin times him. Dan's pedometer shows that he has run 25/100 of a mile.* *4. Dan thinks he ran further than Sujin. Is Dan correct? Justify your answer by using a visual model.* *5. Sujin thinks that if she adds the number of miles*

Phase	RATIONALE	SUGGESTED TEACHER QUESTIONS/ACTIONS AND POSSIBLE STUDENT RESPONSES
S E T U P S E T U P S E T U P	Having students think-pair-share and then whole-group share what they know and what they are trying to find will reveal any confusions or misconceptions that can be dealt with prior to engaging in the task. (MP1) <u>Set the Expectations</u> In addition to instructional objectives, students need behavioral objectives so that we can encourage and recognize the habits of mind of proficient problem solvers. Be clear about how you expect them to work: • engaging in private think time • showing at least two solutions • sharing their thinking with others • understanding others' solutions • incorporating the vocabulary in written and oral explanations. (MP1, MP3, MP6)	*she and Dan ran on the second day, that the total distance will be greater than 1 mile. Is Sujin correct? Show your answer in two different ways.* Ask clarifying questions: **What do we know? What are we trying to find out?** Have a student(s) read the remainder of the task. Ask others to follow along: *EXTENSION:* *The next day, Sujin and Dan decided to run for 10 minutes one last time. The number of miles that each of them ran is shown on the number line below.* *6. How far did each person run after 10 minutes? Show their distances as both fractions and decimals and explain how you know.* • Ask students to think-pair-share: **What do you know? What are you trying to find out?** Then ask students to share what they know and what they are trying to find, encouraging them to also share something a partner may have shared. Use the talk move of restating as students share. Ask: **What questions do you have?**

Phase	RATIONALE	SUGGESTED TEACHER QUESTIONS/ACTIONS AND POSSIBLE STUDENT RESPONSES
E X P L O R E	**INDEPENDENT PROBLEM-SOLVING TIME** *PART A* Give students private think time to understand and make sense of the problem for themselves and to begin to solve the problem in a way that makes sense to them. (MP1)	**INDEPENDENT PROBLEM-SOLVING TIME** *PART A* • Tell students to work on the problem by themselves for a few minutes (private think time). • Circulate around the class as students work individually. Ask focusing, assessing, and advancing questions but do not tell them how to solve the problem. • After several minutes, tell students they may work with a partner or in their groups. They could make connections with someone who has a solution different from theirs *or* similar to theirs. They should be able to explain and critique the reasoning of others. (MP3)
E X P L O R E	**FACILITATING SMALL-GROUP EXPLORATION** What do I do if students have difficulty getting started? Ask questions that do not give away the answer or that do not explicitly suggest a solution method. • Ask questions that reveal students' thinking without taking over the thinking for them by telling them how to solve the problem. (MP1)	**FACILITATING SMALL-GROUP EXPLORATION** What do I do if students have difficulty getting started? • If students are having difficulty drawing the number line for question 1 you might ask: -**Look at the two distances. What do you know about these numbers?** -**What range could your number line have?** • If students are having difficulty deciding on the intervals for the number line you might say: -**How does saying the numbers in word form help us understand what the intervals should be?** Drawing the number line and locating the distances • Students should be able to construct a number line that goes from 0 to 1. If their number lines extend far beyond 1, you might ask: **Look at the two distances. What would be reasonable intervals for a number line to show these distances? Why?**

E X P L O R E **E X P L O R E** **E X P L O R E**	<u>Drawing the number line</u> • Using a number line to mode a real world problem is an example of modeling with mathematics. (MP4) • It is important to consistently ask students to explain their thinking. It not only provides the teacher insight as to how the child may be thinking, but might also assist other students who may be confused. (MP3) • Pressing students to use correct mathematical language will strengthen their academic language and is more likely to lead to conceptual understanding. (MP6) • Pressing students to use the language "six tenths" and "four tenths" for decimals provides a connection to the base ten system and to the fact that decimals have fraction equivalents. (MP6) • Using 10 X 10 grids requires that the student use an area model, and then relate it to the linear model of a number line. One technique is to color the decimal represented on the grid, and then cut the tenths into strips, laying the strips end-to-end in a linear model. A number line can then be drawn representing the whole and the tenths. (MP5) • Providing connections between different representations strengthens students' conceptual understanding. (MP2) <u>Possible misconceptions or errors:</u> It is important to have students <u>explain their thinking</u> before assuming they are making an error or having a misconception. After listening to their thinking, <u>ask focusing questions</u> that will move them toward understanding their misconception or error. (MP1; MP3) If many students have the same misconception or are making the same error, you might have a class discussion about the error or misconception so that it does not get in	• Students should be able to locate 0.6 and 0.4 on the number line. You might ask: **How do we read the other two distances? Where would they be placed on the number line? How do you know?** • Some students may need additional support in locating tenths on a number line. You might begin by using base ten strips or 10 by 10 squares that represent one. Ask students to use the strips or the square to represent each of the values. Then have them construct a number line the same length as ten strips of the 10 by 10 square and use the representation to locate its point on the number line. (MP5) Possible misconception or error: Some students may label their number line 0-10 to reflect the ten minutes. Ask: **What does the 10 represent? Are we measuring time or distance and how do you know?** *PART B* <u>What do I do if students have difficulty getting started?</u> • If students are having difficulty drawing a visual model for PART B you might ask: -**What is similar and different about the day one distances and the day two distances?** -**How can the number line we created in Part A help us create one here?** <u>Possible misconceptions or errors:</u> • If students think that 25/100 is bigger than 8/10, you might ask the student to think about how the size of a denominator impacts the size of a fraction. (MP7) • If students are having difficulty determining if the total distance is greater than 1 mile, you might ask: **- Let's imagine that Dan ran 1/10 of a mile instead of 25/100. What would be the total distance? How were you able to figure that out and how can you**

E X P L O R E **E X P L O R E** **E X P L O R E**	the way of solving the task. • Consistently asking students to explain their thinking and to use correct mathematical language develops mathematical habits that will support students' learning throughout their school experience. (MP3; MP6) • Asking assessing, focusing and advancing questions based on what the students are currently thinking or doing scaffolds their learning from what they already know and moves them towards the mathematical goals. (MP3)	**apply that knowledge to this problem?** **- How might we relate or compare the fractions to a different fraction, a benchmark fraction, to help us determine the answer by reasoning?** EXTENSION What do I do if students have difficulty getting started? • If students are having difficulty identifying the points on the number line, you might ask: -**What does each hash mark on the number line represent?** Possible misconceptions or errors: • *Incorrectly determining the intervals on the number line:* Students may think that the number line is divided into elevenths as there are eleven hash marks. You might ask them: -**How many equal pieces are there between the 0 and 1?** You might also connect the number line to a fraction bar: **How is this number line similar to a fraction bar? How can that help you figure out the intervals?** Identifying the points on the number line • Students should realize that the number line is divided into tenths or in intervals of 0.1 and that Sujin has run 6 of the tenths. • Students may have difficulty identifying the other two points since they fall between intervals. You might say: **How far is it between intervals? How long would half an interval be?** (.05 or 5/100) • The teacher may also want to have the student construct the number line by lining up base-10 rods. In doing so, students can see the hundredths. (MP5) • For Dan's point, the teacher may ask students to think of the point as a number between .30 and .40 vs. .3 and .4.

S H A R E D I S C U S S A N D A N A L Y Z E	**<u>RATIONALE</u>** **<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE</u>** <u>What solution paths will be shared, in what order, and why?</u> The purpose of the discussion is to assist the teacher in making certain that the goals of the lesson are achieved by students. Questions and discussions should focus on the important mathematics and processes that were identified for the lesson. Make sure to mark for students that this is the most important part of the lesson and that you expect them to listen attentively, ask questions of each other, defend their reasoning, and make connections between others' solution paths and their own. (MP3, MP7) ** Indicates questions that get at the key mathematical ideas in terms of the goals of the lesson **Possible Solutions to be Shared** • Asking students consistently to explain how they know something is true develops in them a habit of defending their thinking and reasoning. This leads to deeper understanding of mathematics concepts. (MP3)	**SUGGESTED TEACHER QUESTIONS/ACTIONS** **<u>AND POSSIBLE STUDENT RESPONSES</u>** **<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE</u>** *PART A* <u>What solution paths will be shared, in what order, and why?</u> Ask a student, or a pair of students, to explain how they answered PART A. For the number line solutions, you might ask questions such as: • **How did you know where to begin and end your number line?** Students should state that the distances were all between 0 and 1 mile. • **How did you make the whole into equal parts?** Students should state that they created intervals of tenths. • ****Explain how you knew where to locate each of the distances.** They might convert 0.6 and 0.4 to $^{6}/_{10}$ and $^{4}/_{10}$ respectively. They might say that they counted four or six unit fractions of the size one tenth. They might say they looked at the relationship each has to ½. • **How did you use ½ to help you know which is the larger fraction?** • ****How can you see on the number line who has run the farthest distance so far?** Students should state that Sujin has run the farthest distance so far because her distance is farthest to the right on the number line. Students might also say that since Sujin point is closest to one mile she has run the farthest. For students who compared decimals, you might ask questions such as: • **How do you know that .6 is greater than .4?** Students may make connections with fractions, with comparing whole numbers by place value, and possibly money. If students respond that six is greater than 4, then ask: **What is it six of? What is it four of? What is the**

S H A R E D I S C U S S A N D A N A L Y Z E	This particular discussion is intended to reinforce or strengthen students' number sense about fractions and decimals. Norms for discussions are important throughout. The norms below might be some to use in place of raising hands. (MP2; MP3; MP7) <u>Norms for Discussion</u>: ○ Track (keep your eyes on) the speaker ○ Address the speaker by name ○ Use 3 seconds wait time before adding on or asking a question ○ Talk clearly in order to be understood ○ Define our mathematical reasoning in a clear way ○ Ask questions during mathematics time when we don't understand ○ Explain and justify our mathematical reasoning to each other with questions ○ Defend our mathematical thinking to others • Asking other students to explain the solutions of their peers builds accountability for learning into the discussion. (MP3) • Summarizing key mathematical points lets students know they have said or discovered something that is mathematically important to know. (MP3) • Asking students to summarize the explanations of others holds all students accountable for understanding what is being discussed. (MP2; MP3) • Looking at the solution in more than one way will deepen students' conceptual understanding and help them check to see if their answers make sense. (MP3) • Allowing for multiple representations helps students to make use of structure, see patterns, and reason mathematically. Consider how you might reach your mathematical goals in the context of student thinking. This will empower them to defend their reasoning and communicate to others. (MP3, MP6, MP7)	**place value of the six and four?** For students who use fractions, you might ask questions such as: • **How do you know that the fraction 6/10 is greater than 4/10?** Students should state that when comparing fractions with the same denominator, the fraction with the greater numerator is the greater fraction because there are more unit pieces. • Summarize what has been discussed so far. Say: **So ______ explained to us that Sujin has run the farthest distance because ______________.** • You might also ask students to summarize the discussion by asking: **How did ___ explain why she drew the number line from 0 to 1? How did ___ explain why Sujin had run the farthest distance?** *PART B* <u>What solution paths will be shared, in what order, and why?</u> Ask a student, or a pair of students, to explain how they answered PART B. For students who created a number line you might ask questions similar to: • **How did you decide how to divide your number line?** Students should state that they looked at the denominator of the fraction in tenths, and divided the number line into ten equal intervals, by finding the benchmark of ½, and then dividing the two halves into five equal pieces each. Fifths and tenths can be difficult to depict accurately. Ask students to explain how they did it. Some students may have drawn ten equal intervals, and then marked the 1. Some students may have used the depicted number line as a guide to copy. • **How did you know where to place 25/100?** Students should state that they looked at the

S H A R E D I S C U S S A N D A N A L Y Z E	Varieties of Sharing Protocols (MP3; MP6; MP7): • Student shares own work at projecting device, or in front of class, and fields questions • Anonymous Sharing: Teacher has students write their names on the back of the paper, collects work, orders it, and projects it for the class to discuss. The student who did the work does not comment. The teacher may ask: How does this solution match the problem? What might the thinking be? How can we make it more complete? The goal is not to identify the student but instead to talk about the strategies. • Gallery Walk: Student work is posted around the room, students walk around the room to review it, posting comments and questions on post-it notes. Then the teacher facilitates a discussion around specific work afterwards. • Students work in pairs to create their work with markers on construction paper and solutions are shared as above. Fourth Grade CCSS does not include addition with decimals, only fractions with like denominators, and expressing a fraction with denominator 10 as an equivalent fraction with denominator 100, and using this technique to add two fractions with respective denominators 10 and 100. Keep bringing the addition back to fractions, and not decimals at this time. The focus is on reasoning about the sizes of the pieces, the number of pieces, and equivalence.	denominator of the fraction in hundredths, and realized that it would be too difficult to divide the line into 100 equal pieces, and choose 25 of them. They may state that they know that 25/100 is the same as ¼, or one-quarter, and that they used that understanding to divide the whole into four equal parts, and mark the ¼ point. Ask: **What do you know about benchmark fractions that might help you?** • Or they may know that 25/100 will be halfway between 20/100 and 30/100, so that they choose to divide the line into 10 intervals, showing the equivalence between 20/100 and 2/10, and place the point halfway between the 2/10 and the 3/10 intervals. For students who answered question 4 by drawing a number line, ask: • **How can you compare hundredths and tenths when the pieces are different sizes? How might you use what you know about equivalence to compare parts that are the same size?** • ****What does it mean to compare two points on a number line? What do you notice about the location of the points when you're comparing them? What pattern might you notice about comparing numbers on a number line? What do you notice about the relationship to the benchmark of ½?** Students should state that when comparing two points on a number line, the point on the right is always greater than the point on the left. Sujin ran further than Dan because eight-tenths is further to the right on the number line and is greater than 25-hundredths. Some students may have noticed the relationship of one fraction is greater than ½, and the other fraction is less than ½. For students who compared the numbers with a different visual model, without the use of a number line, ask: • **How did you compare the numbers, and what**

S H A R E D I S C U S S A N D A N A L Y Z E		**connections can you make between your model and the number line model?** For students who answered question 5 by using a number line, students may show a jump of 2-tenths from 8-tenths to one whole, and then indicate that 5-hundredths would be a little further right, indicating that the sum is greater than one. For students who answered question 5 by using equivalent fractions to rename 8/10 as 80/100, and then add 25/100 to find a sum of 105/100, ask: • **How did you approach adding the tenths and hundredths when the pieces were different sizes?** • **Do you agree or disagree with Sujin that she thinks the sum is greater than 1? Why or why not?** For students who answered question 5 using the standard algorithm, they may have lined up the tenths places and correctly calculated that .8 + .25 = 1.05. This algorithm is not taught until Grade 5, so there is not an emphasis on this approach. • For students who answered question 5 by incorrectly lining up the digits so that they are flush right, they may have calculated that: .8 +.25 .33 Ask: **What is the place value of the digits, and how would you express the same value in fractions?** Some students may have the misconception that: .8 + .4 = .12 = 1 2/10 Ask: **What is the place value of the .12, and does it make sense that the sum is smaller than the two parts?**

S H A R E D I S C U S S A N D A N A L Y Z E		**What is 1.2 equal to in fractions?** • Some students may have the misconception that: 8/10 + 25/100 = 33/110 Ask: **If the fractions have different sized parts, how might you use equivalent fractions to add them?** Students may then determine that the total of the distances is less than one. Ask: • **How can you show that calculation on a number line? How do you explain the location of your sum? How does it make sense?** • **What do we know about adding fractions?** EXTENSION <u>What solution paths will be shared, in what order, and why?</u> Ask a student, or a pair of students, to explain how they answered question 6 in the EXTENSION. Students should state that they looked at the end points to determine the range of the number line. They looked at the number of intervals marked between the endpoints to determine the size of the intervals. They noticed that the point for Dan was not on one of the marked intervals. They may have labeled each interval, or only the intervals for Sujin, and those on either side of Dan. They may state that they know that Dan is halfway between three-tenths and four-tenths, and they used their knowledge of equivalent fractions to know that those intervals are equivalent to 30-hundredths and 40-hundredths. Some students may label the point for Dan as 35-hundredths, because that is the mid-point between the two intervals. For students who labeled points on the number line, ask: • **How and why did you determine the labels?** • **How did you approach labeling Dan's point when it did not fall on one of the marked intervals?** For students who used base ten blocks to build a number

S H A R E D I S C U S S A N D A N A L Y Z E	SUMMARY: • Having students summarize key mathematical points lets students know they have said or discovered something that is mathematically important to know. • Encouraging students to write down their new thinking, and record how their thinking has changed, allows time for internalizing the learning. Research has shown that when students reflect on the process of working cooperatively, and how it impacted theirs and other's learning, retention of content is increased.	line, ask: • **How did you use the manipulatives to create a number line? How does the manipulative number line translate into a number line drawn on paper?** SUMMARY: ** **So we discovered that decimals are another name for fractions, and both decimals and fractions are identified and represented as unique points on a number line.** ****Place value can be used to compare and order decimals.** ****Benchmark quantities can assist in ordering and comparing fractions and decimals.** ****Fractions with denominators of 10 and 100 can be added using equivalent fractions.**

PART A

Sujin and Dan decide to have a race to see who can run the farthest distance in 10 minutes. They both run along the same oval track. At the end of 10 minutes, Sujin's pedometer shows that she has run .6 miles and Dan's pedometer shows that he has run 4/10 of a mile.

Sujin

Dan

1. Represent the distance that Dan ran on a number line. Now represent the distance that Sujin ran on the same number line.
2. If Dan changed his pedometer to display decimals like Sujin's pedometer, what decimal would be displayed? Label your number line with that decimal.
3. Who ran the furthest in 10 minutes? Express your answer using >, =, < and justify your answer in two ways.

PART B

The next day, Sujin and Dan decide to run again for 10 minutes to see if they can run further than they did yesterday. Sujin runs first, and Dan times her. At the end of 10 minutes, Sujin's pedometer shows that she has run 8/10 of a mile. Dan runs second and Sujin times him. Dan's pedometer shows that he has run 25/100 of a mile.

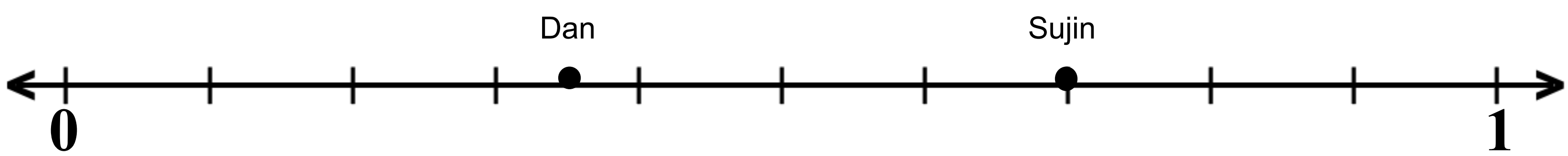
Sujin

Dan

4. Dan thinks he ran further than Sujin. Is Dan correct? Justify your answer by using a visual model.
5. Sujin thinks that if she adds the number of miles she and Dan ran on the second day, that the total distance will be greater than 1 mile. Is Sujin correct? Show your answer in two different ways.

EXTENSION

The next day, Sujin and Dan decided to run for 10 minutes one last time. The number of miles that each of them ran is shown on the number line below.



6. How far did each person run after 10 minutes? Show their distances as both fractions and decimals and explain how you know.