Introduction to Decimals

LEVEL
Grade Five

OBJECTIVES
Students will

- compare fractions to decimals.
- explore and build decimal models.

MATERIALS AND RESOURCES
- Base Ten Blocks (at least 1 cube, 10 flats, 10 rods, 10 units per set) – 1 set per small group
- Chart paper
- 100's grids – 2-3 sheets per small group
- Scissors – 1 or 2 pairs per group
- Scotch tape – 1 per group is best
- Crayons, colored pencils or markers – 1 per group
- Venn diagram – 1 per student

ABOUT THIS LESSON

This lesson introduces students to decimals. Students use what they know about fractions to begin their exploration of decimals. By connecting fractions to decimals, students will build a deeper understanding of decimals. They explore decimals using Base Ten Blocks and 10x10 grids.

PRIOR LEARNING

Fractions and decimals are often difficult for students. One reason may be because instruction tends to rush to the operations without taking the time to build strong conceptual understanding. Another reason might be because fractions and decimals are often taught as separate, isolated skills rather than as connected concepts. While fractions can represent any partitioning, decimals are another notation for fractions and represent partitions of tenths and powers of tenths (hundredths, etc.). In addition to linking the ideas of decimals and fractions, decimal concepts should also build on whole number place value.

- Students should be able to read, write, and represent fractions and to compare fractions using the benchmarks of 0, $\frac{1}{2}$, and 1.
- Students should understand whole number place value.

COMMON CORE STATE STANDARDS FOR MATHEMATICAL CONTENT

This lesson addresses the following Common Core State Standards for Mathematical Content. The lesson requires that students recall and apply each of these standards not necessarily providing the initial introduction to the specific skill.

TARGETED STANDARDS

5.NBT.3 Read, write, and compare decimals to thousandths.

5.NBT.3a Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (\frac{1}{10}) + 9 \times (\frac{1}{100}) + 2 \times (\frac{1}{1000})$w

5.NBT.3b Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

REINFORCED/APPLIED STANDARDS

5.NBT.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

5.NBT.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10.

COMMON CORE STATE STANDARDS FOR MATHEMATICAL PRACTICE

These standards describe a variety of instructional practices based on processes and proficiencies that are critical for mathematics instruction. NMSI incorporates these important processes and proficiencies to help students develop knowledge and understanding and to assist them in making important connections across grade levels. This lesson allows teachers to address the following Common Core State Standards for Mathematical Practice.

MP.1 Make sense of problems and persevere in solving them.
- Students apply their understanding of operations with whole numbers and fractions to decimal concepts.

MP. 2 Reason abstractly and quantitatively.
- Students consider decimal place value and how a number in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.

MP. 3 Construct viable arguments and critique the reasoning of others.
- Students tell and show how to represent decimals when the "whole" changes.

MP. 6 Attend to precision.
- Students communicate precisely with others when they discuss and decide how they can represent 1 whole, 1 tenth, 1 hundredth, and 1 thousandth in the same model.

MP. 8 Look for and express regularity in repeated reasoning.
- Students consider whole number place value and how it relates to decimal place value.

MODALITY

NMSI emphasizes using multiple representations to connect various approaches to a situation in order to increase student understanding. The lesson provides multiple strategies and models for using those representations indicated by the darkened points of the star to introduce, explore, and reinforce mathematical concepts and to enhance conceptual understanding.

P – Physical
V – Verbal
A – Analytical
N – Numerical
G – Graphical

NMSI CONTENT PROGRESSION CHART

In the spirit of NMSI's goal to connect mathematics across grade levels, the Content Progression Chart demonstrates how specific skills build and develop from third grade through sixth grade. Each column, under a grade level lists the concepts and skills that students in that grade should master. Each row illustrates how a specific skill is developed as students advance through their mathematics courses.

3rd Grade Skills/ Objectives	4th Grade Skills/ Objectives	5th Grade Skills/ Objectives	6th Grade Skills/ Objectives
Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9×80, 5×60) using strategies based on place value and properties of operations.	Use place value understanding to round multi-digit whole numbers to any place.	Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

TEACHER PAGES

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ACCOMMODATIONS/SCAFFOLDING SUGGESTIONS

Gifted and Talented (GT)

- Students could work as a group to create a model to represent ten thousandths. This would be a good visual model of ten thousandths for the rest of the class and should be posted.
- Students can acquire and demonstrate knowledge of places beyond the ten thousandths' place.
- Students can show the place value patterns on either side of the decimal point – with decimal places and whole number places.
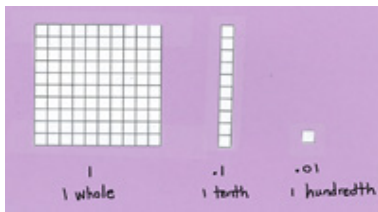
English Language Learners (ELL)

- Provide students concrete examples of the use of fractions and decimals in everyday life. For example, provide a measuring spoon, a baseball card, a price tag.
- If students lack the necessary vocabulary to participate in Activity 1, prior to the lesson have the students look through magazines and newspapers to find and cut out examples of fractions and decimals that they can then share during this activity.
- Provide students with grids and place value charts to help the students keep track of decimal vocabulary such as tenths, hundredths, and thousandths.
- Students work in partners/small groups.
- Students discuss ideas before writing, using graphic organizers.
- Students find relevant trade books related to place value.

Special Education (Sp. Ed.)

- Provide students with grids and place value charts to help the students keep track of decimal vocabulary such as tenths, hundredths, and thousandths.
- Students work in partners/small groups.
- Students discuss ideas before writing, using graphic organizers.
- This lesson can also be taught in a co-teaching environment.

ASSESSMENT

The following types of formative assessments are embedded in this lesson:

- Activity 2 – Are students able to use the Base Ten Blocks to model the different decimals?
- Activity 3 – Are students able to explain their thinking? Are they clear in the difference between tenths, hundredths, thousandths? Are all students contributing to the building of the decimal models and understanding what the models represent?

The following are summative assessments:

- Venn Diagram – suggested answers are provided in the answer section
- Exit slip

TECHNOLOGY SUGGESTIONS

- Gamequarium – multiple reference tools for plant growth can also be used with an interactive white board. http://www.gamequarium.com/plants.html
- United Streaming – This site has a large number of student centered videos by grade level, subject, topic, and standard. www.unitedstreaming.com
- Promethean Planet – This site contains thousands of interactive flip charts where teachers can access mini-lessons on volumes, root growth, etc. It is ideal for all classrooms and can be used with Whiteboards, Active Slates, LCD projectors, individual student computers, etc. www.prometheanplanet.com
- Britannica for Kids – This site has a wealth of information and interactive activities by grade level, standard and topic. http://kids.britannica.com/

REFERENCES

- North Carolina Common Core Instructional Support Tools: This site unpacks the Common Core State Standards for teachers, helping them understand the CCSS. http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/5th.pdf
- Illustrative Math is a site that provides examples of the type of work students should be able to do as the Common Core State Standards are implemented. Users must register to use the site, but it is free. http://www.illustrativemathematics.org/
- The Core Challenge website is a free resource for educators and students, providing lessons and resources for the Common Core State Standards. http://www.corechallenge.org/

COMMON MISCONCEPTIONS

- Decimals and fractions are often thought of as two separate skills and are taught as such. In fact, decimal numbers are simply another way of writing fractions. Both notations have value, and students should understand how the two are related.
- Knowing decimal place value names does not mean students have conceptual understanding of decimals.
- When comparing and ordering decimals, students often think that 0.19 is greater than 0.2 because they are misapplying what they know about whole number place value to decimal place value.

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## LESSON WITH TEACHING SUGGESTIONS

ACTIVITY 1:

- As an introduction to decimals, post a 2-column chart labeled *Everyday Uses of Fractions* and *Everyday Uses of Decimals*.
- Ask students to think about when they have seen or heard fractions or decimals in the world around them; at home, in stores, at a sports games, etc.
- Ask students to provide examples of a fraction or decimal and how it was used. Add the examples to the chart and post in the classroom for future reference.
- Sample chart:

Everyday Uses of Fractions	Everyday Uses of Decimals
• $\frac{1}{2}$ dozen eggs • quarter after 3 • $1\frac{1}{2}$ pounds of hamburger • 1/4 teaspoon	• .285 batting average • 8.15 gallons of gas pumped • $4.39 • 2.5 pounds

- Share with the students that they will begin exploring decimals. Part of what they will explore is how fractions and decimals are similar and how they are different.

ACTIVITY 2:
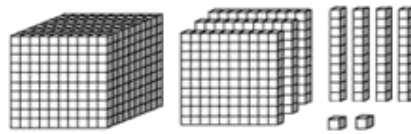
- Provide students with sets of Base Ten Blocks.
- Start by modeling whole numbers. Suppose a unit block equals 1.
  - What is the value of a rod? (10)
  - What is the value of a flat? (100)
  - What is the value of a cube? (1000)

- As each question is asked, allow students time to work with a partner to model the question with their cubes and to discuss their answers before sharing with the class.
- After each question, ask students to explain their reasoning. (i.e., "There are 10 units in a rod, so a rod equals 10." or "There are 10 flats in a cube and one flat equals 100, so 10 of these equals 1000.")
- Change the whole. Suppose that a flat represents 1 whole.
  - What is the value of a rod? ($\frac{1}{10}$)
  - What is the value of a unit? ($\frac{1}{100}$)
  - What is the value of a cube? (10)

- Again, allow students time to work with a partner to model the question with their cubes and to discuss their answers before sharing with the class. Students should be asked to explain how they know. (i.e., "There are 10 rods in a flat, so one rod would be $\frac{1}{10}$ of the flat." or "There are 10 flats in a cube. If one flat equals 1, then 10 flats would equal 10.")
- Repeat this activity as needed, changing the whole each time.

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ACTIVITY 3:
- Students will work in pairs/trios to build decimal models.
- Provide each group of students with 2-3 sheets of the 100's grids. Have students create a model to show thousandths using the hundreds grid. They need to discuss and decide how they can represent 1 whole, 1 tenth, 1 hundredth, and 1 thousandth in the same model. Once they have decided, students should create their model by taping the hundreds grids together.
- Their model might look like one of the following:
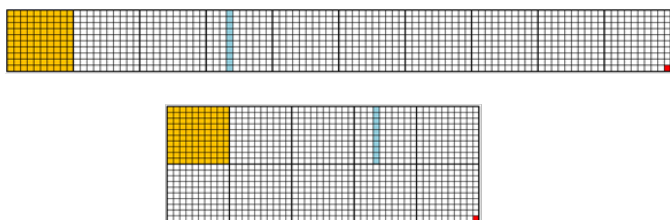
Note: In both of these models, the red represents $\frac{1}{1000}$, the blue represents $\frac{1}{100}$, and the orange represents $\frac{1}{10}$. The whole rectangle represents 1 whole.

- As students are building their models, move between the groups asking them to explain their thinking with the model they are creating. Ask students what $\frac{1}{10}$, $\frac{1}{100}$, or $\frac{1}{1000}$ would look like on their model and how they know.
- When the models are complete, have groups share their models either with another group that has a different model or with the whole class.

- Ask students to complete the following on their models:
    - Shade in $\frac{4}{1000}$ in blue.
    - Shade in $\frac{4}{100}$ in red
    - Shade in $\frac{4}{10}$ in yellow
- Make sure students are clear what the tenths, hundredths, and thousandths are. Ask them to discuss what they notice about what they shaded in on their models.
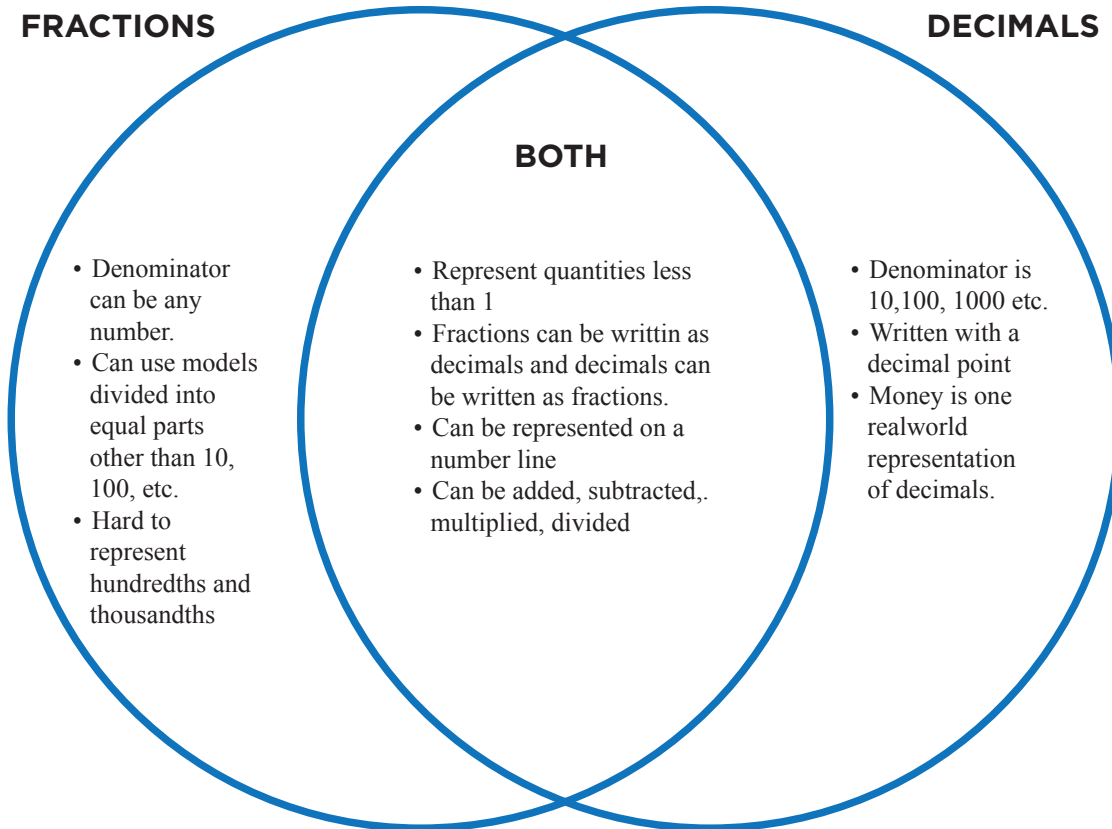- After they have a chance to discuss, have groups share their observations with the class.

CLOSURE:
- Have students work in pairs or trios to complete the Venn diagram comparing fractions and decimals. Each student should fill out his or her own Venn diagram with ideas generated within the group.
- Exit Slip: Each student should complete the exit slip independently.

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ANSWERS

Answers for this lesson are subjective and will vary. To obtain the maximum benefit of the lesson, ask students to go beyond the expected responses.

POSSIBLE ANSWERS FOR VENN DIAGRAM

FRACTIONS

DECIMALS

BOTH

- Denominator can be any number.
- Can use models divided into equal parts other than 10, 100, etc.
- Hard to represent hundredths and thousandths

- Represent quantities less than 1
- Fractions can be writtin as decimals and decimals can be written as fractions.
- Can be represented on a number line
- Can be added, subtracted,. multiplied, divided

- Denominator is 10,100, 1000 etc.
- Written with a decimal point
- Money is one realworld representation of decimals.

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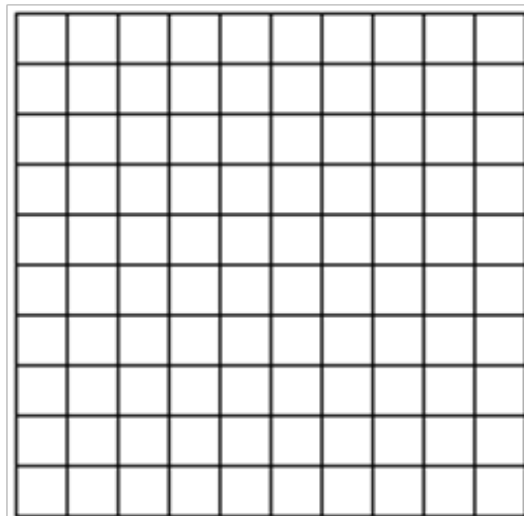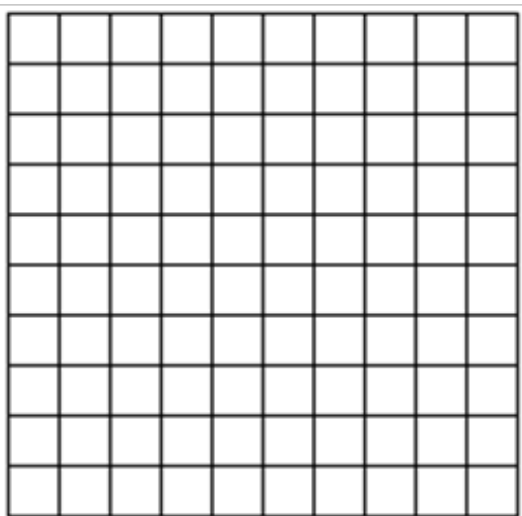214-346-1200
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Introduction to Decimals

FRACTIONS

ONLY FRACTIONS

BOTH

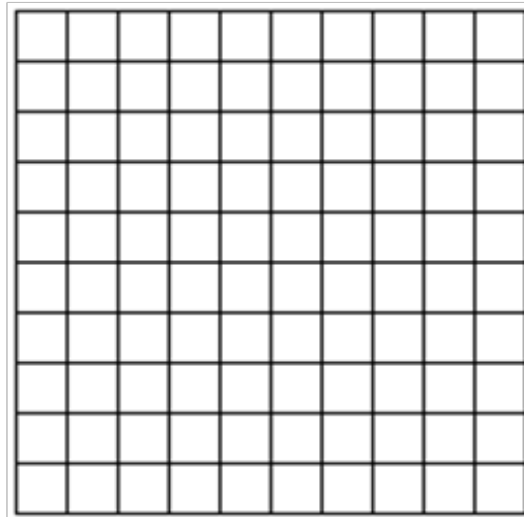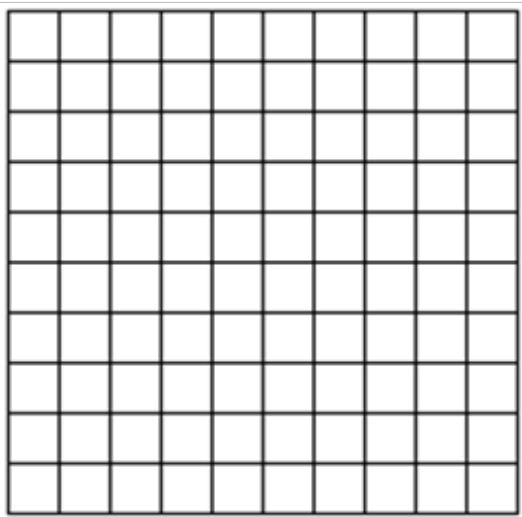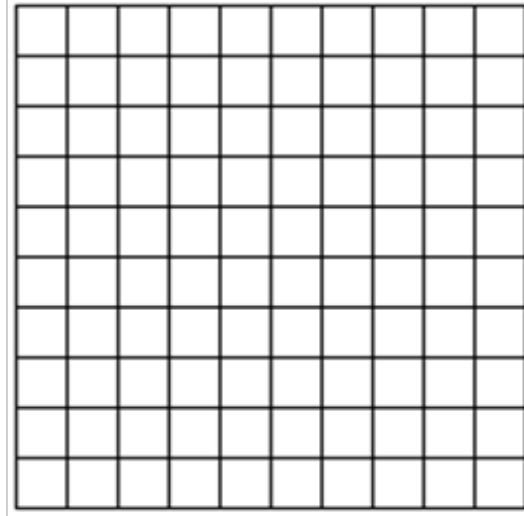**ONLY DECIMALS**
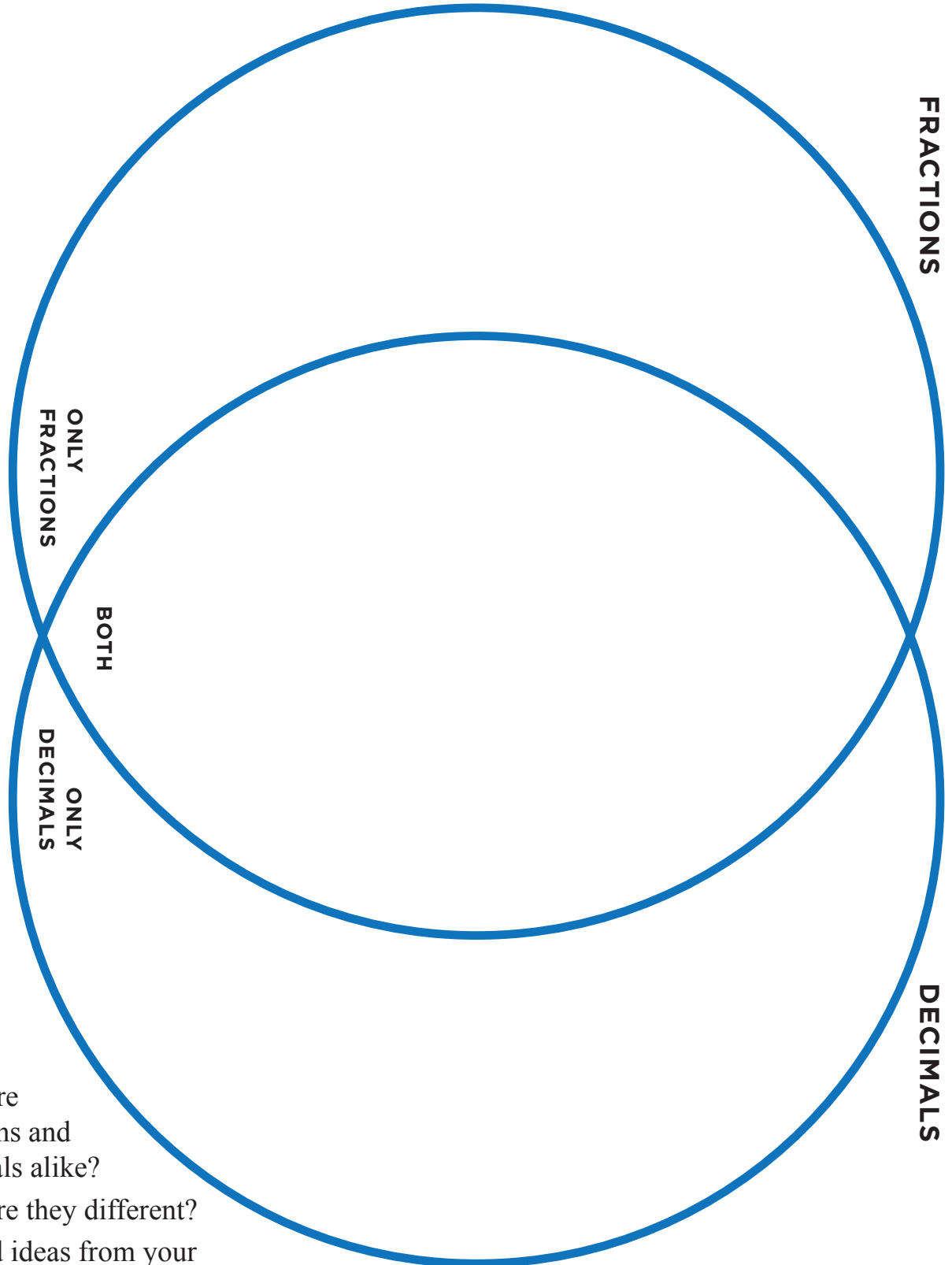
DECIMALS

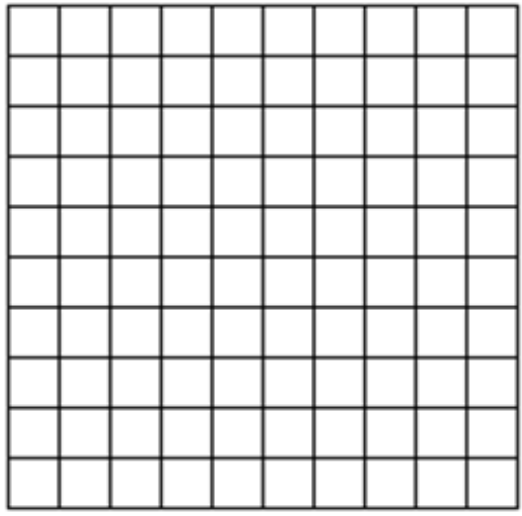## DISCUSS IN YOUR GROUP:

- How are fractions and decimals alike?
- How are they different?
- Record ideas from your discussion in the Venn diagram.

100 GRIDS

EXIT SLIP   NAME_____

List one way decimals and whole numbers are alike and one way they are different.

Alike: _____

_____

Different: _____

_____

List one way decimals and fractions are alike and one way they are different.

Alike: _____

_____

Different: _____

_____

✂ -

EXIT SLIP   NAME_____

Alike: _____

_____

Different: _____

_____

Alike: _____

_____

Different: _____

_____