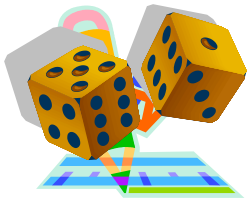
CONSTRUCTING TASK: Decimal Designs



STANDARDS FOR MATHEMATICAL CONTENT

MCC5.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.

MCC5.NBT.3 Read, write, and compare decimals to thousandths.

- **a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 x 100 + 4 x 10 + 7 x 1 + 3 x (1/10) + 9 x (1/100) + 2 x (1/1000).**
- **b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.**

STANDARDS FOR MATHEMATICAL PRACTICE

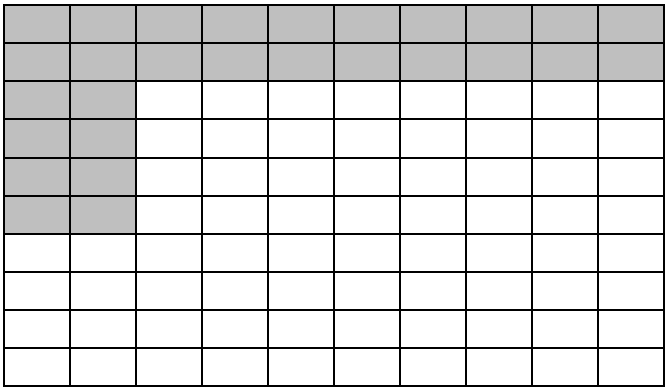
1. **Make sense of problems and persevere in solving them.**
2. **Reason abstractly and quantitatively.**
3. **Construct viable arguments and critique the reasoning of others.**
4. **Model with mathematics.**
5. **Use appropriate tools strategically.**
6. **Attend to precision.**
7. **Look for and make use of structure.**
8. **Look for and express regularity in repeated reasoning.**

BACKGROUND KNOWLEDGE

Students should have had prior experiences and/or instruction with writing fractions and understanding their value. Students' understanding of decimal numbers develops in grades 4-5 as follows:

- 4^{th} Grade – Investigate the relationship between fractions and decimal numbers, limit to tenths and hundreds, order two-digit decimals
- 5^{th} Grade – Compare and order decimals to thousandths place, rounding and operations with decimals

During the introduction or mini-lesson, students may need specific instruction on writing and reading fractions and decimals. For example, the 10-frame below shows 5 out of 10 shaded boxes. As a fraction, that would be written as $\frac{5}{10}$, and read, "five tenths." As a decimal, it would be written as 0.5, and read, "five tenths." The 100 grid below shows 28 shaded squares out of 100. As a fraction, that would be $\frac{28}{100}$, and read, "twenty-eight hundredths." As a decimal, it would be written as 0.28 and read, twenty-eight hundredths."



ESSENTIAL QUESTIONS

- What is a decimal and how can it be represented?
- What is a fraction and how can it be represented?
- How do you read a decimal?
- How do you read a fraction?

MATERIALS

- "Decimal Designs" student recording sheet
- "Decimal Designs, Table" student recording sheet (2 pages; copy page 2 on the back of page 1)
- Crayons or colored pencils

GROUPING

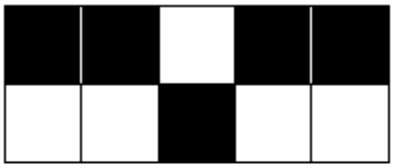
Individual/Partner Task

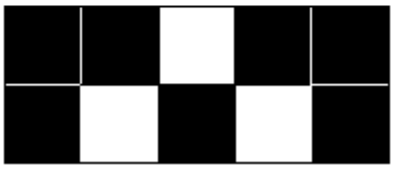
TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

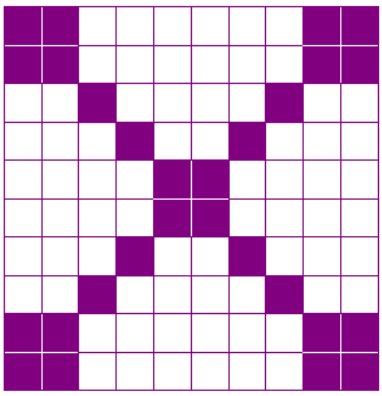
In this task, students will work with occurrences out of 10 and 100, translating them into fractions and then decimals.

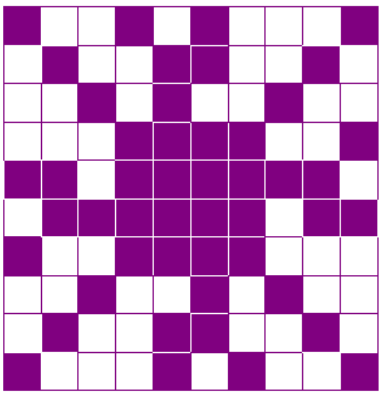
Comments

This lesson could be introduced by sharing shaded 10-frames and 100 grids to represent a fraction or decimal. For example, share with students some of the designs below.



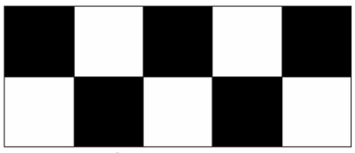




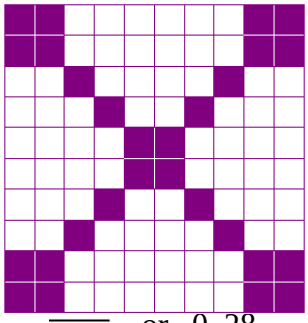


Discuss strategies students could use to count the number of shaded squares. Did they use multiplication? (e.g. Did they count the number of shaded squares in one part and multiply that number by the number of identical parts in the design? Did they count the number of unshaded squares and subtract from 100?) Once students have determined the decimal and fraction for their favorite design ask students to share their thinking.

Finding the number of shaded squares is one way to give students an opportunity to think about pairs that make 100. As students make their decimal designs on the 10 x 10 grid, ask them if they have more shaded or unshaded. If they have more shaded, ask them to count the number of squares that are UNSHADED and subtract that number from 100 (i.e. think about what number added to the number of unshaded squares would equal 100). This is a great opportunity to review numbers that add up to 100 and for students to explain how they know how many squares are shaded.



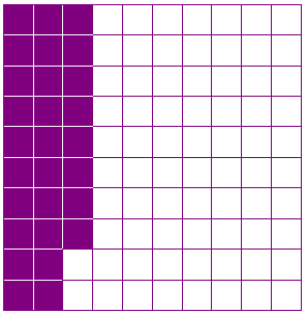
$\frac{5}{10}$ or 0. 5



$\frac{28}{100}$ or 0. 28

It is important for students to recognize that it doesn't matter where the fractional parts are placed. They can be scattered as they are in the diagrams above or they can be connected, as shown below.

$\frac{5}{10}$ or 0. 5



$\frac{28}{100}$ or 0. 28

Task Directions

First, students will follow the directions below from the "Decimal Designs" student recording sheet.

Create tenths and hundredths designs and label them accurately.

Next, students will follow the directions below for the "Decimal Designs, Table" student recording sheet.

1. Look at the example in the table below. Read the following questions and discuss how you would answer them with your partner.
- What do you notice about how "1 out of 10" is written in fraction form?
    - What do you notice about how "1 out of 10" is written in decimal number form?
    - How are they alike? How are they different?
2. Complete the table below. Fill in the last three rows of the table from the "Decimals Designs" student recording sheet.

Input	Output	
	Fraction	Decimal
1 out of 10	$\frac{1}{10}$	0.1
2 out of 10		
4 out of 10		
7 out of 10		
10 out of 10		
___ out of 10		
___ out of 10		
___ out of 10		

3. Look at the example in the table below. Read the following questions and discuss how you would answer them with your partner.
    - What do you notice about how "29 out of 100" is written in fraction form?
    - What do you notice about how "29 out of 100" is written in decimal number form?
    - How are they alike? How are they different?
4. Complete the table below. Fill in the last three rows of the table from the "Decimals Designs" student recording sheet.

Input	Output	
	Fraction	Decimal
29 out of 10	$\frac{29}{100}$	0.29
44 out of 100		
62 out of 100		
75 out of 100		
100 out of 100		
___ out of 100		
___ out of 100		
___ out of 100		

FORMATIVE ASSESSMENT QUESTIONS

- How many squares are shaded out of 10 (or 100)?
- How many squares total are in the figure?
- What fraction represents the shaded part? How do you know?
- What decimal represents the shaded part? How do you know?
- How would you read the fraction (or decimal) you have written?

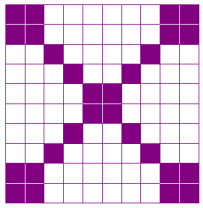
DIFFERENTIATION

Extension

- Students can be encouraged to conduct a survey of 10 people or 100 people and report the results as a fraction and a decimal.

Intervention

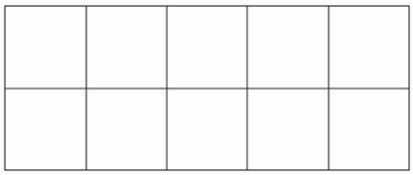
- Some students may need to continue to represent the fractions and decimals using base 10 blocks. See "Ten is the Winner" and "Rolling Around with Decimals" in this unit for more information about using base 10 blocks to represent fractions and decimals.



Name_____ Date_____

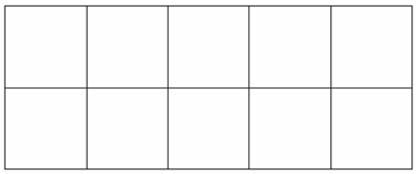
Decimal Designs

Create tenths and hundredths designs and label them accurately.



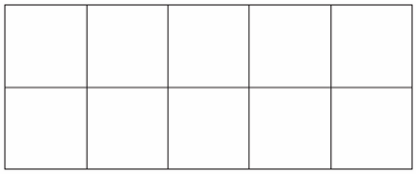
___ shaded boxes out of 10

Fraction _____ Decimal Number _____



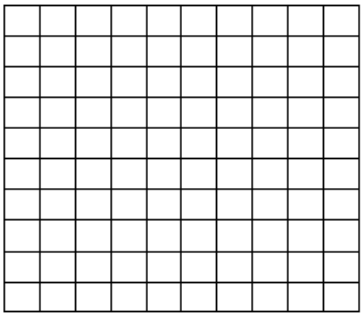
___ shaded boxes out of 10

Fraction _____ Decimal Number _____



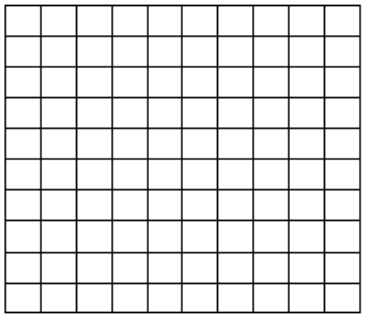
___ shaded boxes out of 10

Fraction _____ Decimal Number_____



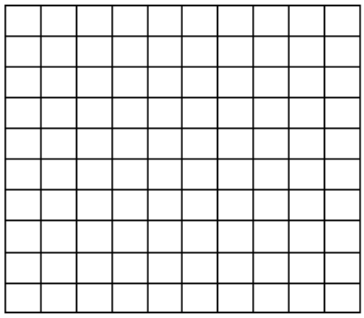
___ shaded boxes out of 100

Fraction _____ Decimal _____



___ shaded boxes out of 100

Fraction _____ Decimal _____



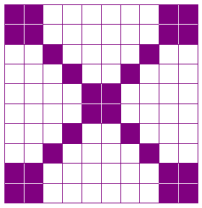
___ shaded boxes out of 100

Fraction _____ Decimal _____

Name _____ Date _____

Decimal Designs

Table



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Decimal Designs

Table, Page 2

3. Look at the example in the table below. Read the following questions and discuss how you would answer them with your partner.
   - What do you notice about how "29 out of 100" is written in fraction form?
   - What do you notice about how "29 out of 100" is written in decimal number form?
   - How are they alike? How are they different?
4. Complete the table below. Fill in the last three rows of the table from the "Decimals Designs" student recording sheet.

Input	Output	
	Fraction	**Decimal**
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100 out of 100		
___ out of 100		
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