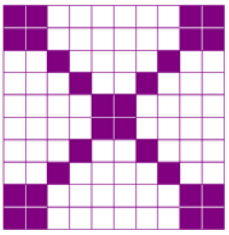
# Constructing Task: Decimal Designs



## STANDARDS FOR MATHEMATICAL CONTENT

**MCC4.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*[1].

**MCC4.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.*

## 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 sure of structure.
8 Look for and express regularity in repeated reasoning.

## BACKGROUND KNOWLEDGE

While students will have previous experiences expressing fractions with denominators of 10 or 100 as fractions, this will be their first experiences with using decimal notation and investigation into decimal fractions. Students' understanding of decimal numbers develops in grades 4-5 as follows.

4th Grade – Focus on the relationship between decimal fractions and decimal numbers and investigate the relationship between decimal fractions and decimal numbers, limit to tenths and hundredths, order decimals to hundredths, add decimal fractions with denominators of 10 and 100 (respectively)

5th Grade – Compare decimals up to thousandths, use decimals in operations

## ESSENTIAL QUESTIONS

- What is a decimal fraction and how can it be represented?

## MATERIALS

- "Decimal Designs: Part 1" student recording sheet
- "Decimal Designs: Part 1, Table, Page 1" student recording sheet
- "Decimal Designs: Part 1, Table, Page 2" student recording sheet (copy on back of page 1)

- "Decimal Designs: Part 2" student recording sheet
- "Decimal Designs: Part 2, Table" student recording sheet
- Crayons or colored pencils

## GROUPING

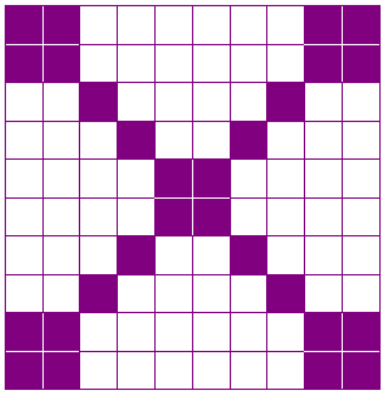
Individual/Partner Task

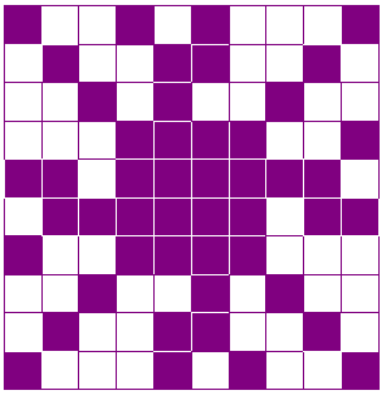
## TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

In this task, students will work with occurrences out of 10 and 100, translating them into decimal fractions and then decimals. Students will also explore and investigation the relationship between tenths and hundredths when in a visual model and in decimal notation. Students will also begin to rename tenths using hundredths.

**Comments**

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

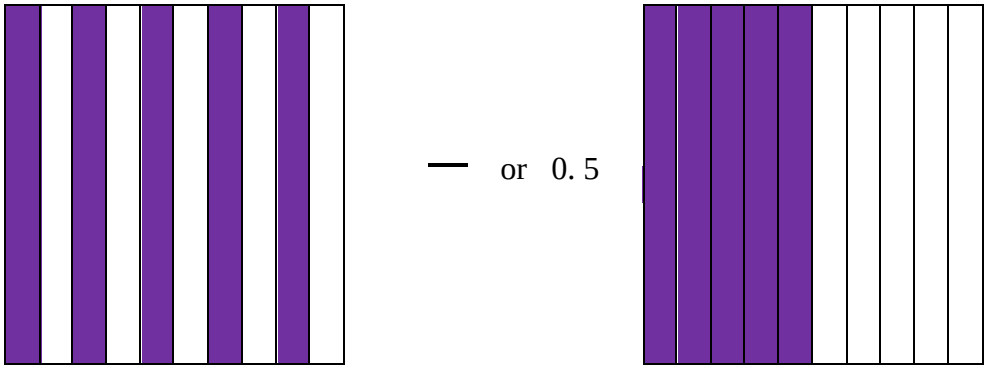


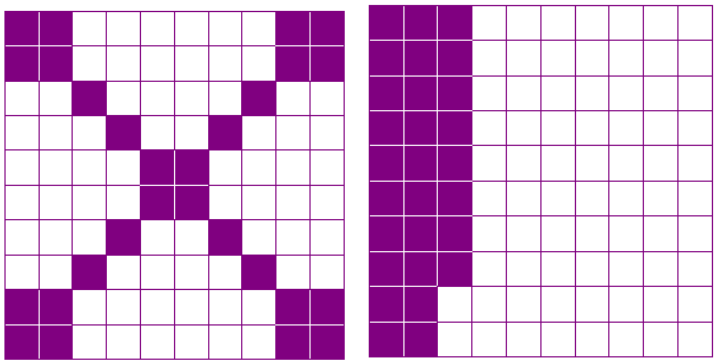


Discuss strategies students could use to count the number of shaded squares. Did they use multiplication? (e.g. Did they count the number of shaded squares in one part and multiply that number by the number of identical parts in the design? Did they count the number of unshaded squares and subtract from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

During the introduction or mini-lesson, students may need specific instruction on writing and reading decimal fractions and decimals. For example, the 10ths square below shows 5 out of 10 shaded boxes. As a fraction, that would be written as —, 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 —, and read, "twenty-eight hundredths." As a decimal, it would be written as 0.28 and read, twenty-eight hundredths."




It is important for students to recognize that it doesn't matter where the fractional parts are placed. They can be scattered (above left) or they can be connected (above right).

**Task Directions**

PART 1

First, students will follow the directions below from the "Decimal Designs: Part 1" 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 decimal fraction form?*
    - *What do you notice about how "1 out of 10" is written in decimal 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.*

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 decimal fraction form?*
    - *What do you notice about how "29 out of 100" is written in decimal 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.

**PART 2**

First, students will follow the directions below from the "Decimal Designs: Part 2" student recording sheet.

*Create tenths and hundredths designs and label them accurately.*

Next, students will follow the directions below for the "Decimal Designs: Part 2, 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 "2 out of 10" is written in decimal form using tenths?
    - What do you notice about how "20 out of 100" is written in decimal form using hundredths?
2. How are they alike? How are they different?
3. Complete the table below. Fill in the last four rows of the table from the "Decimals Designs: Part 2" student recording sheet.

## FORMATIVE ASSESSMENT QUESTIONS

**Part 1:**

- How many squares are shaded out of 10 (or 100)?
- How many squares total are in the figure?
- What decimal fraction represents the shaded part? How do you know?
- What decimal represents the shaded part? How do you know?
- How would you read the decimal fraction (or decimal) you have written?
- Which students are able to accurately write decimal fractions to describe a shaded region of a design?
- Which students are able to accurately write decimals to describe a shaded region of a design?
- Which students are able to accurately read numbers written in decimal fraction or decimal form?

**Part 2:**

- How many squares are shaded out of 10 (or 100)?
- How many squares total are in the figure?
- What decimal fraction represents the shaded part? How do you know?
- What decimal represents the shaded part? How do you know?
- How would you read the decimal fraction (or decimal) you have written?
- How are the models of tenths related to the models of hundredths?
- What do the models of the tenths and hundredths have in common? What is different?
- How can a decimal written in tenths be written as a decimal expressed in hundredths?
- Which students are able to accurately write decimal fractions to describe a shaded region of a design?
- Which students are able to accurately write decimals to describe a shaded region of a design?
- Which students are able to accurately read numbers written in decimal fraction or decimal form?
- Which students were able to connect the representations of tenths to the equivalent representation of hundredths?

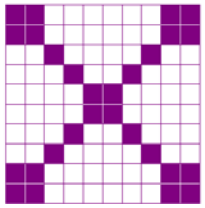
## DIFFERENTIATION

### Extension

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

### Intervention

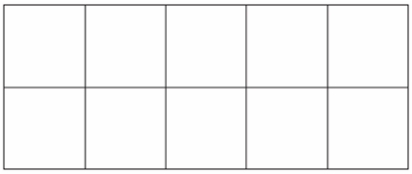
- Some students may need to continue to represent the decimal fractions and decimals using base 10 blocks. See "Ten is the Winner" and "Rolling Around with Decimals" in this unit for more information about using base 10 blocks to represent decimal fractions and decimals.



Name_____ Date_____

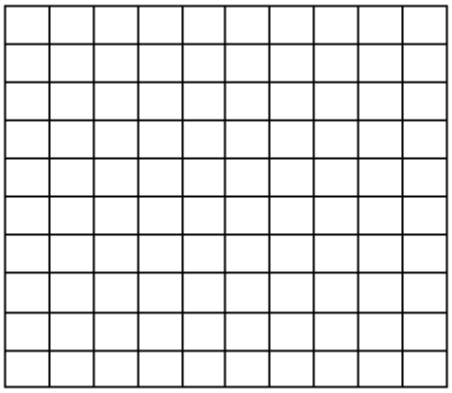
# Decimal Designs: Part 1

Create tenths and hundredths designs and label them accurately.



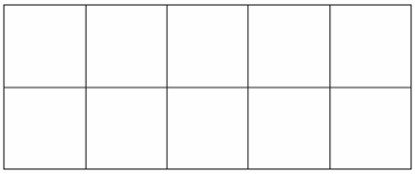
___ shaded boxes out of 10

Decimal Fraction _____ Decimal _____



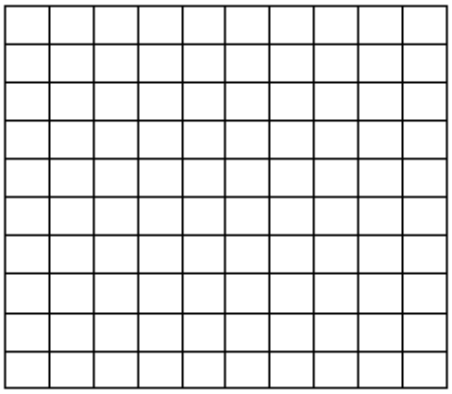
___ shaded boxes out of 100

Fraction _____ Decimal _____



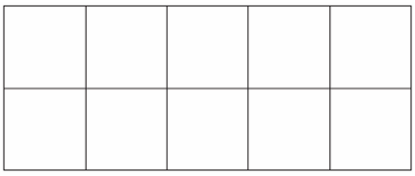
___ shaded boxes out of 10

Decimal Fraction _____ Decimal _____



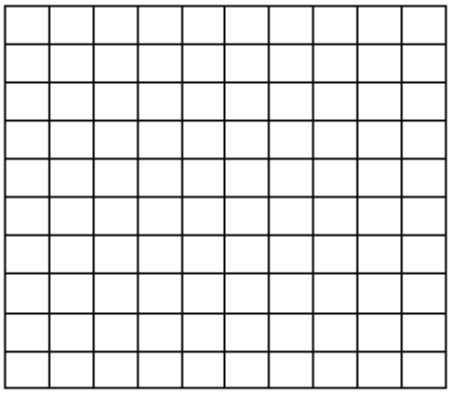
___ shaded boxes out of 100

Fraction _____ Decimal _____



___ shaded boxes out of 10

Decimal Fraction _____ Decimal _____



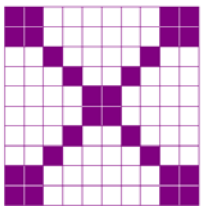
___ shaded boxes out of 100

Fraction _____ Decimal _____

Name _____ Date _____

# Decimal Designs: Part 1

Table



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 decimal fraction form?
   - What do you notice about how "1 out of 10" is written in decimal 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: Part 1" student recording sheet.

| Input | Output | |
|---|---|---|
| | Decimal 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 | | |

# Decimal Designs: Part 1

Table, Page 2

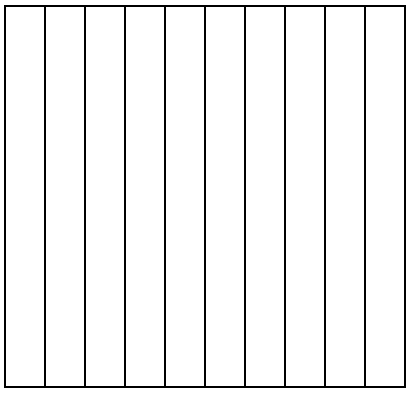
1. Look at the example in the table below. Read the following questions and discuss how you would answer them with your partner.
   - What do you notice about how "29 out of 100" is written in decimal fraction form?
   - What do you notice about how "29 out of 100" is written in decimal form?
   - How 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 | |
|---|---|---|
| | **Decimal Fraction** | **Decimal** |
| 29 out of 100 | $\frac{29}{100}$ | 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 | | |

Name_____ Date_____

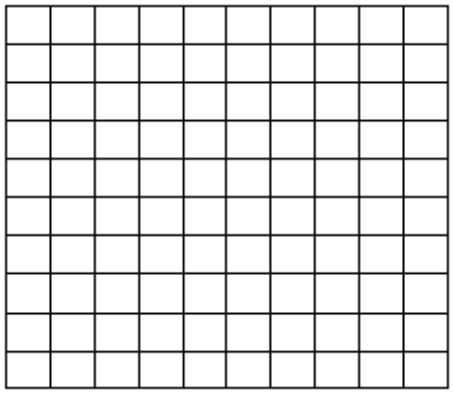
# Decimal Designs: Part 2

Create tenths and hundredths designs that represent the same amount and label them accurately.



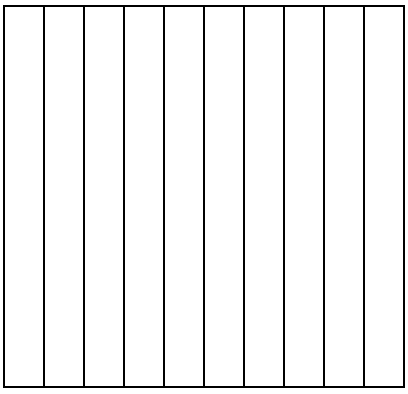
___ shaded boxes out of 10

Fraction _____ Decimal _____



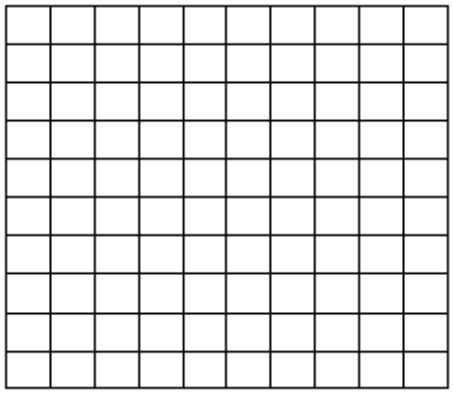
___ shaded boxes out of 100

Fraction _____ Decimal _____



___ shaded boxes out of 10

Fraction _____ Decimal _____



___ shaded boxes out of 100

Fraction _____ Decimal _____

Name _____ Date _____

# Decimal Designs: Part 2

Table

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 "2 out of 10" is written in decimal form using tenths?
   - What do you notice about how "20 out of 100" is written in decimal form using hundredths?
2. How are they alike? How are they different?
3. Complete the table below. Fill in the last four rows of the table from the "Decimals Designs: Part 2" student recording sheet.

| **Input** | **Output** | |
|---|---|---|
| | **Decimal Fraction (using tenths)** | **Decimal (using tenths)** |
| 2 out of 10 | 2/10 | 0.2 |
| 20 out of 100 | 20/100 | 0.20 |
| 8 out of 10 | | |
| 80 out of 100 | | |
| __out of 10 | | |
| __ out of 100 | | |
| __out of 10 | | |
| __ out of 100 | | |