

Multiply by 0.1 and by 0.01

What happens when we multiply by 0.1 and by 0.01?

Students make a design with blocks. They replace each block in the design with a block one-tenth the size (the next smaller block) and one-hundredth the size (a block two sizes smaller). They observe that the designs appear to be shrinking, and the digits in the numbers for each design are the same but shifted one and then two places smaller. They identify patterns for multiplying by 0.1 and 0.01.

Objectives

- To understand the special properties of multiplying by 0.1 and by 0.01
- To think of multiplying by 0.1 and by 0.01 as replacing each block with a block one or two sizes smaller
- To see that multiplying by 0.1 and by 0.01 yields the same result as dividing by 10 and by 100

Materials

- single blocks, tenth blocks and hundredth blocks
- chart paper
- 3 x 5 cards or similar

Each group will need:

- 250 blocks, mostly packed
- tenth blocks and hundredth blocks
- 1 *Shrinking Designs* activity sheet and 1 *Multiply by 0.1 and by 0.01* activity sheet **per student**

◆ Class Introduction

25 MIN.

- Begin by reviewing the groups of 10 inside each block. Start with a block-of-100. Ask,

What is the next smaller block? (*a block-of-10*)

How many blocks-of-10 are inside the block-of-100? (*ten*)

Can we say that the block-of-10 is "one-tenth" the size of a block-of-100? (*yes*)

Repeat the questions for each size block (block-of-10, single blocks, tenth blocks, and hundredth blocks).

- With the class gathered around a table, give 1 single block to each of 8 students. Ask them to place their blocks on the table one at a time to create a design, shape or pattern of their choosing.

(Remind students of lesson 3-5 where they enlarged a design similar to this one. Have students share what they remember from this lesson. In particular, review the concept of multiplying by 10 and 100 as replacing each block with a block ten times larger (the next larger block) and one hundred times larger (the block two sizes larger).

- Leaving the first design intact, have 8 volunteers use tenth blocks to create another design just like the first, except using a tenth block wherever there was a single block in the first design.

Finally, ask 8 more students to create a design that replaces each block in the first design with a hundredth block.

Look at the designs together. Can someone tell me how these designs are similar/different? (*They have the same general shape, but they are getting smaller - as though they might be shrinking.*)

- Ask the class how many single blocks are in the first design. Write that on a card and place it below the design.

Ask the class to identify the number for the blocks in the second design. Write that number below the design. Do the same for the third design.

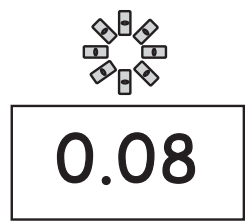
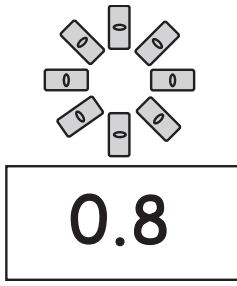
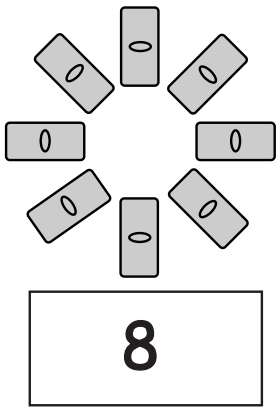
How are these numbers similar? (They all use the same digits, though some use 0 as well.)

On the place mat, they all use the same digit - 8 - but in different places. When the numbers are written in standard form, they still use the digit 8, but zeros are also used. The zeros and the decimal point tell us what size block the digit 8 is referring to.

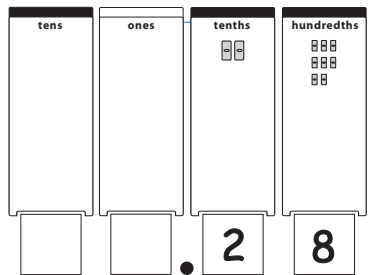
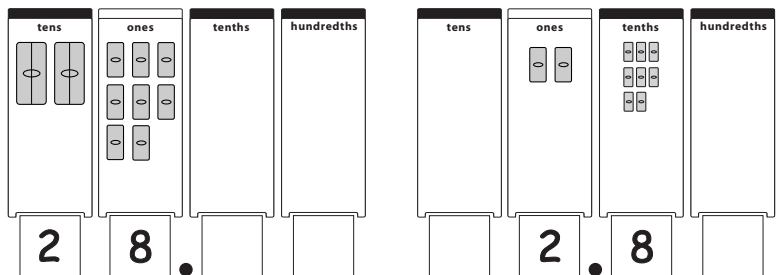
Is there a relationship among the numbers? (Each is one-tenth as much as the previous number.)

Summarize with numbers what students did with their patterns:

8 single blocks	8×1	Number: 8
8 tenth blocks	8×0.1	Number: 0.8
8 hundredth blocks	8×0.01	Number: 0.08



- Ask one student to build 28 on a mat. Then ask another student to build 28×0.1 on a separate mat, regroup the blocks and find the answer. Ask another student to build and solve 28×0.01 .



What do you notice about the blocks and numbers on these mats? (They look like we have replaced each block in the original number with a block one or two sizes smaller.)

Summarize the results of the multiplication on the board:

$$28 \times 1 = 28$$

$$28 \times 0.1 = 2.8$$

$$28 \times 0.01 = 0.28$$

Discuss with students the patterns they see. When we multiply by 0.1 or 0.01,

- ◆ the blocks in the starting number are replaced by blocks one or two sizes smaller, respectively
- ◆ the answers have the same digits as the starting number, only shifted one or two places smaller on the place value chart
- ◆ the numbers for the answers look like the starting numbers, with their decimal points moved 2 places to the left

- Compare this to dividing by 10 and 100.

What happens when we divide a number by 10? (*The answer is one-tenth the size. This is the same thing as when we multiply by 0.1.*)

◆ Group Activity

25 MIN.

- Pass out the activity sheets and make blocks available to all students. Students will build their own designs, sketch them, shrink them by one size, and record the numbers. Students will also predict what the number would be if they shrunk their designs by 2 sizes.

While students are working, ask individuals to predict the results of multiplying various numbers by 0.1 and 0.01. For example:

What do you think the number will be if I multiply 36.2 by 0.1.
(3.62) **Why do you think that?**

◆ Closure

10 MIN.

- Have students share their designs and their results.
Discuss what it means to multiply by 0.1 and by 0.01

What does one-tenth the size mean? (Each block is replaced with a block one size smaller. It takes ten of the smaller blocks to make the larger block - so it is "one-tenth" the size.)

What does one-hundredth the size mean? (Each block is replaced with a block two sizes smaller. It takes one hundred of these smaller blocks to make the larger block - so it is "one-hundredth" the size.)

Have students imagine a design made with a collection of blocks and answer questions about making it 0.1 and 0.01 times smaller. Write this description on the board:

**8 blocks-of-1000, 4 blocks-of-10, 9 single blocks,
6 tenth blocks, and 1 hundredth block**

What is the number for this collection of blocks? (8,049.61)

What is the number for the collection of blocks one tenth the size?
(804.961)

What is the number for the collection of blocks one hundredth the size? (80.4961)

◆ Assessment

- Do students identify the number for the blocks in each design?
- Do students recognize a pattern developing?
- Can students predict the number for the blocks before modeling the designs?
- Do students use the pattern to accurately predict the results for making the design one-tenth the size? One-hundredth the size?
- Do students see the connection between shrinking these designs and multiplying by 0.1 and by 0.01?
- Do students have any difficulty shrinking designs that include blocks of various sizes?
- Do students select the correct blocks to use to make each design one-tenth the size?
- Do students select the correct blocks to use to make each design one-hundredth the size?

Name

.....

Shrinking Designs

1. Use 10-15 single blocks to make a design. Draw your block design:

How many single blocks did you use? _____

2. Imagine replacing each block in the design with the next size smaller block (one tenth the size). How would this design be similar to/different from the original?

Make this design with blocks one size smaller.

What is the number for the blocks in this shrunken design? _____

3. Imagine replacing the blocks in the original design with blocks two sizes smaller (one hundredth the size). How would this design be similar to/different from the original?

Make this design with blocks two-sizes smaller.

What is the number for the blocks in this shrunken design? _____

Name _____

..... **Multiply by 0.1 and by 0.01**

1. Choose a number between 0 and 250: _____

Draw the blocks and write the digits for this number on the mat:

hundreds	tens	ones	tenths	hundredths

2. If you multiply your number $\times 0.1$, what will the result be? Draw the blocks and write the number below.

hundreds	tens	ones	tenths	hundredths

3. If you multiply your original number $\times 0.01$, what will the result be? Draw the blocks and write the number below.

hundreds	tens	ones	tenths	hundredths