Lesson 33

Objective: Design and construct boxes to house materials for summer use.

Suggested Lesson Structure

- Fluency Practice (12 minutes)
- Concept Development (38 minutes)
- Student Debrief (10 minutes)
- Total Time (60 minutes)

Fluency Practice (12 minutes)

- Sprint: Divide Decimals 5.NBT.7 (8 minutes)
- Find the Volume 5.MD.3 (4 minutes)

Sprint: Divide Decimals (8 minutes)

Materials: (S) Divide Decimals Sprint

Note: This Sprint reviews Module 4 concepts.

Find the Volume (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews Lesson 5.

T: On your personal white board, write the formula for finding the volume of a rectangular prism.

S: (Write $V = l \times w \times h$.)

T: (Write $V = l \times w \times h$. Project the rectangular prism with a length of 5 cm, width of 2 cm, and height of 3 cm. Point to the length.) Say the length.

S: 5 cm.

T: (Point to the width.) Say the width.

S: 2 cm.

T: (Point to the height.) Say the height.

S: 3 cm.
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T: On your personal white board, write a multiplication sentence to express the volume of the rectangular prism.
S: (Beneath $V = l \times w \times h$, write $V = 5 \text{ cm} \times 2 \text{ cm} \times 3 \text{ cm}$. Beneath it, write $V = 30 \text{ cm}^3$.)

Continue the process for other rectangular prisms.

T: (Project the cube with side lengths equal to 5 cm.) Name the prism.
S: Cube.
T: What is the length of each side of the cube?
S: 5 cm.
T: On your personal white board, write a multiplication sentence to show the volume of the cube.
S: (Write $V = 5 \text{ cm} \times 5 \text{ cm} \times 5 \text{ cm}$. Beneath it, write $V = 125 \text{ cm}^3$.)

Concept Development (38 minutes)

Materials: (S) Problem Set, 3 pieces of $8\frac{1}{2}" \times 11"$ cardstock paper trimmed to 27 cm by 21 cm, scissors, tape, ruler, summer practice materials

Note: In this lesson, the time for the Application Problem has been allocated to the Concept Development.

Part 1: Establish the criteria for the boxes, and model constructing Box 1.

T: Today, you’ll put your math sense and geometric skills to work as you design and create two different size boxes and one lid to house your summer fluency materials. These are the criteria:
- Boxes must store all summer materials.
- Box 1’s base must measure 19 cm by 13 cm.
- Box 2 must fit inside Box 1 when Box 1 is closed.
- The lid for Box 1 must fit snugly to protect the contents.

T: (Distribute one piece of cardstock.) Here is the paper you will use to make Box 1. What are its measurements? (Allow students time to measure.)
S: 21 centimeters by 27 centimeters.
T: Talk to your partner. Since the base of Box 1 is 19 centimeters by 13 centimeters, what does that mean about the height of Box 1?
S: The height has to be the same all the way around the base, or the sides won’t match up. → If the sides are 3 centimeters high, that means adding 6 centimeters to 19 centimeters and 6 centimeters to 13 centimeters. I would have to trim off some paper. → If you make the height of the sides 4 centimeters, it works perfectly; $19 + (2 \times 4) = 27$, and $13 + (2 \times 4) = 21$.
T: By making the height of the box 4 centimeters, the measurements do work out perfectly. Watch as I model the four steps to make Box 1. (Consider posting the steps.)
Step 1  Measure and mark two points 4 centimeters in from the edge on each side.
Step 2  Connect those marked points to draw the lines of the 19 cm × 13 cm base (shown on the previous page).
Step 3  Cut out the small rectangles in each corner.
Step 4  Fold up the sides, and tape the corners together.

**Part 2: Determine the dimensions of Box 2 and the lid.**

Distribute the Problem Set, rulers, and the other pieces of cardstock.

T: You will decide on the exact dimensions of Box 2 and the lid for Box 1. What will you use to guide your decisions?

S: First, I’ll think about the materials that have to go inside. → I’ll think about making Box 2 fit inside of Box 1. → Box 2 can’t be taller than Box 1 if the lid is going to fit. → The lid has to be just a tiny bit longer than Box 1 so it fits nicely.

T: To complete the project, you each will receive a total of three 27 centimeter by 21 centimeter pieces of cardstock: one to make Box 1, one to make its lid, and one more to make Box 2. After you fold the edges of the cardstock to make the box or lid, will the inner dimensions still be 27 by 23 centimeters?

S: No. They’ll be smaller than that.

T: Take a moment to talk with your partner about how the different sizes of your summer materials will influence the dimensions of Box 2.

S: We have Problem Sets, which are pretty big, and fluency cards and vocabulary cards that are smaller. → We might want the vocabulary cards to go in Box 2. → Problem Sets can still go at the bottom of the bigger box, and smaller things can go in the smaller box.

T: Use a ruler to measure your summer practice materials and decide how you will store them. Will they be rolled, folded, or flat? Then, decide on the reasonable whole number dimensions for Box 2.

T: In order to make the lid fit snugly, you will need to make it only slightly larger than Box 1. Record the dimensions of each box and the lid on your Problem Set along with your reasoning about why those dimensions make sense. Work with a partner if you choose.

S: (Manipulate and measure the summer practice materials, and then decide on the dimensions and record.)

**Part 3: Construct the boxes and lid.**

T: As you assemble your boxes and lid, if you find that you need to make adjustments to the dimensions as you work, record your updated thinking in the space remaining on your Problem Set or on a separate sheet of paper.
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S: (Draw dimensions, and assemble boxes and lids, making adjustments to each if needed.)

Have students decorate and personalize their boxes with designs that show what concepts they have learned in math this year. They will have some time to complete their designs and to place their summer practice materials inside the boxes during Lesson 34.

**Student Debrief (10 minutes)**

**Lesson Objective:** Design and construct boxes to house materials for summer use.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to discuss the activities they completed. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the activities and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- What were the most important factors to consider as you decided on the dimensions of your boxes? Why did those things matter so much?
- To design these boxes, we considered the materials that they would store. What specifically did we take into account? Volume, area, length, width, height? When would it be appropriate to consider other properties?
- What boxes do you see that have been designed for a specific purpose? What are some of the choices that were made to best serve that purpose?
- What was your biggest challenge in designing your boxes? Explain.
Reflection (3 minutes)

In Topic F, to close students’ elementary experience, the Exit Ticket is set aside and replaced by a brief opportunity to reflect on the mathematics done that day as it relates to students’ broader experience of math.
### Divide Decimals

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>1 ÷ 1 =</td>
<td>23.</td>
</tr>
<tr>
<td>2.</td>
<td>1 ÷ 0.1 =</td>
<td>24.</td>
</tr>
<tr>
<td>3.</td>
<td>2 ÷ 0.1 =</td>
<td>25.</td>
</tr>
<tr>
<td>4.</td>
<td>7 ÷ 0.1 =</td>
<td>26.</td>
</tr>
<tr>
<td>5.</td>
<td>1 ÷ 0.1 =</td>
<td>27.</td>
</tr>
<tr>
<td>6.</td>
<td>10 ÷ 0.1 =</td>
<td>28.</td>
</tr>
<tr>
<td>7.</td>
<td>20 ÷ 0.1 =</td>
<td>29.</td>
</tr>
<tr>
<td>8.</td>
<td>60 ÷ 0.1 =</td>
<td>30.</td>
</tr>
<tr>
<td>9.</td>
<td>1 ÷ 1 =</td>
<td>31.</td>
</tr>
<tr>
<td>10.</td>
<td>1 ÷ 0.1 =</td>
<td>32.</td>
</tr>
<tr>
<td>11.</td>
<td>10 ÷ 0.1 =</td>
<td>33.</td>
</tr>
<tr>
<td>12.</td>
<td>100 ÷ 0.1 =</td>
<td>34.</td>
</tr>
<tr>
<td>13.</td>
<td>200 ÷ 0.1 =</td>
<td>35.</td>
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<tr>
<td>14.</td>
<td>800 ÷ 0.1 =</td>
<td>36.</td>
</tr>
<tr>
<td>15.</td>
<td>1 ÷ 0.1 =</td>
<td>37.</td>
</tr>
<tr>
<td>16.</td>
<td>1 ÷ 0.01 =</td>
<td>38.</td>
</tr>
<tr>
<td>17.</td>
<td>2 ÷ 0.01 =</td>
<td>39.</td>
</tr>
<tr>
<td>18.</td>
<td>9 ÷ 0.01 =</td>
<td>40.</td>
</tr>
<tr>
<td>19.</td>
<td>5 ÷ 0.01 =</td>
<td>41.</td>
</tr>
<tr>
<td>20.</td>
<td>50 ÷ 0.01 =</td>
<td>42.</td>
</tr>
<tr>
<td>21.</td>
<td>60 ÷ 0.01 =</td>
<td>43.</td>
</tr>
<tr>
<td>22.</td>
<td>20 ÷ 0.01 =</td>
<td>44.</td>
</tr>
</tbody>
</table>
### Divide Decimals

1. \(10 \div 1 = \)  
2. \(1 \div 0.1 = \)  
3. \(2 \div 0.1 = \)  
4. \(8 \div 0.1 = \)  
5. \(1 \div 0.1 = \)  
6. \(10 \div 0.1 = \)  
7. \(20 \div 0.1 = \)  
8. \(70 \div 0.1 = \)  
9. \(1 \div 1 = \)  
10. \(1 \div 0.1 = \)  
11. \(10 \div 0.1 = \)  
12. \(100 \div 0.1 = \)  
13. \(200 \div 0.1 = \)  
14. \(900 \div 0.1 = \)  
15. \(1 \div 0.1 = \)  
16. \(1 \div 0.01 = \)  
17. \(2 \div 0.01 = \)  
18. \(7 \div 0.01 = \)  
19. \(4 \div 0.01 = \)  
20. \(40 \div 0.01 = \)  
21. \(50 \div 0.01 = \)  
22. \(80 \div 0.01 = \)  
23. \(4 \div 0.1 = \)  
24. \(0.4 \div 0.1 = \)  
25. \(0.04 \div 0.1 = \)  
26. \(0.07 \div 0.1 = \)  
27. \(5 \div 0.01 = \)  
28. \(50 \div 0.01 = \)  
29. \(53 \div 0.01 = \)  
30. \(68 \div 0.01 = \)  
31. \(2 \div 0.1 = \)  
32. \(20 \div 0.1 = \)  
33. \(23 \div 0.1 = \)  
34. \(23.6 \div 0.1 = \)  
35. \(15 \div 5 = \)  
36. \(1.5 \div 0.5 = \)  
37. \(1.5 \div 0.05 = \)  
38. \(3.2 \div 0.04 = \)  
39. \(28 \div 0.07 = \)  
40. \(42 \div 0.6 = \)  
41. \(88 \div 1.1 = \)  
42. \(3.6 \div 0.12 = \)  
43. \(3.63 \div 0.3 = \)  
44. \(8.44 \div 0.04 = \)
Lesson 33: Design and construct boxes to house materials for summer use.

Record the dimensions of your boxes and lid below. Explain your reasoning for the dimensions you chose for Box 2 and the lid.

**BOX 1** (Can hold Box 2 inside.)

The dimensions of Box 1 are ________ × ________ × ________.

Its volume is ________.

**BOX 2** (Fits inside of Box 1.)

The dimensions of Box 2 are ________ × ________ × ________.

Reasoning:

**LID** (Fits snugly over Box 1 to protect the contents.)

The dimensions of the lid are ________ × ________ × ________.

Reasoning:
1. What steps did you take to determine the dimensions of the lid?

2. Find the volume of Box 2. Then, find the difference in the volumes of Boxes 1 and 2.

3. Imagine Box 3 is created such that each dimension is 1 cm less than that of Box 2. What would the volume of Box 3 be?
Lesson 33: Design and construct boxes to house materials for summer use.

Today, you made a box for a special purpose. It shows one way that math is used all the time to create containers. When might there be other opportunities for you to use the math you have learned in elementary school?
1. Find various rectangular boxes at your home. Use a ruler to measure the dimensions of each box to the nearest centimeter. Then, calculate the volume of each box. The first one is partially done for you.

<table>
<thead>
<tr>
<th>Item</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juice Box</td>
<td>11 cm</td>
<td>2 cm</td>
<td>5 cm</td>
<td></td>
</tr>
</tbody>
</table>

2. The dimensions of a small juice box are 11 cm by 4 cm by 7 cm. The super-size juice box has the same height of 11 cm but double the volume. Give two sets of the possible dimensions of the super-size juice box and the volume.