TEXAS MATH SOLUTION

Accelerated Grade 6

Module 1 Topic 4 Lesson 2

Which Warehouse?

Student Edition

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Which Warehouse?

Volume Composition and Decomposition

WARM UP

Calculate each product.

1. 0.5×0.5
2. 0.1×0.9
3. 0.3×0.9
4. 0.8×0.7
5. 0.7×0.7
6. 0.4×0.4
7. 0.6×0.7
8. 0.6×0.8
9. 0.3×0.2
10. 0.2×0.8

LEARNING GOALS

- Fluently add, subtract, and multiply multi-digit decimals using the standard algorithms.
- Determine volumes of figures composed of rectangular prisms.

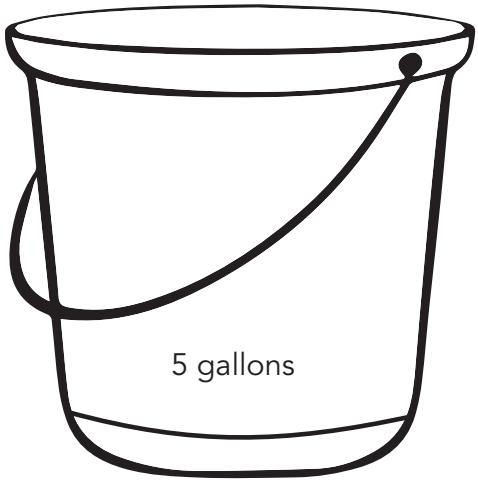
KEY TERMS

- composite solid
- trailing zeros

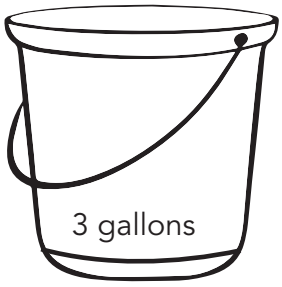
You have calculated areas by composing or decomposing complex shapes into familiar shapes. How can you used this same idea to determine the volume of composite solids?

Measuring Water

You have two empty containers, each with a different volume, as shown. You also have a source of water.



(1155 in.^{3})



(693 in.^{3})

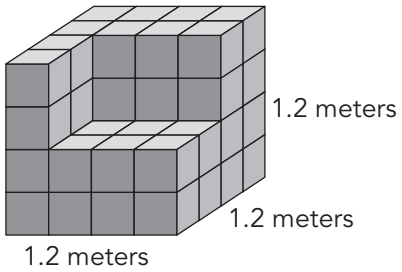
1. Using just these containers, how can you measure out a volume of exactly 4 gallons (924 in.^{3})?

ACTIVITY
2.1 Adding and Subtracting Volumes

As part of Let's Build Together, an organization that builds recreation centers for communities in need, your class is building a concrete bench for use in a community garden.

Your class has been provided with a drawing of your assignment. You need to determine how much concrete is needed to construct the bench.

The bench is a *composite solid*. A **composite solid** is made up of more than one geometric solid.



1. How might you determine the amount of concrete needed to construct your group's bench? What information do you need to know?

Sofia and Hunter propose different strategies for determining the volume of the bench. Sofia's strategy requires the addition of volumes and Hunter's strategy requires the subtraction of volumes. Because of the decimal side lengths of this bench, let's start by reviewing how to add and subtract with decimals.

Let's consider adding decimals.

WORKED EXAMPLE

$3.421 + 9.5 + 12.85 = ?$

Estimating first helps you check your answers. You know what answer to expect.

Before calculating the sum, estimate the answer so you know the approximate sum.

$$3 + 10 + 13 = 26$$

To calculate the exact sum, line up the decimals so that like place values are in the same column. You can use the decimal point as a reference point to help you align numbers in the correct place-value column.

$$\begin{array}{r} 3.421 \\ 9.5 \\ +\ 12.85 \\ \hline 25.771 \end{array}$$

The estimate of 26 and the sum of 25.771 are reasonably close, so the sum appears to be correct.

Lijo added *trailing zeros* to his decimal numbers. **Trailing zeros** are a sequence of 0s in a decimal representation of a number, after which no non-zero digits follow. Trailing zeros do not affect the value of a number.

2. Lijo says that he can write 9.5 as 9.500 to help calculate the sum 3.421 + 9.5 + 12.85.

a. How does this help Lijo calculate the sum?

b. How might Lijo rewrite 12.85 in this sum?

3. Summarize how to add decimals.

You can use a similar algorithm for subtracting decimals. Let's consider two different subtraction problems.

WORKED EXAMPLE

	$18.205 - 3.91$	$22.4 - 8.936$
First, estimate the answer so you know the approximate difference.	$18 - 4 = 14$	$22 - 9 = 13$
Then, line up the decimals so that like place values are in the same column and subtract.	$\begin{array}{r} {\scriptstyle 7\ 11\ 10} \\ 1\not{8}.\not{2}\not{0}5 \\ -3.910 \\ \hline 14.295 \end{array}$	$\begin{array}{r} {\scriptstyle 1\ 11\ 13\ 9\ 10} \\ \not{2}\not{2}.\not{4}\not{0}\not{0} \\ -8.936 \\ \hline 13.464 \end{array}$
Compare the answer to your estimate to check your work.	The estimate of 14 and the difference of 14.295 are reasonably close, so the difference appears to be correct.	The estimate of 13 and the difference of 13.464 are reasonably close, so the difference appears to be correct.

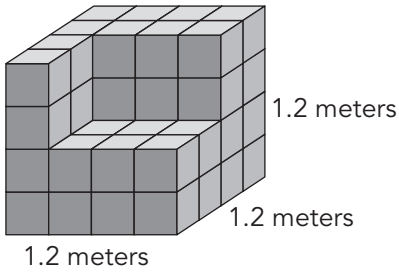
4. Analyze both subtraction problems.

a. What do the subtraction problems have in common?

b. What is different about the subtraction problems in the Worked Example?

5. Summarize how to subtract decimals.

Let's go back to determining the amount of concrete needed for your group's bench.



6. Sofia proposes that the class decompose the bench into rectangular prisms, calculating the volume of each prism, and then adding up the volumes. Use Sofia's strategy to determine the volume of the bench.

7. Hunter proposes that the class first calculate the total volume of a 1.2 meter cube. Then, they can subtract out the portion of the cube that forms the seat of the bench. Determine the volume of the bench using Hunter's strategy.

8. **Compare the volume calculated using Sofia's strategy with the volume calculated using Hunter's strategy.**

NOTES

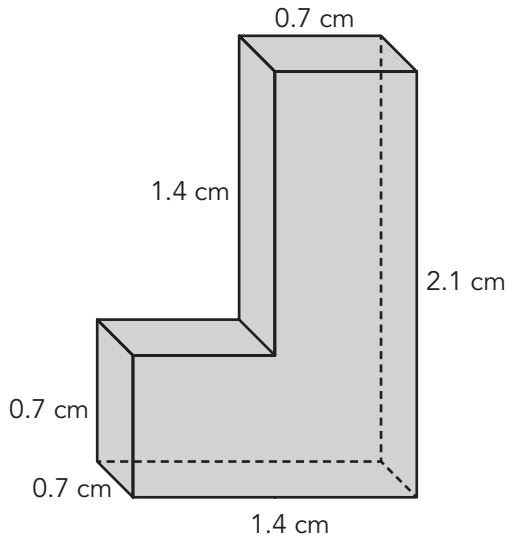
9. **How are Sofia's and Hunter's strategies for determining the volume of composite solids like the strategies used to determine the area of composite figures?**

ACTIVITY 2.2

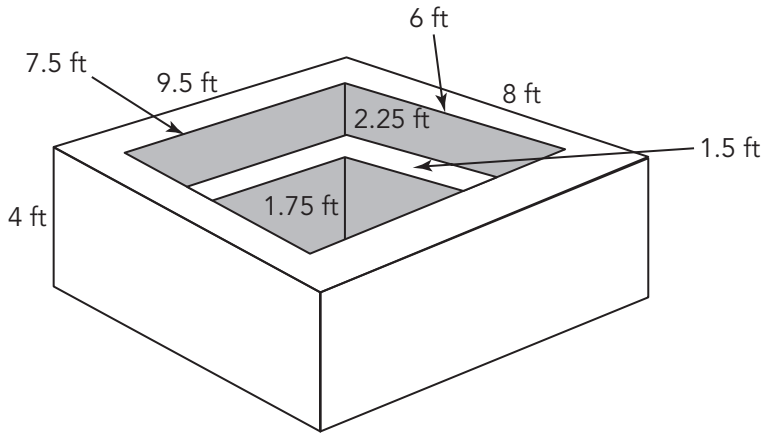
Fluency with Decimal Operations

You have seen that you can add, subtract, and of course multiply positive rational numbers, like decimals, to determine volumes. Let's apply what you know to solve problems.

1. **Determine the volume of the figure.**



2. **Regina is building a hot tub next to her swimming pool. The interior dimensions are 6 feet by 7.5 feet. It includes solid bench seating on all four sides. The bench has a width of 1.5 feet. The bench is positioned 1.75 feet from the ground and 2.25 feet from the top as shown.**

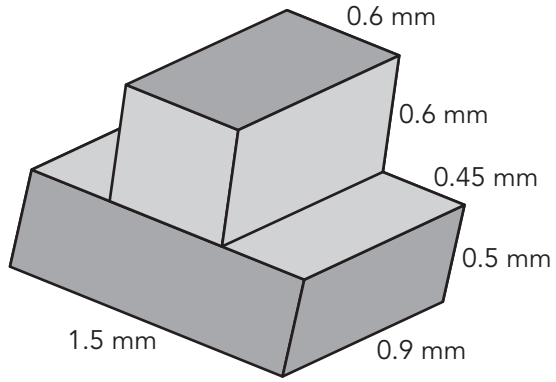


   a. **When the hot tub is filled, the water level will be 0.25 feet from the top. How much water will it take to fill the hot tub?**

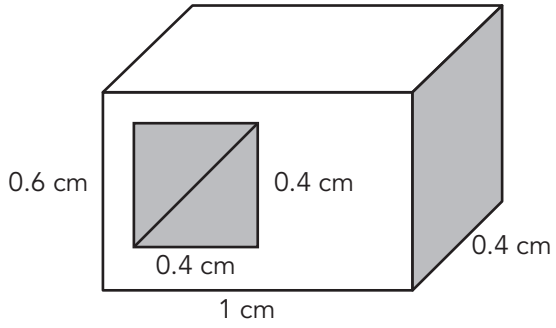
   b. **How many cubic feet of concrete is needed to build the hot tub?**

3. Calculate the volume of each figure. Show your work.

a.



b.



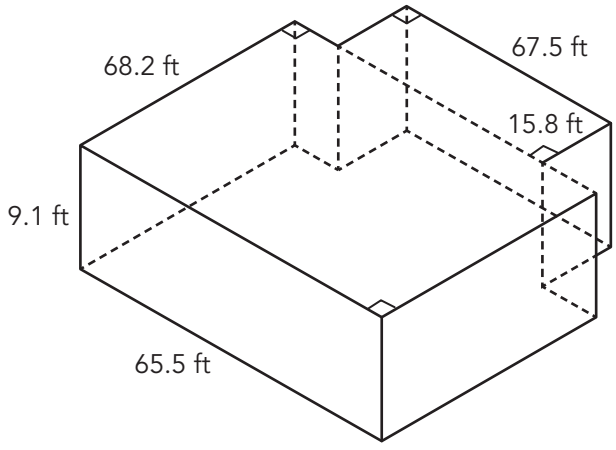
NOTES

TALK the TALK

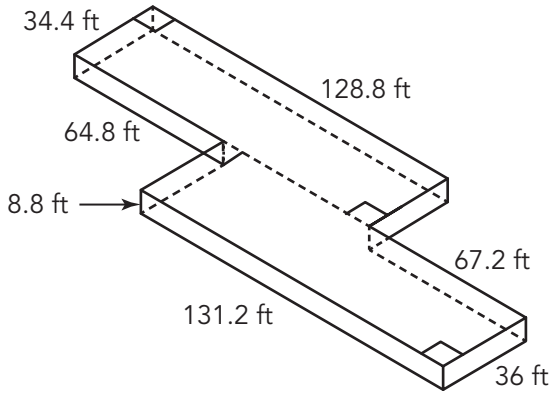
The Volume Warehouse

A business is shopping for warehouse space. Two of their choices are shown.

Warehouse A



Warehouse B



The total cost each month for space in Warehouse A is $0.25 times the number of cubic feet used. The total cost each month for space in Warehouse B is $0.15 times the number of cubic feet used.

1. **Which warehouse space would you recommend? What information would you need to make this decision? Write your findings in a report to your Director of Finance.**

Assignment

LESSON 2: Which Warehouse?

Write

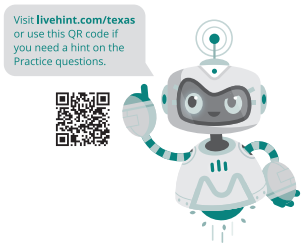
Explain how you can estimate the sum or difference of two or more decimals.

Remember

You can add and subtract decimals the same way you add and subtract whole numbers. Line up the decimal points and then add or subtract.

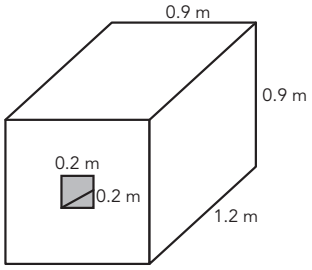
$$\begin{array}{r} 3.421 \\ 9.5 \\ +12.85 \\ \hline 25.771 \end{array}$$

Practice

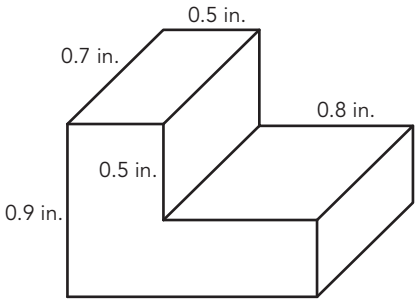


1. Estimate each sum or difference to the nearest whole number. Then, calculate the exact sum or difference.
   a. 4.78 + 67.13 + 3.83
   b. 5.8 + 7.009 + 45.2
   c. 56.02 − 3.76 − 15.27
   d. 25.91 − 12.72 − 0.97

2. Subtract to determine the volume of the figure.

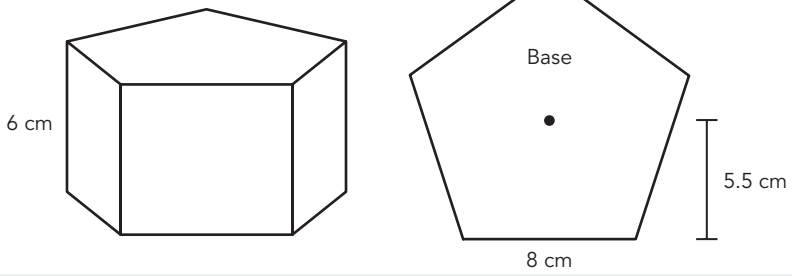


3. Add to determine the volume of the figure.



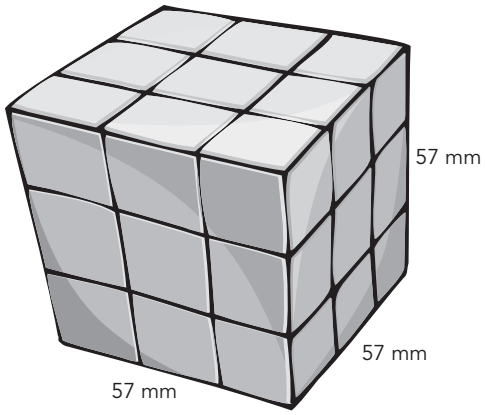
Stretch

Calculate the volume of the right prism with the given base.



Review

1. Consider the Rubik's Cube.
   a. Calculate the volume of one of the tiny cubes making up the Rubik's Cube. Show your work.
   b. Calculate the volume of the Rubik's Cube using your answer to Question 1. Then calculate the volume using the volume formula. Show your work.



2. Ms. Hendrix said that when she was a girl she used to make mixed cassette tapes with her favorite songs. One side of Ms. Hendrix's cassette tapes had $22\frac{1}{2}$ minutes of available space.
   a. How many $4\frac{2}{5}$-minute songs could Ms. Hendrix record on one side of a cassette tape? Show your work.
   b. Use estimation to help explain how you know your answer to Question 2a is reasonable.

3. Calculate each product.
   a. $\frac{2}{3} \times \frac{4}{9}$
   b. $\frac{1}{6} \times \frac{12}{13}$