Lesson 3: Adding and Subtracting Decimals with Few Non-Zero Digits

Let's add and subtract decimals.

3.1: Do the Zeros Matter?

1. Evaluate mentally: $1.009 + 0.391$

2. Decide if each equation is true or false. Be prepared to explain your reasoning.

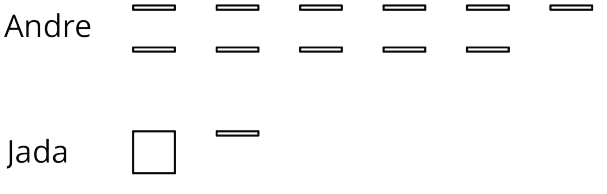
   a. $34.56000 = 34.56$

   b. $25 = 25.0$

   c. $2.405 = 2.45$

3.2: Calculating Sums

1. Andre and Jada drew base-ten diagrams to represent $0.007 + 0.004$. Andre drew 11 small rectangles. Jada drew only two figures: a square and a small rectangle.



   a. If both students represented the sum correctly, what value does each small rectangle represent? What value does each square represent?

   b. Draw or describe a diagram that could represent the sum $0.008 + 0.07$.

2. Here are two calculations of $0.2 + 0.05$. Which is correct? Explain why one is correct and the other is incorrect.

$$\begin{array}{r} 0.2 \\ +\ 0.05 \\ \hline 0.25 \end{array} \qquad \begin{array}{r} 0.2 \\ +\ 0.05 \\ \hline 0.07 \end{array}$$

3. Compute each sum. If you get stuck, consider drawing base-ten diagrams to help you.

a.

$$\begin{array}{r} 0.11 \\ +\ 0.005 \\ \hline \end{array}$$

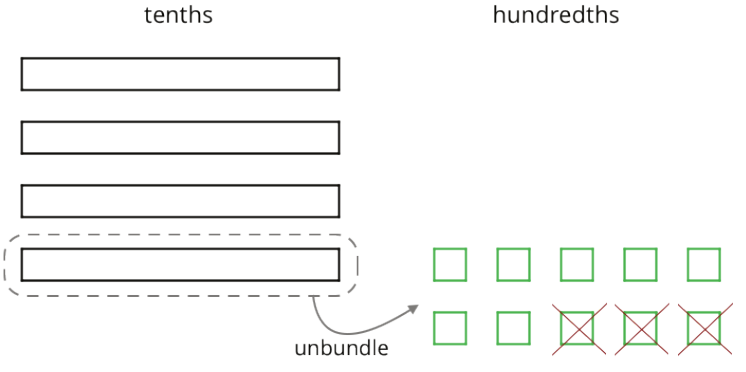
b. $0.209 + 0.01$

c. $10.2 + 1.1456$

3.3: Subtracting Decimals of Different Lengths

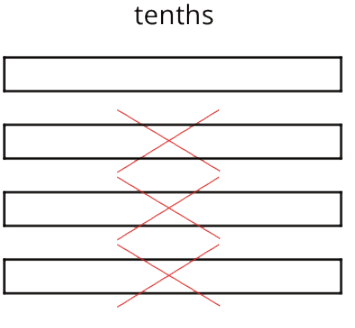
Diego and Noah drew different diagrams to represent $0.4 - 0.03$. Each rectangle represents 0.1. Each square represents 0.01.

- Diego started by drawing 4 rectangles to represent 0.4. He then replaced 1 rectangle with 10 squares and crossed out 3 squares to represent subtraction of 0.03, leaving 3 rectangles and 7 squares in his diagram.



Diego's Method

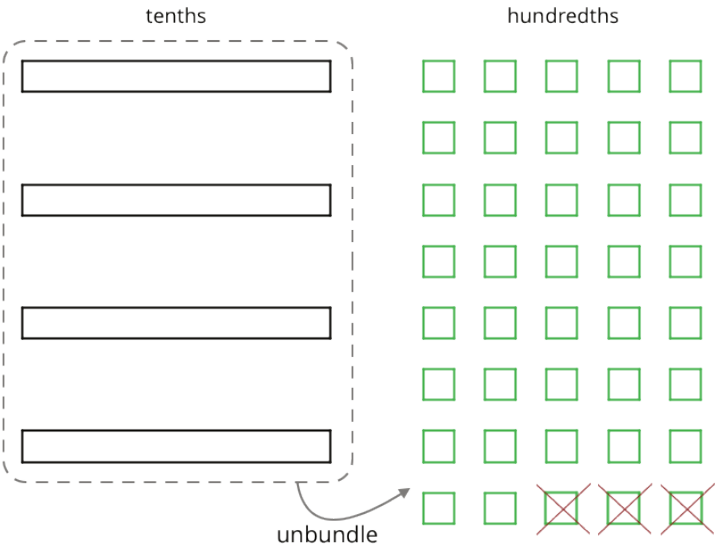
- Noah started by drawing 4 rectangles to represent 0.4. He then crossed out 3 rectangles to represent the subtraction, leaving 1 rectangle in his diagram.



Noah's Method

1. Do you agree that either diagram correctly represents $0.4 - 0.03$? Discuss your reasoning with a partner.

2. Elena also drew a diagram to represent $0.4 - 0.03$. She started by drawing 4 rectangles. She then replaced all 4 rectangles with 40 squares and crossed out 3 squares to represent subtraction of 0.03, leaving 37 squares in her diagram. Is her diagram correct? Discuss your reasoning with a partner.



Elena's Method

3. Find each difference. Explain or show your reasoning.

   a. $0.3 - 0.05$

   b. $2.1 - 0.4$

c. $1.03 - 0.06$

d. $0.02 - 0.007$

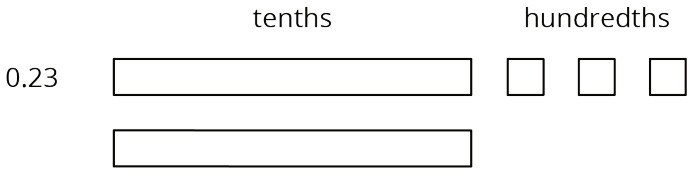
Are you ready for more?

A distant, magical land uses jewels for their bartering system. The jewels are valued and ranked in order of their rarity. Each jewel is worth 3 times the jewel immediately below it in the ranking. The ranking is red, orange, yellow, green, blue, indigo, and violet. So a red jewel is worth 3 orange jewels, a green jewel is worth 3 blue jewels, and so on.

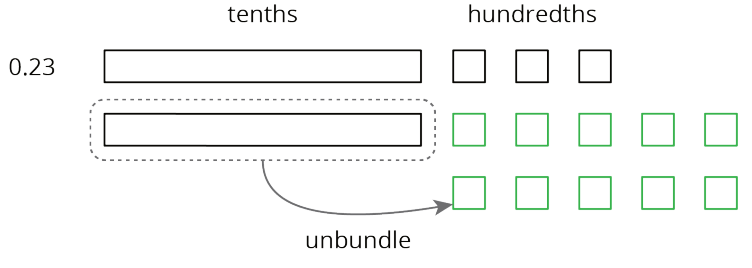
At the Auld Shoppe, a shopper buys items that are worth 2 yellow jewels, 2 green jewels, 2 blue jewels, and 1 indigo jewel. If they came into the store with 1 red jewel, 1 yellow jewel, 2 green jewels, 1 blue jewel, and 2 violet jewels, what jewels do they leave with? Assume the shopkeeper gives them their change using as few jewels as possible.

Lesson 3 Summary

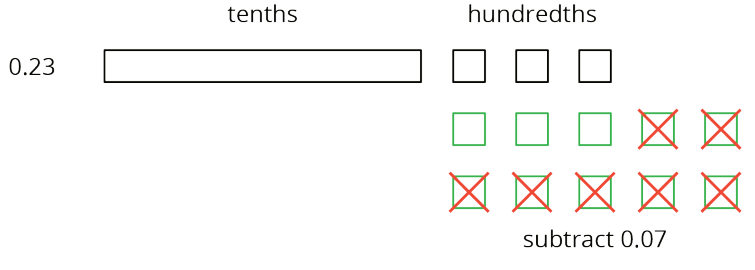
Base-ten diagrams can help us understand subtraction as well. Suppose we are finding $0.23 - 0.07$. Here is a diagram showing 0.23, or 2 tenths and 3 hundredths.



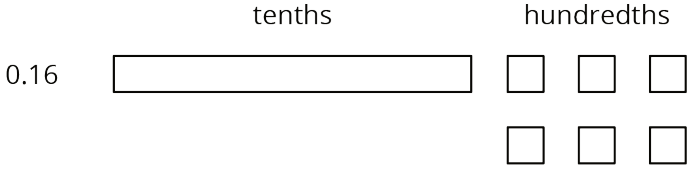
Subtracting 7 hundredths means removing 7 small squares, but we do not have enough to remove. Because 1 tenth is equal to 10 hundredths, we can "unbundle" (or decompose) one of the tenths (1 rectangle) into 10 hundredths (10 small squares).



We now have 1 tenth and 13 hundredths, from which we can remove 7 hundredths.



We have 1 tenth and 6 hundredths remaining, so $0.23 - 0.07 = 0.16$.

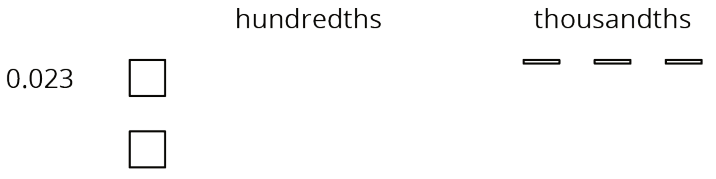


Here is a vertical calculation of $0.23 - 0.07$.

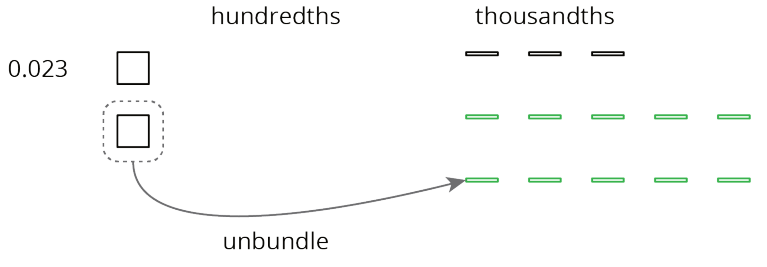
$$\begin{array}{r} {\scriptstyle 1}\ {\scriptstyle 13} \\ 0.\cancel{2}\ \cancel{3} \\ -\ \ 0.0\ 7 \\ \hline 0.1\ 6 \end{array}$$

Notice how this representation also shows a tenth is unbundled (or decomposed) into 10 hundredths in order to subtract 7 hundredths.

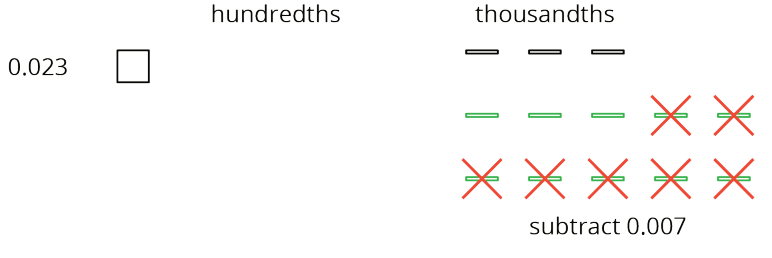
This works for any decimal place. Suppose we are finding $0.023 - 0.007$. Here is a diagram showing 0.023.



We want to remove 7 thousandths (7 small rectangles). We can "unbundle" (or decompose) one of the hundredths into 10 thousandths.



Now we can remove 7 thousandths.



We have 1 hundredth and 6 thousandths remaining, so $0.023 - 0.007 = 0.016$.

Here is a vertical calculation of $0.023 - 0.007$.

$$\begin{array}{r} {\scriptstyle 1}{\scriptstyle 13} \\ 0.0\,\cancel{2}\,\cancel{3} \\ -\quad 0.0\,0\,7 \\ \hline 0.0\,1\,6 \end{array}$$