

Sums and Differences Using Models



CAREER SPOTLIGHT: Packaging Machine Operators



Cluster: Manufacturing

Pathway: Production

Education: These occupations usually require a high school diploma.

Education Zone: Zone 2 (High School Diploma)

Median National Wage: \$38,300

What They Do

Operate or tend machines to prepare industrial or consumer products for storage or shipment. Includes cannery workers who pack food products.

On the job, you would:

- Attach identification labels to finished packaged items, or cut stencils and stencil information on containers, such as lot numbers or shipping destinations.
- Sort, grade, weigh, and inspect products, verifying and adjusting product weight or measurement to meet specifications.
- Stop or reset machines when malfunctions occur, clear machine jams, and report malfunctions to a supervisor.

Watch a CareerOneStop Video about packaging machine operators. <https://www.youtube.com/watch?v=wGITtQuRcaF>

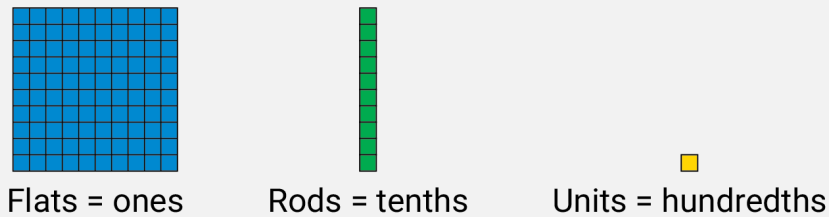
Lesson Objective

In this lesson, you will perform operations with fractions and decimals.

- You will use models to add decimals and fractions.
- You will use models to subtract decimals and fractions.

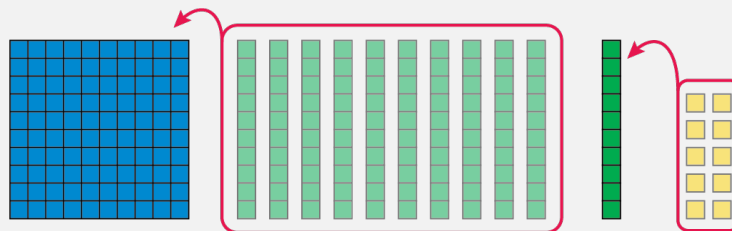
Fraction and Decimal Essentials

When you are adding decimals or fractions with denominators of 10 or 100, it can be helpful to use a **model**. One model is **base ten blocks**, which are special blocks that help you see the place value of each digit in the number. When using base ten blocks with decimals and fractions, the large squares, or flats, are equal to one whole. The sticks, or rods, show tenths, and the cubes, or units, show hundredths.



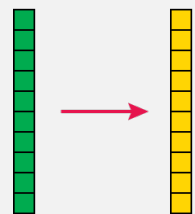
When adding, you will model each number using the base ten blocks, and then combine the flats, rods, and units to find the sum. If there are less than 10 of each block when the numbers are combined, then there are no further steps to find the sum. If there are 10 or more of any block, you will need to regroup.

To **regroup** when adding, combine ten of one block to make the next greater block. Ten units combine to make one rod, and ten rods combine to make one flat.

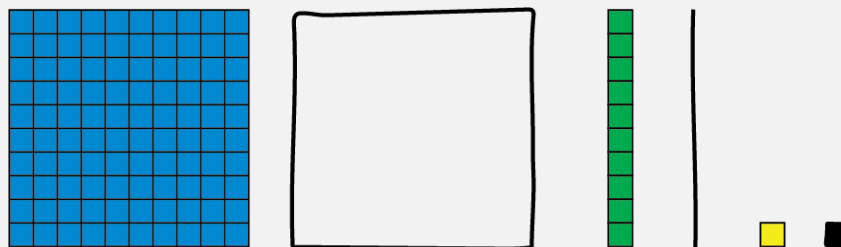


After all the regroupings are done, you can look at the blocks that remain to find the sum.

When you use base ten blocks to add fractions, it is sometimes easier to break apart the rods into units. Each rod is ten units, so every tenth becomes $\frac{10}{100}$. Breaking up the tenths makes it possible to write your answers as fractions with a denominator of 100.



You can also use a sketch, or informal drawing, when using models. With base ten blocks, the flats can be shown as squares, the rods as lines, and the units as dots. These kinds of sketches help you record your work and use models even when the physical blocks are not available.



Using Models to Add Decimals and Fractions

Example 1 Adding Decimals Using Base Ten Blocks

Use base ten blocks to find each sum.

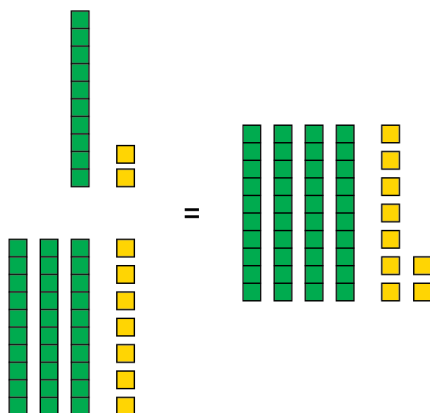
a. $0.12 + 0.37$

b. $2.35 + 1.14$

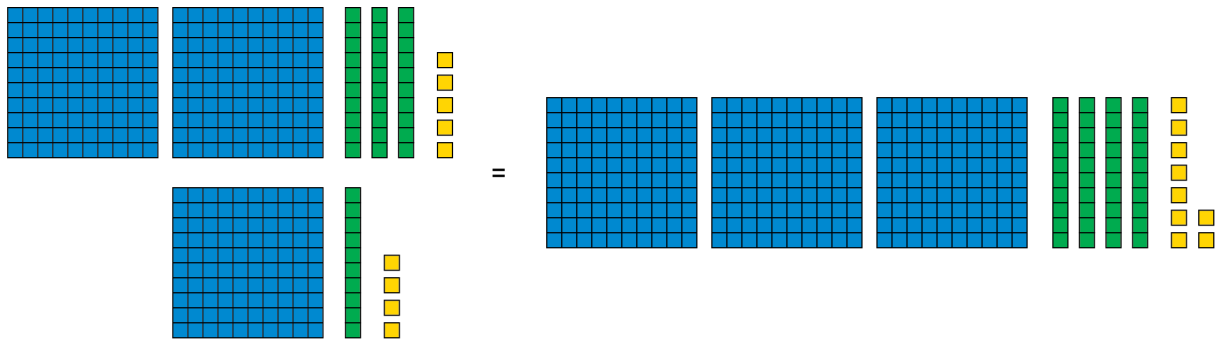
c. $1.29 + 0.82$

Solution

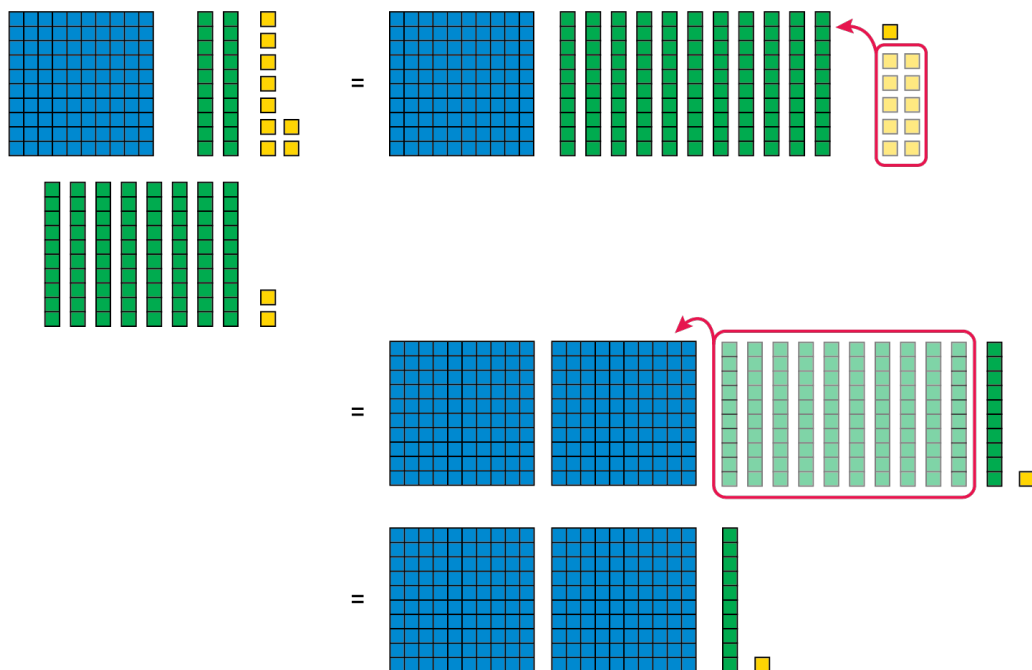
- a. Use base ten blocks to model each number. The number 0.12 uses 1 rod and 2 units, and 0.37 uses 3 rods and 7 units. When combined, the sum is 4 rods and 9 units, or 0.49.



- b. Show each number using base ten blocks. The number 2.35 includes ones, tenths, and hundredths, so you will use 2 flats, 3 rods, and 5 units. The number 1.14 uses 1 flat, 1 rod, and 4 units. When combined, there are 3 flats, 4 rods, and 9 units, so the sum is 3.49.



- c. Show the number 1.29 using 1 flat, 2 rods, and 9 units, and the number 0.82 using 8 rods and 2 units. When combined, there are more than 9 units, so a group of 10 units (0.10) is regrouped to become a rod (0.1). There are now more than 9 rods, so regroup ten rods (1.0) to become one flat (1). Now there are 2 flats, 1 rod, and 1 unit remaining, so the sum is 2.11.



Example 2 Adding Fractions Using Base Ten Blocks

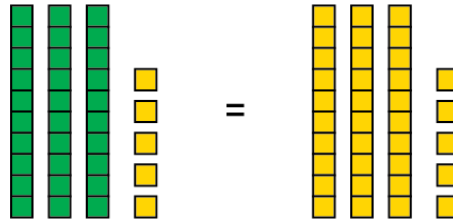
Use base ten blocks to find each sum.

a. $\frac{3}{10} + \frac{5}{100}$

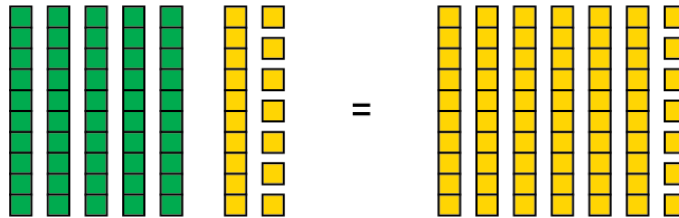
b. $\frac{5}{10} + \frac{17}{100}$

Solution

- a. Use base ten blocks to model each number. The fraction $\frac{3}{10}$ is represented by 3 rods, and $\frac{5}{100}$ uses 5 units. When combined, the sum is 3 rods and 5 units. Since each rod is ten units, the three rods break into 30 units. There are 35 total units, or $\frac{35}{100}$.



- b. The fraction $\frac{5}{10}$ is represented by 5 rods, and the fraction $\frac{17}{100}$ is represented by 17 units. You can break the 5 rods into 50 units, so there are 67 total units, or $\frac{67}{100}$.



Example 3 Adding Decimals and Fractions Using Sketches

Make a sketch to find each sum.

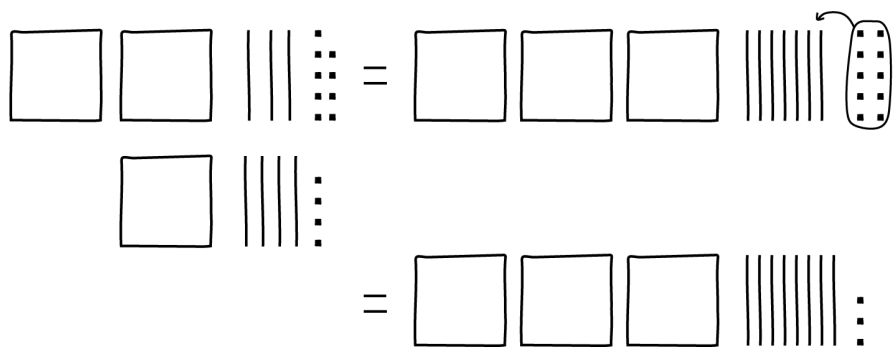
a. $2.39 + 1.44$

b. $\frac{2}{10} + \frac{3}{100}$

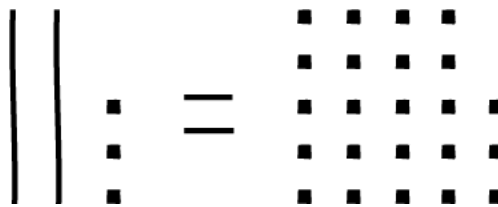
Solution

- a. Make a sketch of the base ten blocks you would use to model each number. For 2.39, there are 2 flats, or squares, 3 rods, or lines, and 9 units, or dots. For the number 1.44, there is 1 square, 4 lines, and 4 dots. Altogether, there are 3 squares, 7 lines, and 13 dots.

Because there are more than 10 units, you need to regroup ten units into 1 ten. This leaves 3 squares, 8 lines, and 3 dots. The sum is 3.83.



- b. Sketch a model using base ten blocks for each fraction. The fraction $\frac{2}{10}$ is two rods, or lines, and $\frac{3}{100}$ is 3 units, or dots. Convert each rod into ten units, so there are a total of 23 units. The sum is $\frac{23}{100}$.



4 Step Into the Career: Adding Decimals

Carson is a packaging machine operator for a company that packages bags of snacks. His job is to check the weights of the packaged foods. One package of mixed nuts is made by combining 3.25 ounces of peanuts with 2.6 ounces of cashews. What should be the total weight of the mixed nuts?

Devise a Plan

Draw a sketch to find the sum of 3.25 and 2.6.

Step 1: Sketch base ten blocks representing 3.25 and 2.6.

Step 2: Combine the place values. Regroup if necessary.

Step 3: Use the combined sketch to find the sum.

Walk Through the Solution

Step 1: Sketch base ten blocks representing 3.25 and 2.6.

The number 3.25 is represented by 3 squares, 2 lines, and 5 dots. The number 2.6 is represented by 2 squares and 6 lines.

Step 2: Combine the place values. Regroup if necessary.

When the blocks are combined, there are 5 squares, 8 lines, and 5 dots. Regrouping is not necessary because all the numbers are less than 10.

Step 3: Use the combined sketch to find the sum.

There are 5 ones, 8 tenths, and 5 hundredths. The sum is 5.85.

The total weight should be 5.85 ounces.

Build Your Skills: Using Models to Add Decimals and Fractions

Use base ten blocks or sketch a model to find each sum.

1. $0.34 + 0.55$

2. $1.27 + 2.25$

3. $2.79 + 1.47$

4. $\frac{1}{10} + \frac{7}{100}$

5. $\frac{2}{10} + \frac{13}{100}$

6. $\frac{7}{10} + \frac{29}{100}$

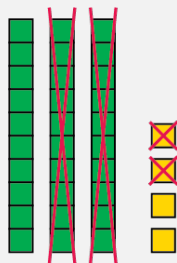
On the Job

7. Darcy is a packaging machine operator for a company that produces orange juice. Part of her job is to verify that each bottle of juice is filled with the correct volume of juice. Each small bottle is filled with 1.85 fluid ounces of orange juice concentrate and 8.2 fluid ounces of purified water.

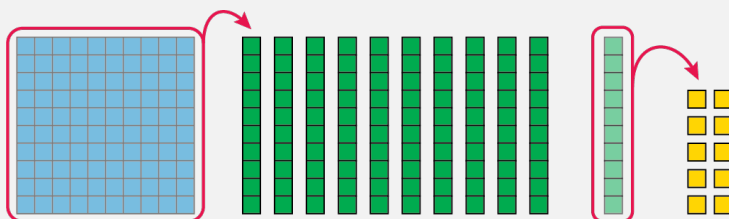
- Make a model or sketch of the problem.
- How many fluid ounces total are in each bottle?

Fraction and Decimal Essentials

You can also use base ten blocks when you are subtracting decimals and fractions. When subtracting, you begin by modeling the number you are subtracting from. For example, in the problem $1.23 - 0.45$, you would use the blocks to model 1.23. Then you remove blocks from the model to subtract. Blocks that are removed will be shown with an X through them, as shown below.



If there are not enough rods or units to remove, you will need to regroup. In subtraction, we regroup when we break up a flat into 10 rods, or a rod into 10 units. You may have heard this called borrowing. This allows you to continue subtracting to find the difference.



As with addition, when you are subtracting fractions it is sometimes easier to break apart the rods into units. Each rod is ten units, so every tenth becomes $\frac{10}{100}$. Breaking up the tenths makes it possible to write your answers as fractions with a denominator of 100.

You can also use a sketch when you are subtracting. Use the same shapes (square, line, dot) to show the flats, rods, and units when you are subtracting. Then you can cross out the model as you subtract.

Using Models to Subtract Decimals and Fractions

Example 5 Subtracting Decimals Using Base Ten Blocks

Use base ten blocks to find each difference.

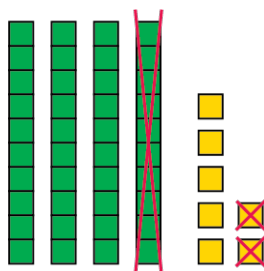
a. $0.47 - 0.12$

b. $2.54 - 1.36$

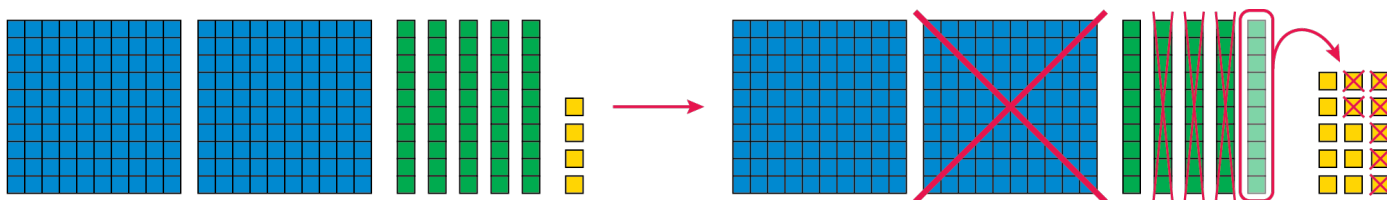
c. $1.15 - 0.87$

Solution

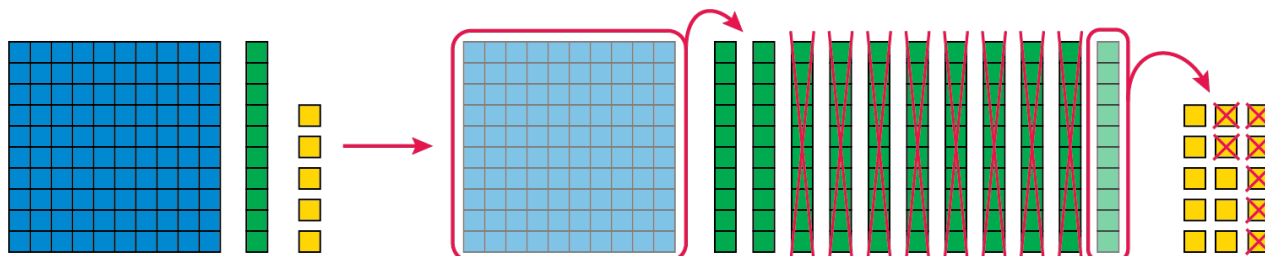
- a. Use base ten blocks to model the number 0.47 using 4 rods and 7 units. Then subtract 0.12 by removing one rod and two units. This leaves 3 rods and 5 units, or 0.35.



- b. Begin by modeling the number 2.54 with the blocks. There will be 2 flats, 5 rods, and 4 units. Then subtract 1.36 by first removing 6 units. Since there are only 4 units, you will need to regroup one of the rods into 10 units before subtracting. Next, remove 3 rods from the 4 rods that remain. Then remove 1 flat. There are now 1 flat, 1 rod, and 8 units remaining, so the difference is 1.18.



- c. Use base ten blocks to model the number 1.15 using 1 flat, 1 rod, and 5 units. Now subtract by removing blocks, beginning with the units. There are only 5 units, so you will need to regroup before removing 7 units. After regrouping there are no rods left, so you will need to regroup one flat into ten rods before removing 8 for the subtraction. There are no flats remaining, 2 rods, and 8 units. The difference is 0.28.



Example 6 Subtracting Fractions Using Base Ten Blocks

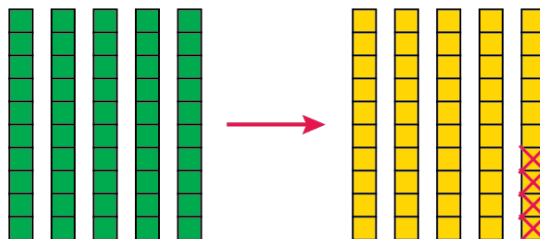
Use base ten blocks to find each difference.

a. $\frac{5}{10} - \frac{4}{100}$

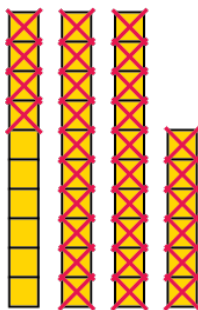
b. $\frac{36}{100} - \frac{3}{10}$

Solution

- a. Use base ten blocks to model the fraction $\frac{5}{10}$ using 5 rods. To subtract $\frac{4}{100}$, or 4 units, you will need to regroup the rods into units. 5 rods break apart into 50 units. Remove 4 of the units, and you are left with 46 units, so the difference is $\frac{46}{100}$.



- b. Model the fraction $\frac{36}{100}$ using base ten blocks. There are 36 units in this fraction. To subtract $\frac{3}{10}$, or 3 rods, you will need to regroup the rods into 30 units. Remove 30 units from the 36 units, leaving 6 units. The difference is $\frac{6}{100}$.



Example 7

Subtracting Decimals and Fractions Using Sketches

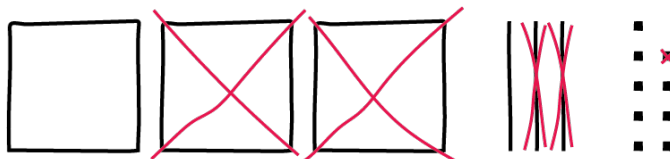
Make a sketch to find each difference.

a. $3.39 - 2.21$

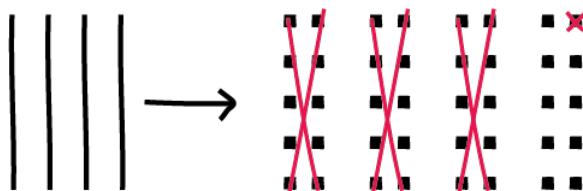
b. $\frac{4}{10} - \frac{31}{100}$

Solution

- a. Make a sketch of the base ten blocks you would use to model the number 3.39. There are 3 flats, or squares, 3 rods, or lines, and 9 units, or dots. Subtract 2 flats, 2 rods, and 1 unit by crossing them out in the drawing. This leaves 1 square, 1 line, and 8 dots. The difference is 1.18.



- b. Sketch a model using base ten blocks for the fraction $\frac{4}{10}$. There will be 4 lines to represent the 4 rods. To subtract, you will need to regroup the rods into units, so change the 4 lines to 40 dots. Then cross out 31 of the dots to show the subtraction. The difference is 9 dots, or $\frac{9}{100}$.



8 Step Into the Career: Subtracting Fractions

Zahira is a packaging machine operator. Her job is to monitor the sorting machine as it sorts apples into boxes of large apples and small apples. She then puts a label on the box that gives an approximate number of apples in the box, based on the weight of each apple. The average weight of the large apples is 0.25 pounds, and the average weight of the small apples is 0.16 pounds. How much more does a large apple weigh than a small apple?

Devise a Plan

Find the difference between 0.25 and 0.16.

Step 1: Make or sketch a model of 0.25 using base ten blocks.

Step 2: Subtract 0.16 from 0.25 by removing blocks from the model.

Step 3: Use the model to find the difference.

Walk Through the Solution

Step 1: Make or sketch a model of 0.25 using base ten blocks.

The number 0.25 would have 2 rods and 5 units.

Step 2: Subtract 0.16 from 0.25 by removing blocks from the model.

Since there are only 5 units, you will need to regroup 1 rod into 10 units before you can subtract. Then subtract 6 units and 1 rod.

Step 3: Use the model to find the difference.

There are 9 units remaining, so the difference is 0.09.

Each large apple weighs 0.09 pounds more than each small apple.

Build Your Skills: Using Models to Subtract Decimals and Fractions

Use base ten blocks or sketch a model to find each difference.

1. $0.78 - 0.34$

2. $3.81 - 2.38$

3. $2.36 - 1.99$

4. $\frac{7}{10} - \frac{43}{100}$

5. $\frac{27}{100} - \frac{12}{100}$

6. $\frac{41}{100} - \frac{3}{10}$

On the Job

7. Thomas is a packaging machine operator for a medical supply company. To accurately calculate the mass of the sterile saline solution he is packing, each full box is weighed, and then the mass of the box is subtracted from the total mass. The fully packed box weighs 3.25 kilograms and the empty box weighs 0.18 kilograms.
- Make a model to find the difference between the packed box and the empty box.
 - What is the mass of the product inside the box?

Career Preparation: Practice

Use base ten blocks or sketch a model to find each sum.

1. $2.28 + 3.19$

2. $1.99 + 1.54$

3. $\frac{2}{10} + \frac{25}{100}$

4. $\frac{13}{100} + \frac{1}{10}$

Use base ten blocks or sketch a model to find each difference.

5. $3.72 - 1.6$

6. $3.17 - 0.89$

7. $\frac{2}{10} - \frac{18}{100}$

8. $\frac{32}{100} - \frac{1}{10}$

9. **Challenge** Use base ten blocks or a model to find the sum of 0.257 and 0.378.

10. **Writing** Explain how you use regrouping to subtract decimals.

Use It On the Job

11. Will is working for a company that packages pills in foil cards for pharmacies. He is a packaging machine operator, and he is responsible for monitoring a machine that stamps an expiration date on each card. He notices that the machine is not working correctly, so some cards are not getting a date and others are getting the wrong date. In a 100-card run, he sees that $\frac{6}{10}$ of the cards have the correct date, and $\frac{24}{100}$ did not get a date. Find the difference between the fraction of cards that have a correct date and the fraction of the cards that have no date.

Devise a Plan

Step 1: Make a model or a sketch of the fraction $\frac{6}{10}$.

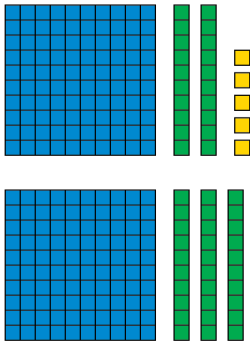
Step 2: _____?

Step 3: _____?

12. Jamie is a packaging machine operator for an ice cream maker. She is verifying the weights of the ice cream containers before the machine places them in a box. If they are too heavy or too light, she removes them from the machine. The maximum allowed weight is 0.7 pounds, and the minimum weight is 0.62 pounds. What is the difference between the maximum and minimum allowed weights?

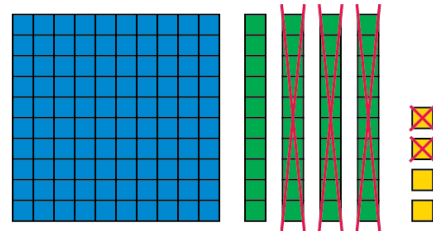
Career Preparation: Check

1. Which sum is shown in the model?



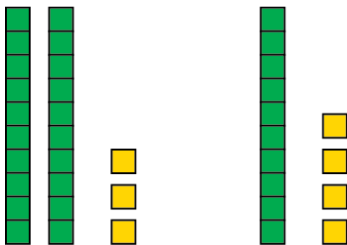
- A. $1.2 + 1.3$ C. $1.25 + 1.33$
 B. $1.25 - 1.33$ D. $12 + 13$

2. Which difference is shown in the model?



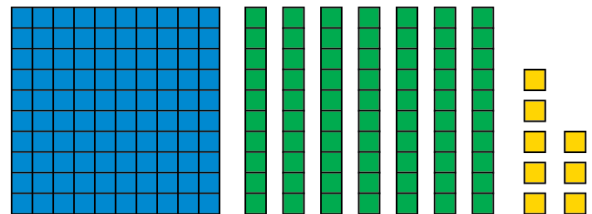
- A. $1.44 + 0.32$ C. $1.44 - 1.32$
 B. $1.44 - 0.32$ D. $1.32 - 1.44$

3. Which is the sum of 0.23 and 0.14? Use the model to help you find the sum.



- A. 0.09 C. 0.37
 B. 0.27 D. 47

4. Which is the difference of 1.78 and 0.65? Use the model to help you find the difference.



- A. 0.12 C. 0.87
 B. 0.43 D. 1.13

Use It On the Job

5. Gavin, a packaging machine operator, is inspecting the labels on cans of soup as they are prepared for packing. He sees that $\frac{4}{10}$ of the cans are chicken noodle soup and $\frac{23}{100}$ of the cans are tomato soup. He knows there is more chicken noodle soup, but he needs to tell his supervisor how much larger the fraction of chicken noodle cans is than the fraction of tomato cans. What is the difference?
6. Sadie is a packaging machine operator for a company that makes baseballs. The baseballs are packed in cases of 100 balls each. Inside each case there are smaller boxes of 10 baseballs. One machine puts 10 balls into a box, and a second machine puts 10 boxes into a case. If each case is one whole, then each box is $\frac{1}{10}$ of the whole, and each individual ball, or unit, is $\frac{1}{100}$ of the whole.

Fill in the blanks by selecting the correct models from the panel.

rods	
units	When you are adding, if there are 10 _____ they can be regrouped as 1 _____.
flats	
wholes	Ten rods can be regrouped into 1 _____.