Numbers and Operations

★ **Module 5** ★

Decimal Operations, Exponents, and Powers

**Lesson 3
Adding and Subtracting
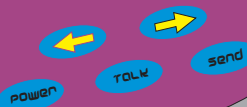Decimals**

Objectives

♦ Estimate decimal sums and differences using rounding and front-end estimation.

♦ Model addition and subtraction of decimals using diagrams and/or illustrations of manipulatives.

♦ Develop and use algorithms to add and to subtract numbers containing decimals (up to thousandths place).

power   **talk**   **send**

Prerequisites

Adding and subtracting multi-digit whole numbers

Estimating sums and differences of whole numbers and decimals

Using place value of whole numbers and decimals

Rounding whole numbers and decimals

Vocabulary

Decimal (4.2)
Estimate (1.5)
Rounding (1.5)
Addend (2.1)
Minuend (2.2)
Subtrahend (2.2)
Hundredths-square (4.1)
Sum (2.1)
Difference (2.2)
Place value (2.1)
Front-end estimation (1.5)

Get Started

- Ask students to find these sums by rewriting each problem vertically and then adding.

235 + 85	2,135 + 5 + 145	524 + 8	$5 + $1.25 + $0.85

$$
\begin{array}{r} 235 \\ +\ 85 \\ \hline 320 \end{array}
\qquad
\begin{array}{r} 2{,}135 \\ 5 \\ +\ 145 \\ \hline 2{,}285 \end{array}
\qquad
\begin{array}{r} 524 \\ +\ \ 8 \\ \hline 532 \end{array}
\qquad
\begin{array}{r} \$5.00 \\ \$1.25 \\ +\ \$0.85 \\ \hline \$7.10 \end{array}
$$

5.3A

- Ask students how they aligned the addends. **Align by place value.**
- Have students write the following decimals in a single column, aligned by place value: 0.5, 2.16, 31.4, 0.732, 15. Have students fill in zeros so each decimal has the same number of place values.
  0.500, 2.160, 31.400, 0.732, 15.000
- Tell students that in today's lesson, they will add and will subtract decimals using place value.

Subtopic 1 — Estimation of Decimal Sums and Differences

Expand Their Horizons

In this subtopic, students estimate decimal sums and differences to solve money problems. They estimate the sums of the cost of several items to find out if there is enough money to make a purchase. They estimate differences to find the change that would be received after a purchase.

1 The cost of the baseball cap rounds to $15.00 and the cost of the tee shirt rounds to $12.00. The total cost is about $15.00 + $12.00 or $27.00. Diane has $30.00, which gives her enough money to buy both items. Her change is about $30.00 – $27.00 or $3.00.

2 The costs of the cookbooks rounds to $16.00, $19.00, and $22.00. The total cost is about $57.00, so Will does not have enough money to purchase the cookbooks.

Additional Examples

1. Joe needs to buy school supplies. A calculator costs $96.44, and the remainder of his supplies cost a total of $42.77. Joe has three $50 bills. Estimate to find if he has enough money to purchase all of his school supplies. How much change or how much more money will Joe need?

2. Brant has four $10 bills, and he wants to buy some gifts for his sister. He wants to buy a stuffed bear that costs $14.43, a baby doll that costs $9.57, and a DVD that costs $21.01. Will Brant have enough money to buy all of these gifts?

Estimate each amount and find the sum of the estimates.

Calculator ≈ $100   Rest of supplies ≈ $40
$100 + $40 = $140

Find out how much money Joe has.
$50 + $50 + $50 = $150
or
$50 x 3 = $150

$140 < $150

Joe has enough money to buy all of his school supplies.

Subtract the two amounts to find the change he will receive.

$150 – $140 = $10 in change

Estimate each amount and find the sum of the estimates.

Stuffed bear ≈ $15
Baby doll ≈ $10
DVD ≈ $20
$15 + $10 + $20 = $45

Find out how much money Brant has.
$10 + $10 + $10 + $10 = $40
or
$10 x 4 = $40

$45 > $40

Brant does not have enough money to buy all of the gifts.

Subtopic 2 — Adding Decimals Using Models and the Standard Algorithm

Expand Their Horizons

In this subtopic, students add decimals using two methods. Students use models to add decimals. Then, they add decimals using the standard algorithm. Teachers may want to review with the students the place value of decimals. Discuss with them how to line up like place values and how to write zeros to the right of addends that have fewer digits than the other addends in the sum.

Before each addition, an estimate of the sum is made using the skills taught in the previous subtopic. Encourage students to estimate their answers before they find the sum. It will help students see if the answers they have found are reasonable.

Common Error Alert:

Students may align the digits of the decimal numbers to the right or left instead of lining up the decimal points and like place values.
For example, may incorrectly write:

$$\begin{array}{r} 3.1 \\ + \ 2.08 \\ \hline \end{array}$$

Instead of:

$$\begin{array}{r} 3.10 \\ + \ 2.08 \\ \hline \end{array}$$

Check students' work to make sure they are lining up the decimal points and like place values of their addends.

5.3C

3 Use the model and shade the two decimal numbers that are written in tenths. Add the decimal numbers modeled. The addends are then written vertically, are lined up by like place value, and are added. The sum is 1.1.

4 Use the model and shade the two decimal numbers that are written in hundredths. Add the decimal numbers modeled. The addends are then written vertically and are added. The sum is 2.1 or 2.10.
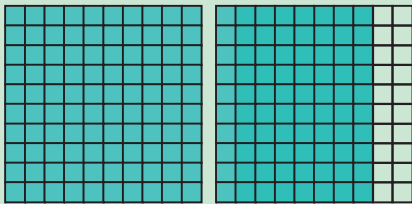
5 This sum is found without the use of a model. The addends have an unequal number of digits to the right of the decimal point. Add a zero at the end of six tenths to make 60 hundredths. The sum is 4.17.

Additional Examples

1. **Find the sum.**
   1.1 + 0.7

   Model and find the sum.

   $$\begin{array}{r} 1.1 \\ + \ 0.7 \\ \hline 1.8 \end{array}$$

2. **Find the sum.**
   16.5 + 7.27

   Write the problem vertically, rewrite 16.5 as 16.50, and find the sum.

   $$\begin{array}{r} 16.50 \\ + \ \ 7.27 \\ \hline 23.77 \end{array}$$

Subtopic 3 — Subtracting Decimals Using Models

Expand Their Horizons

In this subtopic, students subtract decimals with the use of models. The minuend is modeled by shading the blocks in hundredths-squares. Subtraction of the subtrahend is modeled by crossing out the appropriate number of shaded blocks in the model. The remaining shaded blocks show the difference between the minuend and the subtrahend.

Common Error Alert:

Students may shade in seven squares in a hundredth-square when representing the decimal number 0.7 rather than 70 squares. Remind students that 0.7 is equivalent to 0.70.

5.3D

6 The value of the decimal 1.2 is shaded on hundredths-squares. Cross out the value of the subtrahend from the shaded portion. The difference is the remaining shaded portion, 1.08.

7 When tenths are shaded on a hundredths-square, make sure the correct amount is shaded. The value of the minuend is shaded first, and then the value of the subtrahend is crossed out of the shaded portion. The difference, 0.27, is the value of the remaining shaded portion.
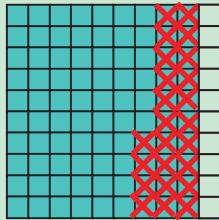
Additional Examples

1. **Subtract using a model.**

   0.9 – 0.24

   Shade 0.9 of the model. Cross out 24 shaded squares, or 24 hundredths. The remaining shaded portion is the difference.
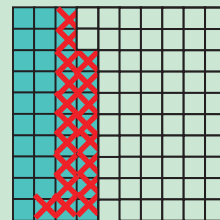
   The difference is 0.66.

2. **Subtract using a model.**

   0.38 – 0.19

   Shade 0.38 of the model. Cross out 19 shaded squares, or 19 hundredths. The remaining shaded portion is the difference.

   The difference is 0.19.

Subtopic 4 — Standard Decimal Subtraction

Expand Their Horizons

In the previous subtopic, students found the difference between two decimal numbers with the use of models. The problems in this subtopic are solved using the standard decimal subtraction algorithm. Again, encourage students to estimate their answers before they do the problems.

5.3E

Common Error Alert:

When the top number has fewer digits than the bottom number, students may bring down the hundredths digit instead of regrouping.

For example, may incorrectly write: Instead of:

$$
\begin{array}{r} 3.4 \\ -\,1.56 \\ \hline 1.96 \end{array}
\qquad
\begin{array}{r} 3.40 \\ -\,1.56 \\ \hline 1.84 \end{array}
$$

Remind students to use zero placeholders in the minuend when necessary.

8   The estimated difference is six. Line up the decimal points and write zero in the thousandths place of the minuend. Regroup to find the difference. The difference is 5.829.

9   The estimated difference is seven. Line up the decimal points and write zero in the hundredths place of the minuend. Regroup to find the difference. The difference is 7.43.

Remind students that they can check any subtraction by adding the difference to the subtrahend and seeing if the sum is the same as the minuend.

Additional Examples

1. Subtract.

$$3.8 - 1.05$$

Line up the decimal points. Write zero in the hundredths place of the minuend. Regroup to find the difference.

$$
\begin{array}{r} 3.8\,\overset{7\ 10}{\cancel{8}\cancel{0}} \\ -\,1.0\ 5 \\ \hline 2.7\ 5 \end{array}
$$

2. Subtract.

$$9.85 - 4.139$$

Line up the decimal points. Write zero in the thousandths place of the minuend. Regroup to find the difference.

$$
\begin{array}{r} 9.8\,\overset{4\ 10}{\cancel{5}\cancel{0}} \\ -\,4.1\ 3\ 9 \\ \hline 5.7\ 1\ 1 \end{array}
$$

5.3F

Look Beyond

Students will soon learn the algorithms for finding the product and the quotient of decimal numbers. There is a different kind of alignment for each of these operations. Students should pay close attention to place value and alignment for addition and subtraction so they can understand the role they play in the algorithms for multiplication and division.

Students will go from lining up like place values to aligning numbers on the right in a product. They will learn how to place the decimal point in a product and in a quotient.

Connections

Adding and subtracting decimals can be used to keep a travel log on a vacation. For example, the number of miles driven in a day is the difference between the odometer reading at the end of the day and the odometer reading at the beginning of the day. The sum of the miles driven each day shows how many miles were driven for the entire vacation.

Addition and subtraction of decimals is needed to maintain a vacation budget. Add the amounts spent each day in various categories, such as eating, lodging, gas, admission fees, etc. Total these amounts and subtract that total from the amount of money budgeted for each day to guard against spending too much money.

5.3G