In Lessons 6 and 7 you learned to add, subtract, multiply, and divide rational numbers. In this lesson you will learn to estimate answers to more difficult problems. Take a look at this problem.

Each morning a gardener uses $24\frac{3}{4}$ gallons of water from a barrel. Each afternoon, she adds $15\frac{1}{4}$ gallons of water to the barrel. By how much has the volume of water in the barrel changed after 5 days?

**Explore It**

Use the math you already know to solve the problem.

- Complete the table. Write the actual change in water volume each morning and afternoon. Then use integers to approximate the change in water volume each day.

<table>
<thead>
<tr>
<th>Change in water volume each morning</th>
<th>Actual Change</th>
<th>Approximate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in water volume each afternoon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Write an equation to show each situation.
  
  approximate change in volume for 1 day  

  \[
  \text{approximate change in volume for 5 days} 
  \]

  actual change in volume for 1 day  

  \[
  \text{actual change in volume for 5 days} 
  \]

- Explain how integer approximations can help you check the answer to the problem.
Adding and subtracting rational numbers such as fractions and decimals can sometimes be hard to visualize. **Approximations** can help you understand the problem, judge the reasonableness of an exact answer, and help you think about whether the answer will be positive, negative, or 0.

It can be easier to visualize the sum $-25 + 15$ than the sum $-24 \frac{3}{4} + 15 \frac{1}{4}$.

Knowing the sum should be about $-10$ helps you check your fraction arithmetic and the sign of your answer.

It can be easier to visualize the product $5 \times (-10)$ than the product $5 \times \left(-9 \frac{1}{2}\right)$.

Knowing the product will be about $-50$ helps you check your fraction arithmetic and the sign of your answer.

Sometimes an approximation may just tell you that the answer will be close to 0, but you’ll need to do the exact calculations to know whether the answer is 0, just above 0, or just below 0.

For example, you might approximate $4 \frac{1}{8} + \left(-7 \frac{1}{4}\right) + 2 \frac{3}{4} = ?$

with $4 + (-7) + 3 = 0$.

But because you approximated, the actual answer may not be exactly 0. You may not even be sure whether the sum is positive, 0, or negative until you do the calculation.

1. Explain how you could use integers to estimate $-28.3 \cdot (-47.9)$.
Read the problem below. Then explore how estimating can be useful when computing with positive and negative decimals.

Luisa deposits $44.60 into her bank account on Tuesday morning. Tuesday afternoon, she withdraws $26.30 and $21.30. Does Luisa have more or less money on Tuesday night than she did on Monday night? How much more or less?

**Picture It**

You can use a number line to understand the problem.

You can use the following number line to approximate each amount to the nearest $5.

```
-10   -5   0   5   10   15   20   25   30   35   40   45
```

**Model It**

You can also use rounding to help understand the problem.

You might approximate each amount by rounding to the nearest $1 or to the nearest $5.

<table>
<thead>
<tr>
<th>Actual Amount</th>
<th>Round to the nearest $1</th>
<th>Round to the nearest $5</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.50</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>-26.30</td>
<td>-26</td>
<td>-25</td>
</tr>
<tr>
<td>-21.30</td>
<td>-21</td>
<td>-20</td>
</tr>
</tbody>
</table>
Connect It

Now you will solve the problem from the previous page using estimates and actual values.

2 Write and solve an equation to show the change in Luisa’s account using values rounded to the nearest $5 and nearest $1.

3 What do the estimates tell you about whether Luisa has more or less money on Tuesday night than on Monday night? Do you think the amount is positive or negative? Explain.

4 Write and solve an equation to show the change in Luisa’s account using exact values.

5 Does this equation tell you whether Luisa has more or less money on Tuesday night than she did on Monday night? Explain.

6 Describe how solving the equation with estimates helped you solve the equation with exact values.

Try It

Use what you just learned to solve these problems. Show your work on a separate sheet of paper.

7 Estimate $73.8 - (-9)\). Then solve.

8 Estimate $-17.7 \div 3$. Then solve.
Read the problem below. Then explore how estimating can be useful when computing with positive and negative fractions.

Jim stands on a dock that is $3\frac{3}{4}$ feet above the lake surface. He dives down $12\frac{1}{2}$ feet below the dock. What is Jim's vertical location relative to the lake surface? Show that your answer is reasonable.

**Picture It**
You can use a number line to understand the problem.

The number line shows the distance that Jim dives.

**Model It**
You can also use rounding to help understand the problem.

Round each fraction to the nearest integer.

<table>
<thead>
<tr>
<th>Actual Distance</th>
<th>Nearest Integer</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3\frac{3}{4}$</td>
<td>4</td>
</tr>
<tr>
<td>$-12\frac{1}{2}$</td>
<td>$-13$</td>
</tr>
</tbody>
</table>
Connect It

Now you will solve the problem from the previous page using estimates and actual values.

9 Write and solve an equation to show Jim’s vertical location using values rounded to the nearest integers.

10 Based on your estimate, is Jim’s position relative to the surface of the lake definitely positive, definitely negative, or too close to 0 to tell? Explain.

11 Write and solve an equation to show Jim’s vertical location using exact values.

12 Describe how solving the equation with integers helped you solve the equation with exact values.

Try It

Use what you just learned about estimating and computing with rational numbers to solve these problems. Show your work on a separate sheet of paper.

13 A sugar-water solution freezes at $-1.8^\circ C$. A saltwater solution freezes at $-13.6^\circ C$. What is the absolute value of the difference between the freezing temperatures of the solutions? Estimate to show that your answer is reasonable.

14 Cecilia records the weight change in her cat over 2 weeks. What number does she record as the total weight change for her cat?

<table>
<thead>
<tr>
<th>My Cat’s Weight Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week</strong></td>
</tr>
<tr>
<td><strong>Weight change</strong></td>
</tr>
<tr>
<td><strong>(in pounds)</strong></td>
</tr>
</tbody>
</table>
Study the model below. Then solve problems 15–17.

Mr. Lee sets up a bank account to pay his rent. Each month a housing company deducts the same amount of rent from Mr. Lee’s account. At the end of the year, the amount of money in Mr. Lee’s account changed by $-8,328. Approximately how much does the amount in his account change in one month?

Look at how you could show your work using estimation.

Total rent ÷ number of months = rent per month

\(-8,328 ÷ 12 = \) ?

Use compatible numbers to estimate the answer.

Think: 84 ÷ 12 = 7

\(-8,400 \) is close to \(-8,328\).

\(-8,400 ÷ 12 = -700\)

Solution: \(-$700\)

15 Anita, Jared, and Steph are rock climbing. Anita is \(42 \frac{1}{2}\) feet below Jared. Steph is \(67 \frac{3}{4}\) feet above Anita. What is Steph’s position compared to Jared? Estimate to show that your answer is reasonable.

Show your work.

Solution: __________________________________________________________________________

Pair/Share

Does your estimate tell you if the answer is definitely positive, definitely negative, or too close to 0 to tell?
16 Browning, Montana, holds the U.S. record for the greatest temperature drop in one day. On January 23, 1916, the temperature changed by an average of $-4.17^\circ$F per hour. To the nearest degree, what was the total temperature change after 24 hours?

**Show your work.**

**Solution:**

17 Fred is scuba diving. He stops to look at a fish that is 14.3 meters below the surface. Then he swims down 5.8 meters deeper to look at a reef. If he then swims up 3.2 meters, which is the BEST approximation of Fred’s position relative to the ocean surface?

A 12 meters
B 11 meters
C $-17$ meters
D $-23$ meters

Lena chose B as the correct answer. How did she get that answer?

__________________________________________________________

__________________________________________________________

__________________________________________________________

Was the total temperature change positive or negative?

Pair/Share

How does your estimate show that your answer is reasonable?

Pair/Share

How will you decide if you should add or subtract each number?

Pair/Share

Does Lena’s answer make sense?
Part 5: Common Core Practice

Lesson 8

Solve the problems. Mark your answers to problems 1–5 on the Answer Form to the right. Be sure to show your work.

1. Which is the best estimate of $-\frac{15}{16} + \left( -\frac{1}{2} \right)$?

   A. 2
   B. $\frac{1}{2}$
   C. 0
   D. $-2$

2. Which is the best estimate of $-\frac{15}{16} + \left( -\frac{1}{2} \right)$?

   A. $1\frac{1}{2}$
   B. $\frac{1}{2}$
   C. $-\frac{1}{2}$
   D. $-1\frac{1}{2}$

3. A garden hose leaks 6.3 liters of water in a week. Which number represents the average volume of water flow in one day?

   A. -0.9 liter
   B. -1.0 liter
   C. -6.3 liters
   D. -44.1 liters

Answer Form

<table>
<thead>
<tr>
<th>Number</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A B C D</td>
</tr>
<tr>
<td>2</td>
<td>A B C D</td>
</tr>
<tr>
<td>3</td>
<td>A B C D</td>
</tr>
<tr>
<td>4</td>
<td>A B C D</td>
</tr>
<tr>
<td>5</td>
<td>A B C D</td>
</tr>
</tbody>
</table>

Number Correct: 5
4. Beth plays a video game in which she starts with 0 points. In round 1, she loses $3\frac{1}{2}$ points; in round 2, she wins $28\frac{1}{2}$ points; and in round 3, she loses another $3\frac{1}{2}$ points. What is her final score?

A. $-18\frac{1}{2}$  
B. $18\frac{1}{2}$  
C. $21\frac{1}{2}$  
D. $35\frac{1}{2}$

5. A fish is swimming in the sunlit zone of the ocean, 516 feet below the ocean surface. A jellyfish in the midnight zone is swimming 19 times deeper. Which is the best estimate of the location of the jellyfish relative to the ocean surface?

A. $-1,000$ feet  
B. $-5,000$ feet  
C. $-10,000$ feet  
D. $-50,000$ feet

6. A credit-card statement shows that Mrs. Gerardo owes between $35 and $45. Estimate to decide which of the items shown in the box might be on her statement. Then write an equation to justify your choices.

Show your work.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payment</td>
<td>+30.00</td>
</tr>
<tr>
<td>Clothing Store</td>
<td>−21.75</td>
</tr>
<tr>
<td>Grocery Store</td>
<td>−26.25</td>
</tr>
<tr>
<td>Clothing Return</td>
<td>+12.36</td>
</tr>
<tr>
<td>Toy Store</td>
<td>−19.99</td>
</tr>
<tr>
<td>Mel’s Diner</td>
<td>−7.35</td>
</tr>
<tr>
<td>Minimart</td>
<td>−5.17</td>
</tr>
</tbody>
</table>

Answer ______________________________________

Self Check  Go back and see what you can check off on the Self Check on page 1.
Lesson 8  (Student Book pages 64–73)

Solve Problems with Rational Numbers

LESSON OBJECTIVES

• Solve problems involving negative integers.

• Use whole-number approximations to estimate, and then compare the estimate to the actual result of computation.

• Connect previous one- or two-step equation-solving to solving equations with positive and negative fractions.

• Connect previous equation-solving to solving equations with positive and negative decimals.

THE LEARNING PROGRESSION

In Grade 6, students solved real-world mathematical problems by writing and solving equations of the form \( x + p = q \) and \( px = q \) for cases in which \( p, q, \) and \( x \) are all nonnegative rational numbers.

Earlier in Grade 7, students developed an understanding of addition, subtraction, multiplication, and division of rational numbers. This lesson extends students’ understanding of fraction and integer addition and subtraction. Students use multi-step equations involving positive and negative fractions to represent and solve word problems. Students use integers to visualize the problem and judge the reasonableness of an exact answer. Later in Grade 7, they will solve multi-step, real-life mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals).

In Grade 8, students will solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

PREREQUISITE SKILLS

• Multiply and divide fractions.

• Add and subtract fractions with like and unlike denominators, including mixed numbers.

• Understand the inverse relationship between multiplication and division and the inverse relationship between addition and subtraction.

VOCABULARY

approximations: numbers that are not exact but are close enough to be used when solving certain problems

In Grade 6, students solved real-world mathematical problems by writing and solving equations of the form \( x + p = q \) and \( px = q \) for cases in which \( p, q, \) and \( x \) are all nonnegative rational numbers.

Earlier in Grade 7, students developed an understanding of addition, subtraction, multiplication, and division of rational numbers. This lesson extends students’ understanding of fraction and integer addition and subtraction. Students use multi-step equations involving positive and negative fractions to represent and solve word problems. Students use integers to visualize the problem and judge the reasonableness of an exact answer. Later in Grade 7, they will solve multi-step, real-life mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals).

In Grade 8, students will solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

CCLS Focus

7.NS.3  Solve real-world and mathematical problems involving the four operations with rational numbers.

7.EE.3  Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

ADDITIONAL STANDARDS: 7.NS.1.d, 7.NS.2.c, 7.EE.3 (see page A32 for full text)

STANDARDS FOR MATHEMATICAL PRACTICE:  SMP 1 (see page A9 for full text)
AT A GLANCE

Students read a word problem and answer a series of questions designed to explore how integer approximations of fractions can help judge the reasonableness of an answer.

STEP BY STEP

- Tell students that this page models building the solution to a problem one step at a time and writing to explain the solution.
- Have students read the problem at the top of the page.
- Work through Explore It as a class.
- Have students explain how to decide what a good approximation for each fraction would be.
- Ask student pairs or groups to explain their solutions for the remaining questions.
- Encourage students to share that integers are easier to work with than fractions and using integer approximations is a quick way to check the reasonableness of an answer.

ELL Support

- Before students begin the task, discuss the meaning of the words approximate and actual.
- Write the words approximate and actual on the board. Have students share the meanings of these words in their own words.
- Discuss the differences and similarities between the meanings.
- Show students examples of exact answers and approximate answers. One example could be the time on a clock. It is exactly 1:51 p.m. or approximately 2:00 p.m.

Mathematical Discourse

- Why is it easier to visualize integers than fractions or decimals?
  Student answers should indicate that integers are easier to locate on a number line and to some students easier to understand than fractions or decimals.

- Do you think approximation is more helpful in multiplication and division problems or in addition and subtraction problems?
  Student should include examples to defend their answers, which will vary.
### AT A GLANCE

Students use integer approximations to judge the reasonableness of fraction and decimal problems.

### STEP BY STEP

- Read Find Out More as a class.
- Discuss the reasons why approximations can be helpful when solving problems that involve fractions or decimals.
- Emphasize that if an estimate is 0, you don’t know whether the exact answer is positive, zero, or negative until you do the calculation.

### Concept Extension

#### Quickly compare problems using estimation.

- Write two problems on the board: \(-32.8 \cdot 14.3\) and \(-32.8 + 14.3\).
- Ask students to use integers to approximate the answers to each problem.
- Ask, *Does the operation affect how you estimate the answers?*
- Discuss how rounding to the nearest ten makes multiplication easier (\(-32.8 \cdot 14.3\) can be approximated by solving the equation \(-30 \cdot 10\)), but \(-32.8 + 14.3\) can easily be approximated by solving the equation \(-33 + 14\).

### Find Out More

Adding and subtracting rational numbers such as fractions and decimals can sometimes be hard to visualize. Approximations can help you understand the problem, judge the reasonableness of an exact answer, and help you think about whether the answer will be positive, negative, or 0.

It can be easier to visualize the sum \(-25 + 15\) than the sum \(-24\frac{3}{4} + 15\frac{1}{4}\).

Knowing the sum should be about \(-10\) helps you check your fraction arithmetic and the sign of your answer.

It can be easier to visualize the product $5 \times \left(\text{10}\right)$ than the product $5 \times \left(\text{-10}\right)$.

Knowing the product will be about \(-50\) helps you check your fraction arithmetic and the sign of your answer.

Sometimes an approximation may just tell you that the answer will be close to 0, but you’ll need to do the exact calculations to know whether the answer is 0, just above 0, or just below 0.

For example, you might approximate $\frac{4}{5} \div \left(\text{-2}\right) = \frac{4}{\text{-10}}$.

With $4 + \left(\text{-7}\right) + 3 = 0$.

But because you approximated, the actual answer may not be exactly 0. You may not even be sure whether the sum is positive, 0, or negative until you do the calculation.

#### Reflect

1. Explain how you could use integers to estimate $-28.3 \cdot (\text{-479})$.
   
   I could approximate $-28.3$ with $-30$ and $-479$ with $-500$.
   
   I know that a negative multiplied by a negative is positive. So my answer should be approximately $1,500$.

### Real-World Connection

Ask students to share situations in which they use approximations when adding and subtracting rational numbers in everyday life.

**Examples:**

- buying 4 pounds of bananas at $0.89 per pound; buying 10 apps that each cost $1.99;
- going to a movie that starts at 7:35 and runs for $1\frac{3}{4}$ hours.
Students use integers to estimate the answer to a multi-step decimal subtraction problem.

**STEP BY STEP**

- Read the problem at the top of the page as a class.
- Discuss the meaning of the terms deposit, withdraw, and balance.
- Read Picture It. Have a volunteer explain how the number line is used to help understand the problem.
- Ask student volunteers to explain how to round each amount to the nearest $1 and nearest $5 as shown in the table.

**Visual Model**

- Some students may have trouble correctly rounding numbers. Use a number line to help them understand rounding.
- To round 44.60, draw a number line on the board, labeling the units from 43 to 46. Mark each half unit.
- Have a student place a mark to show where 44.60 would be on the number line.
- Explain that 44.60 is between 44 and 45 but closer to 45. In this case, the decimal was rounded to the nearest whole number.

**Mathematical Discourse**

- How do the two estimates shown in the table compare to each other?
  The estimates to the nearest $5 are not as close to the actual amounts as the estimates to the nearest $1 are.
- How would you decide whether to round to the nearest $1 or nearest $5?
  Students may say that it will depend on how close you want the estimate to be.
AT A GLANCE

Students revisit the problem on page 66 to solve the problem using integer estimates and then the actual decimal values.

STEP BY STEP

• Read Connect It as a class. Be sure to point out that the questions refer to the problems on page 66.

• Ask students to explain which estimate is better: the one using numbers rounded to the nearest $5 or the one using numbers rounded to the nearest $1. Students should indicate that rounding to the nearest $1 is closer, but it is still an estimate.

• Ask student pairs or groups to share how the estimates helped solve the equation with exact values.

• Be sure that students understand that a negative result means that Luisa had less than she started with.

ELL Support

• Help students work on their oral language as well as their mathematical language by reviewing the terminology used when finding approximations, such as more, less, the same, estimate, and rounding.

• On the board write the list of numbers 5, 10, 15, 20, 25. … Tell students that these are the multiples of 5.

• Write other lists of numbers and have students verbally describe the lists.

TRY IT SOLUTIONS

7 Solution: 82.8; Students may estimate first by rounding to the nearest integer \((74 + 10 = 84)\) and then writing and solving the equation \(73.8 + 9\).

ERROR ALERT: Students who wrote 64.8 may have solved the problem \(73.8 \div (-9)\), forgetting to rewrite the subtraction problem as an addition problem using the additive inverse.

8 Solution: \(-5.9\); Students may estimate first by rounding to the nearest integer \((-18 \div 3 = -6)\) and then writing and solving the equation \(-17.7 \div 3\).
Students use integers to estimate a fraction addition problem.

**STEP BY STEP**

- Read the problem at the top of the page as a class.
- Read Picture It. Guide students to understand how the number line shows the distance Jim dives.
- Ask students to explain how the numbers $3\frac{3}{4}$ and $12\frac{1}{2}$ are shown on the number line.
- Make sure students understand that the final location is relative to the lake surface, not Jim’s original position.

**SMP Tip:** Students who attempt to make sense of problems (SMP 1) prior to solving them use estimates to make conjectures about the form and meaning of their solutions. This is especially important when the problems must be solved using fractions and decimals which can be difficult to visualize.

**Mathematical Discourse**

- **What does the zero on the number line represent in this problem? How do you know?**
  
The zero represents the lake surface. The dock is $3\frac{3}{4}$ feet above the lake surface, and the number line shows the starting point $3\frac{3}{4}$ past zero.
AT A GLANCE

Students revisit the problem on page 68 to solve the problem using integer estimates and then the actual fractional values.

STEP BY STEP

• Read Connect It as a class. Be sure to point out that the questions refer to the problems on page 68.
• Have students share how they know if Jim’s position is positive, negative, or close to zero.
• Ask student pairs or groups to explain how first solving the equation with integers helped solve the equation with exact values.

Try It

Use what you just learned about estimating and computing with rational numbers to solve these problems. Show your work on a separate sheet of paper.

13 Solution: 11.8°C; Students may estimate first by rounding to the nearest integer [−2 − (−14)] and then writing and solving the equation −1.8 − (−13.6).

14 Solution: 1/16 pound; Students may try to round to the nearest integer first (0 + 0), which is too close to zero to tell. Then they may write and solve the equation −5/16 + 3/8.

ERROR ALERT: Students who wrote 11/16 did not include the negative sign and added 5/16 + 3/8.
Lesson 8

Part 4: Guided Practice

Study the model below. Then solve problems 15–17.

Fred is scuba diving. He stops to look at a fish that is 14.3 meters below the surface. Then he swims down 3.8 meters deeper to look at a reef. If he then swims up 3.2 meters, which is the BEST approximation of Fred’s position relative to the ocean surface?

A 12 meters
B 11 meters
C 17 meters
D 23 meters

Lena chose B as the correct answer. How did she get that answer?

Lena used the expression $14 - 6 + 3$. She should have used $14$.

SOLUTIONS

15 Solution: $25\frac{1}{4}$ feet; Students could use compatible numbers to estimate ($-45 + 70 = 25$) and then solve the equation $-42\frac{1}{2} + 67\frac{3}{4}$.

16 Solution: $-100.08$; Students could solve the problem by using the equation $-4 \cdot 25$ to estimate and then solve the problem $-4.17 \cdot 24$ to find the exact answer.

17 Solution: C; Students could solve the problem by estimating the solution using the equation $-14 - 6 + 3$.

Ex Estimating the solution using compatible numbers is one way to solve the problem.

Was the total temperature change positive or negative?

How will you decide if you should add or subtract each number?

How does your estimate make sense?

Does Lena’s answer make sense?

Does the total temperature change positive or negative?

Remember to pair/share.

Show your work.

15 Browning, Montana, holds the U.S. record for the greatest temperature drop in one day. On January 23, 1916, the temperature changed by an average of $-41.7$° F per hour. To the nearest degree, what was the total temperature change after 24 hours?

Estimate: $-4 \cdot 25 = -100$; Actual: $-4.17 \cdot 24 = -100.08$

Solution: $-100\, ^\circ \text{F}$

16 Fred is scuba diving. He stops to look at a fish that is 14.3 meters below the surface. Then he swims down 3.8 meters deeper to look at a reef. If he then swims up 3.2 meters, which is the BEST approximation of Fred’s position relative to the ocean surface?

A 12 meters
B 11 meters
C 17 meters
D 23 meters

Lena chose B as the correct answer. How did she get that answer?

Lena used the expression $14 - 6 + 3$. She should have used $14$.

17 Solution: C; Students could solve the problem by estimating the solution using the equation $-14 - 6 + 3$.

Explain to students why the other two answer choices are not correct:

A is not correct because 14 must be negative to show the fish was below the surface, and $-5.8$ rounds to $-6$, not $-5$.

D is not correct because $-3$ means Fred swam down 3 meters instead of up.
Part 5: Common Core Practice

Lesson 8

Solve the problems. Mark your answers to problems 1–5 on the Answer Form to the right. Be sure to show your work.

1. Which is the best estimate of $\frac{15}{16} + \left| -\frac{3}{2} \right|$?
   A. 2
   B. $\frac{1}{2}$
   C. 0
   D. $-2$

2. Which is the best estimate of $\frac{15}{16} + \left| -\frac{3}{2} \right|$?
   A. $1\frac{1}{2}$
   B. $\frac{1}{2}$
   C. $-\frac{1}{2}$
   D. $-1\frac{1}{2}$

3. A garden hose leaks 6.3 liters of water in a week. Which number represents the average volume of water flow in one day?
   A. $-0.9$ liter
   B. $-1.0$ liter
   C. $-6.3$ liters
   D. $-44.1$ liters

4. Beth plays a video game in which she starts with 0 points. In round 1, she loses $3 \frac{1}{2}$ points; in round 2, she wins 28 $\frac{1}{2}$ points; and in round 3, she loses another $3 \frac{1}{2}$ points. What is her final score?
   A. $-18 \frac{1}{2}$
   B. $18 \frac{1}{2}$
   C. $21 \frac{1}{2}$
   D. $35 \frac{1}{2}$

5. A fish is swimming in the sunlit zone of the ocean, 516 feet below the ocean surface. A jellyfish in the midnight zone is swimming 19 times deeper. Which is the best estimate of the location of the jellyfish relative to the ocean surface?
   A. $1,000$ feet
   B. $5,000$ feet
   C. $-10,000$ feet
   D. $-50,000$ feet

6. A credit card statement shows that Mrs. Gerardo owes between $35 and $45. Estimate to decide which of the items shown in the box might be on her statement. Then write an equation to justify your choices.

   Show your work.

   - Payment: $30.00$
   - Clothing Store: $21.75$
   - Grocery Store: $26.25$
   - Clothing Return: $12.36$
   - Toy Store: $19.99$
   - Men’s Diner: $7.35$
   - Minimart: $5.17$

   Some possible solutions:
   - grocery store, Mel’s Diner, Minimart: $26.25 + (-7.35) + (-5.17) = -38.77$
   - clothing store, toy store: $-21.75 + (-19.99) = -41.74$
   - clothing store, grocery store, clothing return: $-21.75 + (-26.25) + 12.36 = -35.64$

   Answer ____________________________

   Self Check: Go back and see what you can check off on the Self Check on page 1.

AT A GLANCE

Students estimate and solve positive and negative fraction and decimal problems that might appear on a mathematics test.

STEP BY STEP

• First, tell students that they will estimate and solve positive and negative fraction and decimal problems. Then have students read the directions and answer the questions independently. Remind students to fill in the correct answer choices on the Answer Form.

• After students have completed the Common Core Practice problems, review and discuss correct answers. Have students record the number of correct answers in the box provided.

SOLUTIONS

1. Solution: A; For example, estimate using the equation $-1 \div -\frac{1}{2}$.

2. Solution: D; For example, estimate using the equation $-1 + -\frac{1}{2}$.

3. Solution: A; Solve the equation $6.3 \div 7$.

4. Solution: C; Solve the equation $-3\frac{1}{2} + 28\frac{1}{2} - 3\frac{1}{2}$.

5. Solution: C; A possible estimate would be $-500 \cdot 20$.

6. Solution: See possible student work above.
Assessment and Remediation

• Ask students to estimate and then solve $-32.9 - (-15.3)$. $[-33 - (-15) = -18; -17.6]$
• For students who are struggling, use the chart below to guide remediation.
• After providing remediation, check students’ understanding. Ask students to estimate
  $-3\frac{4}{5} + 7\frac{1}{4} \left[-4 + 7 = 3; 3 \frac{9}{20}\right]$
• If a student is still having difficulty, use Ready Instruction, Level 7, Lesson 7.

<table>
<thead>
<tr>
<th>If the error is . . .</th>
<th>Students may . . .</th>
<th>To remediate . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>have used 15 instead of $-15$ to estimate.</td>
<td>Remind students to rewrite the subtraction problem as an addition problem using the additive inverse property before estimating.</td>
</tr>
<tr>
<td>17</td>
<td>have rounded $-32.9$ to $-32$ instead of $-33$.</td>
<td>Remind students that numbers are rounded up if the decimal is 0.5 or higher.</td>
</tr>
<tr>
<td>48</td>
<td>have used positive 32.9 instead of negative.</td>
<td>Remind students to attend to precision and make careful note of whether the numbers are positive or negative.</td>
</tr>
</tbody>
</table>

Hands-On Activity

Round decimals using a number line.

**Materials:** cards with positive and negative decimals between $-10$ and $10$ written on them, a number line showing the numbers $-10$ to $10$ on a strip of paper

Have students take a card and place it in approximately the correct location on the number line. By looking at the number line, students should identify which integer the decimal is closest to and write that on the card. Challenge students to do this with all of the cards.

Challenge Activity

Write a problem for a given estimate.

Tell students that two fractions have an estimated total of $-14$. Challenge students to write a fraction addition, subtraction, multiplication, and division problem that would have an estimated answer of $-14$. [Possible answers: $-63\frac{3}{5} + 50\frac{1}{3}, -12\frac{1}{4} - 1\frac{5}{8}$, $-6\frac{2}{3} \cdot 2\frac{1}{3}, 28\frac{2}{5} \div -2$]