Overview

The Overview introduces the topics covered in Observations and Activities. Scroll through the Overview using [(] to review, if necessary. Read each screen carefully. Look for new terms, definitions, and concepts.

Observations

The Observations illustrate number sense concepts relating to the set of integers. Scroll through the Observations using [(] to review, if necessary. Read each screen carefully. When you come to a Write an Observation screen, stop and write the answers to the questions on your worksheet.

Observation 1

How far apart are the bird and the fish? Should your answer be positive or negative? Write an explanation for your answers here.

______________________________________________

______________________________________________

______________________________________________

Observation 2

What is the sign of the answer to the problem \(-3 \times -11\)?

______________________________________________

In your own words, state the rules for multiplying and dividing signed numbers (shown in the grids on the next screens).
Activities

The Activities help you practice integer concepts. You can select from two different activities—What Is My Sign? and Integer Smash. Follow these steps to play the activity and complete your worksheet.

1. Make sure you are in the Activities for this section.

2. Highlight an activity using □ or □, and press ENTER.

What Is My Sign?

1. In your head, quickly solve the sliding expression to determine if the result is positive, negative, or zero.

2. As soon as you know the sign of the result, press □ and □ to move the expression into the proper category on the left (+, 0, or −). Once the expression is in the correct row, you can press □ to slide it quickly to the left. If the answer is incorrect, the correct answer is displayed; press any key to resume play.

3. Follow your teacher’s instructions for how long to play the activity.

4. What was your score? ________________________________

5. How many incorrect answers did you have? __________

(Shown in top right corner of the screen.)
Activities (continued)

Integer Smash

1. Highlight a level (bronze = least difficult; gold = most difficult), and press [ENTER] to select it.

2. For bronze or silver levels only, press (①), ①, (③), (④), or (⑥) to select the operation you want to practice.

3. Enter the missing number (press [②] for negative numbers) and press [ENTER]. If the answer is incorrect on the second attempt, the correct answer is displayed; press any key to resume play. As you play the activity, write each number sentence and solution. Show your work here.

4. What level and operation (bronze and silver only) did you play? __________________________________________

5. What was your score? __________________________

Scoring: You get two attempts to solve each problem. You earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try. You can earn up to 10 points.
Try-It!™ on Your TI-83 Plus or TI-73

Learn to use the subtraction key (\(\text{-}\)), the negation key (\(\bar{\text{c}}\)), and the absolute value function (\(\text{abs}\)).

Use the negation and the subtraction keys to calculate \(-5 - -4\).

### To Do This | Press | Display (TI-83 Plus shown)
--- | --- | ---
1. Exit the Topics in Algebra 1 application and clear the Home screen. | \(\boxed{\text{2nd}} \boxed{\text{QUIT}}\) \(\boxed{\text{EXIT}} \boxed{\text{CLEAR}}\) | 

2. Calculate \(-5 - -4\).
   **Note:** The negation key (\(\bar{\text{c}}\)) and the subtraction key (\(\text{-}\)) are different. | \(\boxed{5} \boxed{-} \boxed{4}\) \(\boxed{\text{ENTER}}\) | \(-5 - -4\) \(-1\)

Enter \(-5 - -3 \times -2\), first without using parentheses and then using parentheses.

### To Do This | Press | Display (TI-83 Plus shown)
--- | --- | ---
1. Calculate \(-5 - -3 \times -2\).
   **Note:** On the TI-73, notice the difference between the \(\times\) variable key (\(\times\)) and the multiplication key (\(\text{x}\)). | \(\boxed{5} \boxed{-} \boxed{3} \boxed{\times} \boxed{2}\) \(\boxed{\text{ENTER}}\) | \(-5 - -4\) \(-1\)
   \(-5 - -3 \times -2\) \(-11\)

2. Calculate \(-5 - (-3 \times -2)\). | \(\boxed{5} \boxed{-}\) \(\boxed{(-3} \boxed{\times} \boxed{2}\) \(\boxed{\text{ENTER}}\) | \(-5 - -4\) \(-1\)
   \(-5 - -3 \times -2\) \(-11\)
   \(-5 - (-3 \times -2)\) \(-11\)

3. Calculate \((-5 - -3) \times -2\). | \(\boxed{(-5} \boxed{\times} \boxed{3}\) \(\boxed{-}\) \(\boxed{2}\) \(\boxed{\text{ENTER}}\) | \(-5 - -4\) \(-1\)
   \(-5 - -3 \times -2\) \(-11\)
   \(-5 - (-3 \times -2)\) \(-11\)

The calculator uses the Order of Operations rules, which say that multiplication and division are performed from left to right, and then addition and subtraction are performed from left to right. Notice that multiplication was calculated before subtraction in the expression \(-5 - -3 \times -2\). Notice that the expression \(-5 - (-3 \times -2)\) has the same answer.

The calculator performs operations inside the parentheses before operations outside the parentheses. Notice that the expression \((-5 - -3) \times -2\) has a different answer than the expressions \(-5 - -3 \times -2\) and \(-5 - (-3 \times -2)\).
Try-It!™ on Your TI-83 Plus or TI-73 (continued)

Use the absolute value (abs() function on the calculator to find the absolute value of -12.

<table>
<thead>
<tr>
<th>To Do This</th>
<th>Press</th>
<th>Display (TI-83 Plus shown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Find the absolute value of -12, which is written as</td>
<td>-12</td>
<td>.</td>
</tr>
<tr>
<td>Note: The [MATH] NUM menu varies slightly from the TI-73 to the TI-83 Plus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Select the absolute value (abs() function. It is copied to the Home screen.</td>
<td>1:abs(</td>
<td>-11</td>
</tr>
<tr>
<td>3. Calculate the result.</td>
<td>[2] 12</td>
<td>12</td>
</tr>
</tbody>
</table>

Additional problems—Calculate the following problems by hand, then check your answers using the calculator. Remember to use the Order of Operations rules.

1. \(-4 + (-12 \times 10) = \)
2. \(4 \times -8 - (-10 \times 2) = \)
3. \((-30 \div -5) - 6 = \)
4. \(|-12 + -28| = \)
5. \(|-4 \times -8 - (-10 \times 2)| = \)
6. \(-| -3 - 14 - (-10) | = \)
Objectives

- To illustrate the set of integers in a Venn diagram.
- To give an overview of the following definitions: the sign of a number, numbers of opposite sign, and absolute value.
- To give illustrations of the sets of positive and negative integers, and zero.
- To review ordering and the additive inverse property.
- To show examples of addition, subtraction, multiplication, and division of integers.

Math Highlights

This section begins with a Venn diagram and follows with an illustration of the use of integers on the Fahrenheit and Celsius scales. The temperature equivalencies shown are integer values. Students are reminded that the absolute value operation is defined as the distance of the number from zero. Examples of addition, subtraction, multiplication, and division operations are given. A number line model is used for addition and subtraction. Subtraction uses the *add-the-opposite* rule.

Common Student Errors

Students may have trouble identifying rules, such as the *add-the-opposite* rule for subtraction.

*Note:* The number line model for addition and subtraction is shown on the calculator when the Topics in Algebra 1 application is installed.

Following are some activities to help students construct the rules for multiplication and division. These activities are not part of the Topics in Algebra 1 application.

<table>
<thead>
<tr>
<th>Pattern Development for Multiplication and Division</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Investigation 1:</strong> What is the product of a positive and negative number?</td>
</tr>
<tr>
<td>3 × 3 = 9</td>
</tr>
<tr>
<td>3 × 2 = 6</td>
</tr>
<tr>
<td>3 × 1 = 3</td>
</tr>
<tr>
<td>3 × 0 = 0</td>
</tr>
<tr>
<td>3 × -1 = -3</td>
</tr>
<tr>
<td>3 × -2 = -6</td>
</tr>
<tr>
<td>3 × -3 = -9</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>

**Observation:** The product of a positive and negative number is negative.
Common Student Errors (continued)

<table>
<thead>
<tr>
<th>Pattern Development for Multiplication and Division (continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Investigation 2:</strong> What is the product of two negative numbers?</td>
</tr>
</tbody>
</table>
| 3 × -3 = -9  
2 × -3 = -6  
1 × -3 = -3  
0 × -3 = 0  
-1 × -3 = 3  
-2 × -3 = 6  
-3 × -3 = 9 |
| Start with the last number sentence from Investigation 1 (3 × -3 = -9). Keep decreasing the first term by 1 to create the sequence of multiplication values shown to the right. Notice that the values on the right side of the number sentences increase by 3. |
| **Observation:** The product of two negative numbers is positive. |
| ... |
| **Investigation 3:** What are the division rules for multiplying signed numbers? |
| -6 ÷ 3 = -2 since  
3 × -2 = -6  |
| **Observation:** Division rules are developed using multiplication as the inverse operation. The rules are similar. |
| -6 ÷ -2 = 3 since  
-2 × 3 = -6 |

Student Worksheet Notes with Answers

Overview

Tell students:

1. How to find the **Overview**, if necessary.

2. How to navigate the application, if necessary.

3. To scroll through the **Overview** on the calculator. Point out new terms, definitions, and concepts, and tell students to look for them as they go through the **Overview**.
Observations

The Observations help students understand operations with signed integers. If necessary, tell students how to find the Observations.

Observation 1

How far apart are the bird and the fish? Should the answer be positive or negative? Students write an explanation of their answers.

The bird and the fish are +125 ft. apart. The distance is positive. (Students will see the answers on the next three screens. Signed numbers give a perspective as shown on the screens.) Explanations will vary.

Observation 2

What is the sign of the answer to the problem \(-3 \times -11\)?

The answer is positive. \(-3 \times -11 = 33\).

What are the rules for multiplying and dividing signed numbers?

The product of a positive and negative number is negative.

The product of two numbers with the same sign is positive.

Rules for division are similar to the rules for multiplication.
Activities

**What Is My Sign?**

Tell students to:

1. Quickly solve the expression in their heads before it slides all the way to the left.

2. Move the expression into the correct category (+, 0, or -) using and #. Once the expression is in the correct row, they can press to slide it quickly to the left. If the answer is incorrect, the correct answer is displayed; press any key to resume play.

3. Follow your instructions. For example, students can play:
   - Until they have answered incorrectly four times (no time limit).
   - Until a certain amount of time has expired (highest score with the fewest misses wins).
   - Until a certain score has been reached (first student to reach the score with the fewest misses wins).
   - Repeatedly over a period of time (days, weeks, etc.) for tracking improvement of high scores.

4. Record their score.

5. Record how many incorrect answers they had.

(Shown in top right corner of the screen.)

**Integer Smash**

Tell students to:

1. Highlight a level (bronze = least difficult; gold = most difficult), and press ENTER to select it.

2. Bronze or silver levels only: Press +, -, *, or / to select the operation that they want to practice.

3. Enter the missing number (press for negative numbers) and press ENTER. As they play the activity, write each number sentence and solution, showing all of their work on the worksheet.

4. Record the level and operation (bronze and silver only) they played.

5. Record their score.
Try-It!™ on Your TI-83 Plus or TI-73

These keystroke exercises let students practice using the basic operation keys (±, ÷, ×, ÷), the negation key (±), the parentheses keys ([ ]), and the absolute value function ([MATH] NUM 1:abs( ).

Tell students to follow the steps exactly on the calculators. Example screens are displayed on the worksheets for students to compare with the calculator screens.

**Additional problems**—These problems give students additional practice using the subtraction key (–), the negation key (±), and the absolute value function ([MATH] NUM 1:abs( ). Remind them to follow the Order of Operations rules.

Tell students to do the following calculations by hand, and then check the answers using the calculator.

1. \(-4 + 12 \times -10 = 116\)
2. \(4 \times -8 - (-10 \times 2 = -12\)
3. \(-30 \div -5 - 6 = 0\)
4. \(\left| -12 + -28 \right| = 40\)
5. \(\left| -4 \times -8 - (-10 \times 2 \right| = 52\)
6. \(\left| -3 - 14 - -10 \right| = -7\)
Number Sense: Rational Numbers

Overview

The Overview introduces the topics covered in Observations and Activities. Scroll through the Overview using [ ] ( ) to review, if necessary). Read each screen carefully. Look for new terms, definitions, and concepts.

Observations

The Observations illustrate number sense concepts relating to rational numbers. Scroll through the Observations using [ ] ( ) to review, if necessary). Read each screen carefully. When you come to a Write an Observation screen, stop and write the answers to the questions on your worksheet.

Observation 1

Write $\frac{4}{3}$ as an improper fraction.

Write your answer here. Show all of your work.

Observation 2

Write $\frac{5}{8}$ and $\frac{2}{11}$ as decimals.

Write your answer here. Show all of your work.

Observation 3

Write .1875 and $\frac{1}{4}$ as percentages.

Write your answer here. Show all of your work.
Activities

The Activities help you practice rational number concepts. You can select from two activities—Slide and Number Smash. Follow these steps to play the activity and complete your worksheet.

1. Make sure you are in the Activities for this section.
2. Highlight an activity using $ or #, and then press ENTER.

**Slide**

1. Highlight a level (bronze = least difficult; gold = most difficult), and press ENTER to select it.
2. Line up the fractions so they add to 1 (horizontally or vertically). As a fraction slides across the screen, press $ and # to move it up or down. Once a fraction is in the correct row, you can press ! to slide it quickly to the left.
3. Follow your teacher’s instructions for how long to play the activity.
4. What level did you play? __________________________
5. What was your score? __________________________
6. Write a paragraph describing the Slide activity. What was your strategy for playing the game?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Activities (continued)

Number Smash

1. Highlight a level (bronze = least difficult; gold = most difficult), and press ENTER to select it.

2. Press ÷, ×, ÷, or × to select the operation you want to practice.

3. Enter the missing number (press Î© for negative numbers), and press ENTER. As you play the activity, write each number sentence and solution. Show your work below.
   - To enter a mixed number, enter the whole number and press (UNIT). Then enter the fraction.
   - To enter a fraction, press (n/d) and enter the numerator. Press (n/d) again and enter the denominator.

If the answer is incorrect, the correct answer is displayed; press any key to resume play.

4. What level and operation did you play? __________________________

5. What was your score? __________________________
### Try-It!™ on Your TI-83 Plus

Investigate how the calculator computes addition expressions. Solve \( \frac{2}{3} + \frac{5}{6} \).

<table>
<thead>
<tr>
<th>To Do This</th>
<th>Press</th>
<th>Display (TI-83 Plus shown)</th>
</tr>
</thead>
</table>
| 1. Exit the Topics in Algebra 1 application and clear the Home screen. | [2nd] [QUIT]  
 ṅEXIT ṅCLEAR |  |
| 2. Enter the expression on the Home screen. | 2 ÷3 ÷5 ÷6 | 2\( \frac{3}{5} \) + 6 |
| 3. To specify that you would like the result to be shown in fraction form, select ▶Frac. It is copied to the Home screen. | MATH  
 1▶Frac |  |
| 4. Evaluate the answer. | ENTER | 2\( \frac{3}{5} \) + 6▶Frac \( \frac{3}{2} \) |

Notice that the answer is in simplified form. The calculator follows the Order of Operations rules. Division is performed before addition. Solve this problem by hand. Show all of your work.
Try-It!™ on Your TI-83 Plus (continued)

Investigate how the calculator computes division expressions. Solve $\frac{1}{2} \div \frac{2}{3}$.

<table>
<thead>
<tr>
<th>To Do This</th>
<th>Press</th>
<th>Display (TI-83 Plus shown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Solve without parentheses and specify that you want the result in fraction form.</td>
<td>$1 \div 2 \div 2 \div 3$&lt;br&gt; MATH 1→Frac&lt;br&gt; ENTER</td>
<td>$1 \div 2 \div 2 \div 3$→Frac $\frac{1}{12}$&lt;br&gt; ENTER</td>
</tr>
<tr>
<td>2. Solve using parentheses and specify that you want the result in fraction form.</td>
<td>$\frac{1}{2} \div \frac{2}{3}$&lt;br&gt; 1 \div 2 \div 3&lt;br&gt; MATH 1→Frac&lt;br&gt; ENTER</td>
<td>$\frac{1}{2} \div \frac{2}{3}$→Frac $\frac{1}{12}$&lt;br&gt; ENTER</td>
</tr>
</tbody>
</table>

The calculator gives two different answers, depending on how you entered the expression.

Which one is the answer for the problem $\frac{1}{2} \div \frac{2}{3}$?

Solve this problem by hand. Show all of your work here. Explain which answer from the calculator is the desired answer and why.

Additional problems—Calculate the following problems by hand. Simplify your answers. Then check your answers using the calculator. Remember to use the Order of Operation rules.

1. $-\frac{1}{3} + \frac{1}{4} =$
2. $-\frac{2}{3} \times \frac{5}{6} =$

3. $\frac{3}{5} \div \frac{5}{6} =$
4. $\frac{1}{2} - \frac{2}{5} =$

5. $-\frac{2}{5} + \frac{1}{4} \times \frac{2}{3} =$
6. $\frac{1}{8} \times \frac{3}{16} \div \frac{1}{2} =$

7. $-\frac{1}{6} - \frac{1}{12} + \frac{3}{4} =$
8. $-\frac{1}{2} - \frac{3}{4} \div (-3) =$
Try-It!™ on Your TI-73

Investigate how the calculator computes addition expressions. Solve $\frac{2}{3} + \frac{5}{6}$.

<table>
<thead>
<tr>
<th>To Do This</th>
<th>Press</th>
<th>Display (TI-73 shown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Exit the Topics in Algebra 1 application and clear the Home screen.</td>
<td>2nd [QUIT]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXIT CLEAR</td>
<td></td>
</tr>
<tr>
<td>2. Select the b/c and Mansimp mode settings.</td>
<td>MODE</td>
<td></td>
</tr>
<tr>
<td>Note: See Tip™ 2: Adjusting Your Calculator Settings for more information.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|    - Enter 2nd [QUIT]  
|    - Press [MODE]  
|    - Press [2nd]   
|    - Press [ENTER]  
|    - Press [2nd]   
|    - Press [ENTER]  |             |                       |
| 3. Calculate the result.                                                 |             |                       |
|                                                                          |             |                       |
| 4. Simplify the fraction.                                                 | SIMP ENTER  |                       |
|                                                                          |             | Simplified by a factor of 3. |

Notice that the answer is in simplified form. The calculator follows the Order of Operations rules. Division is performed before addition. Solve this problem by hand. Show all of your work.
Try-It!™ on Your TI-73 (continued)

Investigate how the calculator computes division expressions. Solve $\frac{1}{2} \div \frac{2}{3}$.

<table>
<thead>
<tr>
<th>To Do This</th>
<th>Press</th>
<th>Display (TI-73 shown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Solve without parentheses and specify that you want the result in fraction form.</td>
<td>$1 \div 2 \div 2 \div 3$</td>
<td>$1/2/2/3+F+/+D$</td>
</tr>
<tr>
<td>2. Solve using parentheses and specify that you want the result in fraction form.</td>
<td>$(1 \div 2) \div (2 \div 3)$</td>
<td>$(1/2)/(2/3)$</td>
</tr>
<tr>
<td>3. Simplify the result by a factor of 25.</td>
<td>SIMP 25</td>
<td>$1/2/2/3+F+/+D$</td>
</tr>
</tbody>
</table>

The calculator gives two different answers, depending on how you entered the expression. Which one is the answer for the problem:

\[ \frac{1}{2} \div \frac{2}{3} \]

Solve this problem by hand. Show all of your work here. Explain which answer from the calculator is the desired answer and why.

Additional problems—Calculate the following problems by hand. Simplify your answers. Then check your answers using the calculator. Remember to use the Order of Operation rules.

1. $-\frac{1}{3} + \frac{1}{4}$
2. $-\frac{2}{3} \times \frac{5}{6}$
3. $\frac{3}{5} \div \frac{5}{6}$
4. $\frac{1}{2} - \frac{-2}{5}$
5. $-\frac{2}{5} + \frac{1}{4} \times \frac{2}{3}$
6. $\frac{1}{8} \times \frac{3}{16} \div \frac{1}{2}$
7. $-\frac{1}{6} - \frac{1}{12} + \frac{3}{4}$
8. $-\frac{1}{2} - \frac{3}{4} \div (-3)$
Number Sense: Rational Numbers

Objectives

- To review the definition of rational numbers as ratios and as terminating and repeating decimals.
- To review ordering and the reciprocal property of rational numbers.
- To review operations with rational numbers.

Math Highlights

Students review rational numbers. This includes rational numbers as ratios, terminating decimals, repeating decimals, and integers, as well as operations with fractions. In the Observations, students are reminded of the connection between fractions, decimals, and percents.

Common Student Errors

- Students might confuse the algorithms for addition, subtraction, multiplication, and division of fractions.
- Students may have trouble identifying whether a fraction is positive or negative. For example:

  \[-\frac{1}{3} = \frac{1}{3} \text{ or } -\frac{1}{3} = \frac{-1}{3} = -\frac{1}{3}\]

- Students may have problems because they use short cuts to change the decimal representation of a number to a percent representation. Using short cuts does not provide an understanding of why the representations are equal. Students should understand that the quantity stays the same. Using the multiplicative identity, 1=\(\frac{100}{100}\), is the key to the change in the representation. For example, students change \(0.1875\) to a percent. A shift of the decimal point gives the correct answer, but without any connection to the math they know. However, multiplying by 1 in the form \(\frac{100}{100}\) gives the same result and makes the connection to the math as well.

  \[0.1875 \times \frac{100}{100} = \frac{18.75}{100} = 18.75\%\]
Overview

Tell students:

1. How to find the Overview, or tell them to review the instructions on the worksheet.
2. How to navigate the application, if they are not yet familiar with the application.
3. To scroll through the Overview on the calculator. Point out new terms, definitions, and concepts, and tell students to look for them as they go through the Overview.

Observations

The Observations help students understand number sense concepts relating to rational numbers. If necessary, tell students how to find the Observations.

Observation 1

Write $4\frac{2}{3}$ as an improper fraction.

Answer: $\frac{14}{3}$

Remind students to write the answer on the worksheet and to show all of their work.
Observations (continued)

Observation 2

Write $\frac{5}{8}$ and $\frac{2}{11}$ as decimals.

Answer: .625 and .18.

Remind students to write the answers on the worksheet and to show all of their work.

Observation 3

Write .1875 and $\frac{1}{4}$ as percentages.

Answer: 18.75% and 25%.

Remind students to write the answers on the worksheet and to show all of their work.

Activities

Slide

Tell students to:

1. Highlight a level (bronze = least difficult; gold = most difficult), and press ENTER to select it.

2. Line up the fractions so they add to 1 (horizontally or vertically). As a fraction slides across the screen, press ▼ and ▲ to move it up or down. Once a fraction is in the correct row, they can press → to slide it quickly to the left.
Activities (continued)

Scoring: When a row or column adds up to 1, it disappears, and the player scores 2 points.
The game automatically ends if the screen is full, or you press (QUIT) to stop.

Slide (continued)

3. Follow your instructions. For example, students can play:
   • Until the screen fills up (no time limit).
   • Until a certain amount of time has expired (highest score wins).
   • Until a certain score has been reached (first student to reach the score wins).
   • Repeatedly over a period of time (days, weeks, etc.) for tracking improvement of high scores.

4. Record the level they played.
5. Record their scores.
6. Write on the worksheet a paragraph in which they describe the Slide activity and the strategy for playing.

Number Smash

Tell students to:
1. Highlight a level (bronze = least difficult; gold = most difficult), and press [ENTER] to select it.
2. Press [+] or [-] or [×] or [÷] to select the operation that they want to practice.
3. Enter the missing number (press [-] for negative numbers), and press [ENTER]. As they play the activity, they should write each number sentence and its solution on the worksheet, showing all their work. If the missing number is a mixed number or fraction, tell them:
   • To enter a mixed number, enter the whole number, press [UNIT], and then enter the fraction.
   • To enter a fraction, press [n/d] and enter the numerator. Press [n/d] again and enter the denominator.
If the answer is incorrect, the correct answer is displayed; press any key to resume play.
4. Record the level and operation they played.
5. Record their scores.
Try-It!™ on Your TI-83 Plus or TI-73

Review the Order of Operations rules with students, if necessary. Explain to them that the calculator uses the Order of Operations rules to simplify expressions. Discuss with them how parentheses are used.

Note: The Try-It! activities are repeated for each of the two calculators—the TI-83 Plus and then the TI-73. The problems are the same, but they vary due to the differences in the two calculators. The Additional problems, which are identical, can be performed on either calculator. They are repeated for your convenience when you copy the activities.

Tell students to do the two calculator Try-It! investigations.

- Investigate how the calculator computes addition expressions. Solve \( \frac{2}{3} + \frac{5}{6} \).
- Investigate how the calculator computes division expressions. Solve \( \frac{1}{2} \div \frac{2}{3} \).

Ask students to explain the difference in the two results in second investigation.

Although each of the two results is correct based on how the problem was entered, to make sure that the division is performed correctly, the problem must be entered as \((1 \div 2) \div (2 \div 3)\). The answer is 3/4, not 1/12. The calculator uses the Order of Operations rules. Operations inside parentheses are performed before operations outside parentheses.

On the TI-73, students must simplify the fraction 75/100 to get 3/4. They may either specify the factor to use, as shown, or let the calculator simplify the fraction, one factor at a time by repeatedly pressing [SIMP].

Additional problems—Make sure that students understand and use the Order of Operation rules so they can determine when to use parentheses.

1. \( -\frac{1}{3} + \frac{1}{4} = -\frac{1}{12} \)
2. \( -\frac{2}{3} \times \frac{5}{6} = -\frac{5}{9} \)
3. \( \frac{3}{5} \div \frac{5}{6} = \frac{18}{25} \)
4. \( \frac{1}{2} \div \frac{2}{5} = \frac{9}{10} \)
5. \( -\frac{2}{5} + \frac{1}{4} \times \frac{2}{3} = -\frac{7}{30} \)
6. \( \frac{1}{8} \times \frac{3}{16} \div \frac{1}{2} = \frac{3}{64} \)
7. \( -\frac{1}{6} \div \frac{1}{12} + \frac{3}{4} = \frac{1}{2} \)
8. \( -\frac{1}{2} \div \frac{3}{4} \times (-3) = -\frac{1}{4} \)
Overview

The Overview introduces the topics covered in Observations and Activities. Scroll through the Overview using (left arrow) to review, if necessary. Read each screen carefully. Look for new terms, definitions, and concepts.

Observations

The Observations illustrate number sense concepts relating to real numbers. Scroll through the Observations using (left arrow) to review, if necessary. Read each screen carefully. When you come to a Write an Observation screen, stop and write the answers to the questions on your worksheet.

Observation 1

Write three different irrational numbers. Show your work.

__________________________________________________________

__________________________________________________________

__________________________________________________________

Observation 2

Try these problems . . .

Use the real number properties to solve the following problems quickly. Show your work.

\[25 \times 24 = \]

\[8 \times 102 = \]

\[6 \times 46 = \]
Activities

The Activities help you practice real number concepts. You can select from two activities—Raining Reals and What Is My Property? Follow these steps to play the activity and complete your worksheet.

1. Make sure you are in the Activities for this section.

2. Highlight an activity using ▲ or ▼, and press ENTER.

Raining Reals

1. Highlight a level (silver = less difficult; gold = more difficult), and press ENTER to select it.

2. As the numbers fall on your screen, quickly determine if the “raining” number is rational or irrational.

3. Press 4 to move the number into the RATIONAL set, or press 3 to move the number into the IRRATIONAL set. If the answer is incorrect, the correct answer is displayed; press any key to resume play.

4. Follow your teacher's instructions for how long to play the activity.

5. What level did you play? __________________________

6. What was your final score? _______________________

7. How many incorrect answers did you have? __________
   (Shown in top right corner of the screen.)

8. Write a paragraph describing the activity. Describe your strategy for playing.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Activities (continued)

What Is My Property?

1. Look at the equation and decide which single property, out of these six, it represents.
   - Commutative +
   - Commutative *
   - Associative +
   - Associative *
   - Distributive * Over +
   - Distributive * Over –

2. Scroll through the property choices with [↑] and/or [↓]. To select a property, press [ENTER]. If the answer is incorrect, the correct answer is displayed; press any key to resume play. As you play the activity, record each equation and its property.

   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________

3. What was your score? ________________________________
Try-It!™ on Your TI-83 Plus or TI-73

Investigate how the calculator deals with irrational numbers.

In the Overview, you used the Pythagorean theorem to find the length of $\sqrt{2}$. Draw a right triangle so that the hypotenuse has length $\sqrt{2}$. Pythagoras (569–475 B.C.), a great Greek mathematician, discovered irrational numbers (numbers that are not rational and therefore are not ratios). There is a proof that, for example, $\sqrt{2}$ cannot be written as a fraction.

Hint: Draw each leg with length 1 inch. The hypotenuse is $\sqrt{1^2+1^2}=\sqrt{1+1}=\sqrt{2}$

Remember that $\sqrt{2} \times \sqrt{2} = 2$. Picture this by envisioning a square whose sides measure $\sqrt{2}$ units. You created this length in your picture above.

Look at the square whose side has a length of $\sqrt{2}$ on the Geoboard screen below. Can you see that the area is $\sqrt{2} \times \sqrt{2} = 2$ square units? Count it up! Shade in the area on the screen shown.
Try-It!™ on Your TI-83 Plus or TI-73 (continued)

Find the calculator decimal approximation for $\sqrt{2}$.

<table>
<thead>
<tr>
<th>To Do This</th>
<th>Press</th>
<th>Display (TI-83 Plus shown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Exit the Topics in Algebra 1 application and clear the Home screen.</td>
<td>2nd [QUIT]</td>
<td></td>
</tr>
<tr>
<td>2nd [EXIT] CLEAR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Select the Float setting from the mode screen.</td>
<td>MODE</td>
<td></td>
</tr>
<tr>
<td>Notes: See Tip™ 2: Adjusting Your Calculator Settings for details.</td>
<td>¥ until Float is highlighted</td>
<td>Normal Sci Eng, Float 0123456789 Real Deg gradian TblFig Pol Sex Connected Dot SeqModal Simul Rplm+ r&gt;and r&lt;b 9-1 10 Prem Int Horiz 8-T</td>
</tr>
<tr>
<td>The TI-83 Plus mode screen varies slightly from the TI-73.</td>
<td>ENTER</td>
<td></td>
</tr>
<tr>
<td>3. Return to the Home screen.</td>
<td>2nd [QUIT]</td>
<td></td>
</tr>
<tr>
<td>4. Calculate the decimal approximation for $\sqrt{2}$.</td>
<td>2nd [√] 2 [1]</td>
<td>$\sqrt{2}$ 1.414213562</td>
</tr>
<tr>
<td>ENTER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Square your result.</td>
<td>$x^2$ ENTER</td>
<td>$\sqrt{2}$ 1.414213562</td>
</tr>
<tr>
<td>Note: Ans = previous answer. The calculator remembers that you entered $\sqrt{2}$.</td>
<td></td>
<td>Ans ² 1.414213562 2</td>
</tr>
</tbody>
</table>

Is $\sqrt{2}$ equal to the decimal 1.414213562? It looks like the calculator says this is true. Calculate $1.414213562^2$ to see.

| 6. Calculate the square of 1.414213562.                                  | 1 √ 4 1 4 2 1 3 5 6 2 | $\sqrt{2}$ 1.414213562 |
| ENTER                                                                    | Ans ² 1.414213562 2 | 1.414213562² 2          |
| 1.999999999                                                             |                | 1.9999999999            |

The answer shows 1.999999999, but you know you should get the answer 2.

Be careful! When you use your calculator, you have to know your math. The calculator can do amazing math, but it only shows you an approximation for many answers. You have to understand the problem before you use the calculator. It is up to you to determine if calculator answers are reasonable and how you will use them.
Word Problem: Missy’s Garden

Missy wants to build a small fence around a garden in her backyard. The garden is in the shape of a right triangle. One leg is 2 meters and the other leg is 1 meter. The store sells fencing in tenths of a meter.

1. What is the exact perimeter of Missy’s garden? Show all your work.

Math Hint: Use the Pythagorean theorem to find the length of the third side of the garden, and then find the perimeter of the garden. (See the Real Numbers Overview on the calculator.)

2. What length of fencing should Missy buy if the store only sells the fencing in tenths of a meter? Use the calculator. Show all your work.

Calculator Hint: After you calculate the approximate answer on your calculator, try setting MODE so that Float=1. See Tip™ 2: Adjusting Your Calculator Settings for details. This will give you one decimal place or tenths. Observe how the calculator displays the results!
Word Problem: Jose and Maria’s Backyard Pool

Jose and Maria have a circular pool in their backyard. Their parents would like to make a cover for the pool. They bought a square piece of material whose sides are the same length as the diameter of the pool. The diameter of the pool is 3.5 meters.

1. How much material will they have left over? Find the exact and approximate answers. Use the calculator. Show all your work. (See Hints below.)

   ____________________________________________________________  
   ____________________________________________________________  
   ____________________________________________________________  
   ____________________________________________________________  
   ____________________________________________________________  
   ____________________________________________________________  
   ____________________________________________________________  
   ____________________________________________________________  

2. Exact answer: ________________________________________________

3. Approximate answer (to 3 decimal places): ________________________

Calculator Hints:
- Use Float = 3 on your calculator to display 3 decimal places.
- Press $\mathbf{\text{2nd}} \ [\pi]$ to find the calculator's approximation for $\pi$.

Math Hints:
- Area of a square: $A = s^2$, where $s$ is the length of the sides of the square.
- Area of a circle: $A = \pi r^2$, where $r$ is the radius of the circle (diameter = 2$r$).
Objectives

- To illustrate the real number system in a Venn diagram.
- To identify real numbers as rational numbers $\cup$ irrational numbers.
- To review writing rational numbers as terminating or repeating decimals.
- To review writing irrational numbers as nonterminating, nonrepeating decimals.
- To show physical representations of the irrational numbers, $\sqrt{2}$ and $\pi$, and to review the Pythagorean theorem and the formula for finding the circumference of a circle.
- To state the real number system properties—commutative, associative, and distributive—as well as the identity and inverse properties.

Math Highlights

This section starts with the building of the Venn diagram of the real number system. Definitions of rational and irrational numbers are given. Two examples of irrational numbers, $\sqrt{2}$ and $\pi$, are developed. $\sqrt{2}$ is shown as the length of the hypotenuse of a right triangle with legs of 1 unit. $\pi$ is shown as the circumference divided by the diameter for any circle. The statements of the properties of the real numbers follow.

Common Student Errors

- Many students may not have developed a solid understanding of number sets. Remind them that using rational and irrational numbers, they can name every location on a number line. Later in their studies of mathematics, this will be referred to as the Completeness Property of Real Numbers, which was an important discovery in mathematics. Later, they will also extend the real numbers to the complex numbers, $a + bi$, which are numbers used, for example, in the study of the relationship between electricity and magnetism.
- Students probably have used $22/7$ or 3.14 as an approximation of $\pi$. They may think that these values are exactly $\pi$, but they are not equal to $\pi$. This provides an opportunity to talk about approximations to several decimal places in real problems. The worksheet problems give students an opportunity to find exact and approximate answers. There are wonderful web sites that show $\pi$ to millions of places. Mathematicians are still searching for more place values. This study of $\pi$ requires the use of computers to assist the search.
- Some students may not be aware that the ratio of the circumference of a circle $C$ divided by the diameter $d$ is $\pi$. $C/d = \pi$. This may be confusing because they have been told that $\pi$ is irrational and is not a ratio. Yet $\pi$ came from a ratio of circumference to diameter. It turns out that either $C$ or $d$ is also irrational. The mathematics to prove this is not given at this level; therefore, students have to accept this without much explanation. This is a deep discussion that will not be of interest to some students, but other students may find it fascinating.
Student Worksheet Notes with Answers

Overview

Tell students:

1. How to find the Overview, or tell them to review the instructions on the worksheet.
2. How to navigate the application, if they are not yet familiar with the application.
3. To scroll through the Overview on the calculator. Point out new terms, definitions, and concepts, and tell students to look for them as they go through the Overview.

Observations

The Observations help students understand number sense concepts relating to real numbers. Tell students how to find the Observations.

Observation 1

Write three different irrational numbers. Students show their work.

Answers will vary.

Observation 2

Try these problems . . .
Students use the real number properties to solve the problems, showing their work.

- **associative property:**
  
  \[ 25 \times 24 = 25 \times (4 \times 6) = (25 \times 4) \times 6 = 100 \times 6 = 600 \]

- **distributive over + property:**
  
  \[ 8 \times 102 = 8 \times (100 + 2) = (8 \times 100) + (8 \times 2) = 800 + 16 = 816 \]

- **distributive over − property:**
  
  \[ 6 \times 46 = 6 \times (50 - 4) = (6 \times 50) - (6 \times 4) = 300 - 24 = 276 \]
Activities

Raining Reals

Tell students to:

1. Highlight a level (silver = less difficult; gold = more difficult), and press [ENTER] to select it.
2. Determine if the “raining” number is rational or irrational.
3. Press [C] to move the number into the RATIONAL set, or press [D] to move the number into the IRRATIONAL set. If the answer is incorrect, the correct answer is displayed; press any key to resume play.
4. Follow your instructions. For example, students can play:
   - until they have answered incorrectly four times (no time limit)
   - until a certain amount of time has expired (high score wins)
   - until a certain score has been reached (first student to reach the score with the fewest misses wins)
   - over a period of time (days, weeks, etc.) for tracking improvement of high scores
5. Record the level they played.
6. Record their final scores.
7. Record how many incorrect answers they had.
   (Shown in top right corner of the screen.)
8. Write their strategy for playing the game.

What Is My Property?

Tell students to:

1. Look at the equation and decide which one property, out of these six, it represents:
   - Commutative +
   - Commutative *
   - Associative +
   - Associative *
   - Distributive * Over +
   - Distributive * Over −
2. Scroll through the choices with [A] and/or [B] and press [ENTER] to select the correct property. If the answer is incorrect, the correct answer is displayed; press any key to resume play. As they play the activity, record each equation and its property.
3. Record their scores.
Try-It!™ on Your TI-73 or TI-83 Plus

Tell students to:

- Use the Pythagorean theorem to draw a triangle whose two legs = 1 unit and whose hypotenuse = $\sqrt{2}$ units.
- Shade in the area on the Geoboard screen on the worksheets.
- Go through the keystroke example to:
  - Find the calculator decimal approximation for $\sqrt{2}$.
  - Understand how the calculator approximates numbers.
  - Understand that they must be conscientious about the mathematics involved.

Word Problem: Missy’s Garden

Remind students to:

- Use the Pythagorean theorem to find the third side of the garden and then the perimeter.
- Set the decimal mode notation (MODE) to Float and then to 1 (answer rounded to tenths), so they can see how the calculator displays answers.

1. Exact perimeter: $1 + 2 + \sqrt{5}$ meters
2. Length of fencing rounded to tenths: 5.2 meters

Note: The number rounds down. This is mathematically correct, but impractical in the real world, where Missy would need to purchase 5.3 meters in order to fence the garden. You may want to discuss meaningful interpretation of word problems with the students.

Word Problem: Jose and Maria’s Backyard Pool

If necessary, review the formulas for area of a square and area of a circle. They are shown on the worksheet.

Covering material left over:

1. Exact: Area of square—area of circle = $(3.5)^2 - \pi(3.5/2)^2 = 12.25 - 3.0625 \pi$ square meters
2. Approximate: 2.629 square meters (3 decimal places; use Float=3)