Chapter 10

Signed Numbers
Chapter Outline

- Signed Numbers
- Adding Signed Numbers
- Subtracting Signed Numbers
- Multiplying and Dividing Signed Numbers
- Order of Operations
§ 10.1

Signed Numbers
Section Objectives

- Representing Real-Life Situations
- Graphing Signed Numbers
- Comparing Signed Numbers
- Finding the Absolute Value of a Number
- Finding the Opposite of a Number
- Reading Bar Graphs Containing Signed Numbers
### Representing Real-Life Situations

<table>
<thead>
<tr>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive numbers</strong>: Numbers greater than 0.</td>
<td>A worker in a silver mine in Nevada works 1445 feet underground. Write this as a signed number.</td>
</tr>
</tbody>
</table>
| **Signed numbers**: We call positive numbers, negative numbers, and zero the signed numbers. | **SOLUTION**  
1445 feet underground \( d = -1445 \) |
| **Negative numbers**: Numbers that are less than 0. |  |
EXAMPLE
Graph the following signed numbers on a number line:

-4, 0, 2, \(-\frac{3}{4}\)

SOLUTION
Comparing Signed Numbers

EXAMPLE
Insert < or > between the following pair of numbers to make a true statement.

\[ 0 > \frac{-7}{8} \]

SOLUTION

\[ 0 > \frac{-7}{8} \]

0 is greater than \(-\frac{7}{8}\).
### Finding the Absolute Value of a Number

<table>
<thead>
<tr>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Absolute value</strong>: The number’s distance from 0 on a number line.</td>
<td><strong>Find the absolute value of -31.6.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>SOLUTION</strong></td>
</tr>
<tr>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>
Finding the Opposite of a Number

<table>
<thead>
<tr>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opposites</strong>: Two numbers that are the same distance from 0 on the number line but are on opposite sides of 0.</td>
<td>Find the opposite of 8.</td>
</tr>
<tr>
<td><strong>SOLUTION</strong></td>
<td>opposite of 8 = –8</td>
</tr>
</tbody>
</table>

8 away from 0 8 away from 0
EXAMPLE
Which lake shown has the second lowest elevation?

SOLUTION
Lake Eyre
Adding Signed Numbers
Section Objectives

- Adding Signed Numbers
- Solving Problems by Adding Signed Numbers
## Adding Signed Numbers

### Same Sign

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add their absolute values.</td>
<td>Add: $23 + 12$</td>
</tr>
</tbody>
</table>

**SOLUTION**

$$|23| + |12| = 23 + 12$$
$$= 35$$

### Different Sign

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find the larger absolute value minus the smaller absolute value.</td>
<td>Add: $8 + (-3)$</td>
</tr>
</tbody>
</table>

**SOLUTION**

$$|8| - |-3| = 8 - 3$$
$$= 5$$
EXAMPLE
The temperature at 4 p.m. on February 2 was \(-10^\circ\) Celsius. By 11 p.m. the temperature had risen 12 degrees. Find the temperature at 11 p.m.

SOLUTION

\[
|12| - |-10| = 12 - 10 = 2
\]

The temperature at 11 p.m. is 2° Celsius.
§ 10.3

Subtracting Signed Numbers
Section Objectives

- Subtracting Signed Numbers
- Adding and Subtracting Signed Numbers
- Solving Problems by Subtracting Signed Numbers
Subtracting Signed Numbers

<table>
<thead>
<tr>
<th>Formula</th>
<th>Example</th>
</tr>
</thead>
</table>
| If $a$ and $b$ are numbers, then $a - b = a + (-b)$ | Subtract: $-5 - (-5)$

**SOLUTION**

$$|5| - |5| = 5 - 5 = 0$$
Adding and Subtracting Signed Numbers

**EXAMPLE**
Simplify: \( 12 - 5 - 7 \)

**SOLUTION**
\[
12 - 5 - 7 = 12 + (-5) + (-7) \\
= 12 + (-12) \\
= 12 - 12 \\
= 0
\]
EXAMPLE
In the card game canasta, it is possible to have a negative score. If Juan Santanilla’s score is 15, what is his new score if he loses 20 points?

SOLUTION

\[
15 - 20 = 15 + (-20) \\
= | -20 | - | 15 | \\
= 20 - 15 \\
= -5
\]

because -20 has a negative sign and was the larger of the two numbers

Juan Santanilla’s new score is -5.
§ 10.4

Multiplying and Dividing Signed Numbers
Section Objectives

- Multiplying Signed Numbers
- Dividing Signed Numbers
- Solving Problems by Multiplying and Dividing Signed Numbers
Multiplying Signed Numbers

<table>
<thead>
<tr>
<th>Products of Like Signs</th>
<th>Product of Different Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>The product of two numbers having the same sign is a positive number.</td>
<td>The product of two numbers having different signs is a negative number.</td>
</tr>
<tr>
<td>$(+)(+) = +$</td>
<td>$(+)(-) = -$</td>
</tr>
<tr>
<td>$(-)(-) = -$</td>
<td>$(-)(+) = -$</td>
</tr>
</tbody>
</table>

**EXAMPLE**
Multiply -2 by -5 and -4

**SOLUTION**

\[-2(-5)(-4) = -2(20)\]

\[= -40\]
Dividing Signed Numbers

<table>
<thead>
<tr>
<th>Quotient of Like Signs</th>
<th>Quotient of Different Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>The quotient of two numbers having the same sign is a positive number.</td>
<td>The quotient of two numbers having different signs is a negative number.</td>
</tr>
<tr>
<td>( \frac{(+)}{(+)} = + )</td>
<td>( \frac{(+)}{(-)} = - )</td>
</tr>
<tr>
<td>( \frac{(-)}{(-)} = + )</td>
<td>( \frac{(-)}{(+)} = - )</td>
</tr>
</tbody>
</table>

**EXAMPLE**
Divide -30 by 6.

**SOLUTION**

\[
\frac{-30}{6} = -5
\]
Solving Problems by Multiplying and Dividing Signed Numbers

**EXAMPLE**

Joe Norstrom lost $400 on each of seven consecutive days in the stock market. Represent his total loss as a product of signed numbers and find his total loss.

**SOLUTION**

\[ 7 \cdot (-400) = -2800 \]

Joe Norstrom’s total loss is $2800.
§ 10.5

Order of Operations
Section Objectives

- Order of Operations
- Simplifying Expressions
## Simplifying Expressions

### Order of Operations

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Perform all operations within parentheses ( ), brackets [ ], or other grouping symbols such as fraction bars or square roots.</td>
</tr>
<tr>
<td>2.</td>
<td>Evaluate any expressions with exponents.</td>
</tr>
<tr>
<td>3.</td>
<td>Multiply or divide in order from left to right.</td>
</tr>
<tr>
<td>4.</td>
<td>Add or subtract in order from left to right.</td>
</tr>
</tbody>
</table>
EXAMPLE
Simplify: \( 3 + (-8) \div 2 \)

SOLUTION
\[
3 + (-8) \div 2 = 3 + \frac{-8}{2} = 3 + (-4) = -1
\]