Number Sets and Absolute Value

Palomar College

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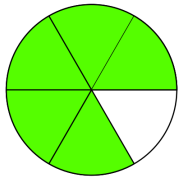
Objectives

- Introduce specific vocabulary
- Define common number sets and learn their symbols.
- Classify a number into correct number sets.
- Find the absolute value of a real number.

A **set** is a collection of objects. Each of these objects is called an **element** of the set. We will be focusing on sets of numbers. The most common number sets have a name and a symbol that represents them.

One way to define a set of numbers is by listing them in **roster notation**. An example of a set in roster notation is $\{2, 4, 6\}$. This set has three elements. Another way to define a set is called **set-builder notation**, in this form we list rules for the numbers in the set instead of listing them. An example of set-builder notation is $\{x|x \text{ is an even number between 1 and 7.}\}$. This is also the set $\{2, 4, 6\}$.

A number written in the form $\frac{5}{6}$ is called a **fraction**. The top number is called the **numerator** and the bottom number is called the **denominator**. A fraction may refer to parts of a whole. The denominator tells us how many equal parts the whole is divided into and the numerator tells us how many of those parts we need.



$\frac{5}{6}$ represents the shaded region of the circle because 5 of the 6 equal parts have been shaded.

Number Sets

- **Natural Numbers:** $\mathbb{N} = \{1, 2, 3, 4, 5, 6, \ldots\}$
  The three dots $(\ldots)$ after the 6 mean that the list goes on forever.
- **Whole Numbers:** $\mathbb{W} = \{0, 1, 2, 3, 4, 5, \ldots\}$
  Whole numbers include all natural numbers and the number zero.
- **Integers:** $\mathbb{Z} = \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$
  All whole numbers are integers and so are all their negatives.
- **Rational Numbers:** $\mathbb{Q} = \{\frac{p}{q} | p \text{ and } q \text{ are integers and } q \neq 0\}$
  All fractions with integer numerators and denominators are a rational numbers, as long as the denominator is not 0. All integers are also rational numbers.
- **Irrational Numbers:** $\mathbb{I} = \{a | a \text{ is a decimal number that is not a rational number}\}$
  Some common examples of irrational numbers are $\pi = 3.1415927\ldots$ and $\sqrt{2} = 1.4142136\ldots$.
  Irrational numbers have decimal expansions that do not terminate or repeat.
- **Real Numbers:** $\mathbb{R} = \{a | a \text{ is either rational or irrational}\}$
  Real numbers consist of all rational numbers and all irrational combined. All real numbers can be plotted on a real number line.

Classifying Numbers Example

List the numbers from the set $\{-2, 0, \frac{1}{4}, -1.5, 112, -3, 11, \sqrt{3}\}$ that belong to each of the following sets:

a) Natural $\mathbb{N}$ $\quad 112, 11$
b) Whole $\mathbb{W}$ $\quad 0, 112, 11$
c) Integer $\mathbb{Z}$ $\quad -2, 0, 112, -3, 11$
d) Rational $\mathbb{Q}$ $\quad -2, 0, \frac{1}{4}, -1.5, 112, -3, 11$
e) Irrational $\mathbb{I}$ $\quad \sqrt{3}$
f) Real $\mathbb{R}$ $\quad -2, 0, \frac{1}{4}, -1.5, 112, -3, 11, \sqrt{3}$

Let's Try It

List the numbers from the set $\{\frac{1}{3}, 0, 1.5, -57, 3, 11, \sqrt{7}, -\pi\}$ that belong to each of the following sets:

a) Natural $\mathbb{N}$
b) Whole $\mathbb{W}$
c) Integer $\mathbb{Z}$
d) Rational $\mathbb{Q}$
e) Irrational $\mathbb{I}$
f) Real $\mathbb{R}$

Examples with Absolute Value

Find the absolute value of each number.

a) $|5| \quad 5$
b) $|-3| \quad 3$
c) $|0| \quad 0$
d) $|\frac{2}{3}| \quad \frac{2}{3}$
e) $|-4.2| \quad 4.2$
f) $|-\sqrt{3}| \quad \sqrt{3}$

Let's Try It

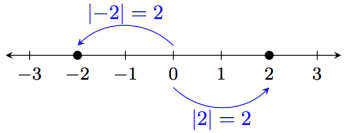
Find the absolute value of each number.

a) $|-8|$
b) $|7|$
c) $|-\frac{2}{5}|$
d) $|0|$
e) $|\sqrt{2}|$
f) $|-3.8|$

Absolute Value

The **absolute value** of a real number a, written $|a|$, is the distance between a and 0 on a real number line.

The absolute values of 2 and -2 are both 2, since they are both two units away from 0.

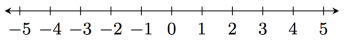


Practice

1) Tell which set or sets each number belongs to: $\mathbb{N}$, $\mathbb{W}$, $\mathbb{Z}$, $\mathbb{Q}$, $\mathbb{I}$, and $\mathbb{R}$.

a) 8
b) 0
c) -2
d) $\frac{2}{3}$
e) $-\sqrt{5}$
f) -1.52

2) Plot each number in the list on the real number line. $-4, 0, 2.5, \frac{1}{2}, 5$



3) Find the absolute value of each number.

a) $|-4|$
b) $|5|$
c) $|-\frac{5}{8}|$
d) $|-1.75|$
e) $|-\sqrt{7}|$
f) $|7.2|$

Number Sets and Absolute Value

Answers to Practice

1. Tell which set or sets each number belongs to: $\mathbb{N}, \mathbb{W}, \mathbb{Z}, \mathbb{Q}, \mathbb{I}$, and $\mathbb{R}$.

   (a) 8 $\quad \mathbb{N}, \mathbb{W}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$

   (b) 0 $\quad \mathbb{W}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$

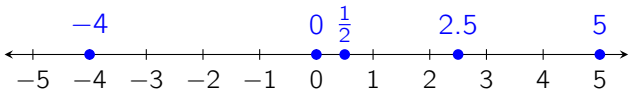
   (c) -2 $\quad \mathbb{Z}, \mathbb{Q}, \mathbb{R}$

   (d) $\frac{2}{3}$ $\quad \mathbb{Q}, \mathbb{R}$

   (e) $-\sqrt{5}$ $\quad \mathbb{I}, \mathbb{R}$

   (f) -1.52 $\quad \mathbb{Q}, \mathbb{R}$

2. Plot each number in the list on the real number line. $-4, 0, 2.5, \frac{1}{2}, 5$



3. Find the absolute value of each number.

   (a) $|-4|$ $\quad 4$

   (b) $|5|$ $\quad 5$

   (c) $\left|-\frac{5}{8}\right|$ $\quad \frac{5}{8}$

   (d) $|-1.75|$ $\quad 1.75$

   (e) $\left|-\sqrt{7}\right|$ $\quad \sqrt{7}$

   (f) $|7.2|$ $\quad 7.2$