

Number Sense (Part 3 - Finite and infinite sets)

You will learn that sets of numbers are classified as finite or infinite depending on the number of elements in the set.

Finite set

A finite set has a countable number of elements. For example, the following set is finite: $\{1, 2, 3, 4, 5\}$. Notice the braces $\{ \}$ are used to indicate a set. The elements, or members, of the set are listed within the braces. Sometimes finite sets can be defined in a manner that does not require their elements to be listed.

$$D = \{\textit{Days of the week}\}$$

$$E = \{\textit{positive even numbers less than twenty}\}$$

$$P = \{\textit{polygons that have less than 6 side}\}$$

Activity 1:

Write the elements for the preceding three examples in set notation.

Empty set

The empty set is a finite set. As the name implies, it is the set that contains no elements. It is represented by either $\{ \}$ or \emptyset . The months of the year with 35 days is an example of the empty set.

Infinite set

An infinite set has an uncountable number of elements. For example, the following sets are infinite: $\{\dots, -2, -1, 0\}$, $\{1, 2, 3, 4, \dots\}$, $\{\dots, 0.001, 0.01, 0.1, 1, 10, \dots\}$, and $\{0, \dots, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}, 1\}$. The three dots (...) mean and so on and are used to show that the pattern continues. As with the finite sets, infinite set can be defined in a way that does not require their elements to be listed.

$$I = \{\textit{integers}\}$$

$$T = \{\textit{multiples of three}\}$$

$$R = \{\textit{real numbers between one and two}\}$$

Activity 2:

- I. Write the elements for the preceding three examples in set notation.
- II. Give an example of an empty set.

Note: It is important to recognize how the three-dot notation is used. It may be used in either an infinite set $\{1, 2, 3, 4, \dots\}$, meaning that the set continues forever, or a finite set $\{1, 2, 3, 4, \dots, 20\}$, meaning all the whole numbers in between 1 and 20.

Activity 3:

For each of the following examples, classify the set as either finite or infinite.

1. $\{2, 4, 6, 8, 10\}$
2. $\{\text{odd numbers}\}$
3. $\{\text{odd numbers between } -1,000 \text{ and } 1,000\}$
4. $\{\text{integers less than } 6\}$
5. $\{\text{whole numbers less than } 6\}$
6. $\{-6, -5, -4, \dots, 8\}$
7. $\{\text{days of a single year in which there is rain}\}$
8. $\{\text{countries of the world}\}$
9. $\{-20, -10, 0, 10, \dots\}$
10. $\{0\}$

AIMS Practice:

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|------------------------------------|-------------------------------------------------|
| 1. Which set of numbers is finite? | 2. Which set of numbers is infinite? |
| A. $\{\text{factors of } 45\}$ | A. $\{\text{whole numbers less than } 10\}$ |
| B. $\{\text{even numbers}\}$ | B. $\{\text{positive integers less than } 10\}$ |
| C. $\{\text{multiples of } 3\}$ | C. $\{\text{Natural numbers less than } 10\}$ |
| D. $\{\text{negative integers}\}$ | D. $\{\text{negative numbers less than } 10\}$ |