

Chapter

7

Sets and Venn diagrams

- A** Sets
- B** Set builder notation
- C** Complements of sets
- D** Venn diagrams
- E** Venn diagram regions
- F** Numbers in regions
- G** Problem solving with Venn diagrams

Syllabus reference: 1.1, 3.5

A **set** is a collection of numbers or objects.

the set of all digits which we use to write numbers is $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$.

The numbers or objects in a set are called the **elements** or **members** of the set.

{ set }

We use the symbol \in to mean *is an element of*
and

\notin to mean *is not an element of*.

The set $\{ \}$ or \emptyset is called the **empty set** and contains no elements.

$\{ \}$ null set

SPECIAL NUMBER SETS

$$\mathbb{N} = \{1, 2, 3, 4, \dots\}$$

natural #'s

$$\mathbb{Z} = \{\dots, -3, -2, -1, 0, 1, \dots\}$$

integers

$$\mathbb{Z}^+ = \{1, 2, 3, \dots\}$$

$$\mathbb{Z}^- = \{\dots, -3, -2, -1\}$$

$0.75\overline{2}$

$$\mathbb{Q} = \text{rational #'s}$$

rational

$$\mathbb{R} = \text{real #'s}$$

$$\mathbb{R}^+ =$$

$0.3\overline{232}$

$$\mathbb{R}^- =$$

$$x = 0.\overline{32323232}$$

$$100x = 32.\overline{3232}$$

$$\begin{array}{r} 100x = 32 + \cancel{x} \\ - \quad \cancel{x} \end{array}$$

$$\frac{99x}{99} = \frac{32}{99}$$

$$\frac{8}{9} = 0.\overline{888}$$

$$\frac{32}{99} = 0.\overline{3232}$$

$$\frac{123}{999} = 0.\overline{123123}$$

COUNTING ELEMENTS OF SETS

The number of elements in set A is written $n(A)$.

Cardinality of set A is $n(A)$

A set which has a finite number of elements is called a **finite set**.

Infinite sets are sets which have infinitely many elements.

the sets \mathbb{N} , \mathbb{Z} , \mathbb{Z}^+ , \mathbb{Z}^- , \mathbb{Q} , and \mathbb{R} are all infinite sets

SUBSETS

Suppose P and Q are two sets. P is a **subset** of Q if every element of P is also an element of Q . We write $P \subseteq Q$.

$$P = \{4\text{-legged}\}$$
$$Q = \{\text{cats}\}$$
$$Q \subseteq P$$

We say P is a **proper subset** of Q if P is a subset of Q but is *not equal* to Q . We write $P \subset Q$.

$$Q = \{\text{even numbers}\}$$
$$P = \{4, 8, 10\}$$
$$Q \not\subseteq P$$
$$P \subseteq Q$$
$$P \subset Q$$

$$A = \{ \dots -2, 0, 2, 4, \dots \}$$

$$B = \{ \text{even integers} \}$$

$$A \subseteq B \quad B \subseteq A$$

$$A \neq B \quad B \neq A$$

UNION AND INTERSECTION

Every element in P and every element in Q is found in $P \cup Q$.



If P and Q are two sets then

- $P \cap Q$ is the **intersection** of P and Q , and consists of all elements which are in **both** P and Q .
- $P \cup Q$ is the **union** of P and Q , and consists of all elements which are in P **or** Q . or both

$$A = \{1, 3, 4\}$$

$$B = \{2, 4, 6\}$$

$$A \cap B = \{4\}$$

$$A \cup B = \{1, 2, 3, 4, 6\}$$

Two sets are **disjoint** or **mutually exclusive** if they have no elements in common.

If $P = \{1, 3, 4\}$ and $Q = \{2, 3, 5\}$

$$P \cap Q = \{3\}$$

$$P \cup Q = \{1, 2, 3, 4, 5\}$$

