

Exercises 1 Sets

Set, element, empty set, subset, universal set, intersection, union, complement

Objectives

- know and understand what a set, an element of a set, an empty set, a subset, an intersection, a union, and a complement are.
- know and understand the illustration of a set in a Venn diagram.
- be able to perform basic set operations.

Problems

1.1 Look at the sets A, B, and C:

A = Set of all cities of the world

B = Set of all European cities

C = Set of all coastal cities of the world

Find at least five elements of the following sets:

- a) $B \cap C$
- b) $B \setminus C$
- c) $C \setminus B$
- d) $A \setminus (B \cup C)$

1.2 You will find a pdf-file with scanned pages of the textbook Harshbarger/Reynolds* on Moodle:
> Additional Materials > Algebraic Concepts (Harshbarger/Reynolds)
(pages 2 to 55 of chapter “0 Algebraic Concepts” and pages A1 to A5)

Go to section “0.1 Sets” (pages 2 to 9).

- a) Study the theory (pages 2 to 6).
- b) Do the odd-numbered exercises 1 to 59 (pages 6 to 9).

*Harshbarger, R.J., Reynolds, J.J.: Mathematical Applications for the Management, Life, and Social Sciences; Houghton Mifflin Company, Boston / New York 2007, 8th edition, ISBN 978-0-618-73162-6

1.3 Decide which statements are true or false. Put a mark into the corresponding box.
In each problem a) to c), exactly one statement is true.

- a) A = Set of all cities of the world
 B = Set of all European cities

- $A \cap B = A$
- $A \cup B = B$
- $B \in A$
- $B \subset A$

- b) A is any set.

- $A \cup \{\} = \{\}$
- $A \cap A = \{\}$
- $A \setminus A = \{\}$
- $A \setminus A = A$

c) A and B are any sets.

$(A \cup B) \subset (A \cap B)$

$(A \cap B) = (A \setminus B)$

$(A \cup B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$

$(A \cap B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$

Hint:

- Draw a Venn diagram for each statement.

Answers

- 1.1 a) $B \cap C = \{\text{Lisbon, Copenhagen, Barcelona, Naples, Stockholm, ...}\}$
 b) $B \setminus C = \{\text{London, Paris, Madrid, Berlin, Rome, ...}\}$
 c) $C \setminus B = \{\text{Tokyo, San Francisco, Sydney, Rio de Janeiro, Cape Town, ...}\}$
 d) $A \setminus (B \cup C) = \{\text{Chicago, Mexico City, Nairobi, Beijing, Bogotá, ...}\}$

1.2 see Harshbarger/Reynolds (page A1)

Note:

- Only answers of the odd-numbered exercises (1, 3, 5, ...) are available.

- 1.3 a) 4th statement
 b) 3rd statement
 c) 3rd statement