Exercises 2 Numbers Number sets, intervals, absolute value

Objectives

- know the definition and elements of natural numbers, integers, rational numbers, and real numbers.
- know and understand what an open, half-open, and closed interval is.
- know and understand what the absolute value of a real number is.
- be able to perform basic operations with real numbers.

Problems

2.1 Decide whether each statement is true or false:

a)	$4 \in \mathbb{N}$	b)	$-\frac{14}{7} \in \mathbb{Z}$	c)	$\sqrt{2} \in \mathbb{Q}$
d)	$\sqrt{9} \in \mathbb{N}$	e)	$\sqrt{9} \in \mathbb{Q}$	f)	$\sqrt{9} \in \mathbb{R}$
g)	$1.67854 \in \mathbb{Q}$	h)	$1.67\overline{854} \in \mathbb{Q}$	i)	$\mathbb{N} \subset \mathbb{Z}$
j)	$\mathbb{Z} \subseteq \mathbb{Q}$	k)	$\mathbb{Q} \subset \mathbb{R}$	1)	$\mathbb{R} \setminus \mathbb{Z} = \mathbb{N}$

2.2 Determine the following sets:

a)	$\mathbb{Z} \setminus \mathbb{N}$	b)	$\mathbb{Z} \cup \mathbb{N}$	c)	$\mathbb{Z}\cap\mathbb{N}$
d)	$\mathbb{Q} \cap (\mathbb{R} \setminus \mathbb{Q})$	e)	$\mathbb{Q} \cup (\mathbb{R} \setminus \mathbb{Q})$	f)	$(\mathbb{Q}\setminus\mathbb{Z})\cap\mathbb{N}$

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

Go to section "0.2 The Real Numbers" (pages 9 to 15).

- Study the theory (pages 9 to 13). a)
- b) Do the exercises (pages 13 to 15).

*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

2.4 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)

$$N \cup \mathbb{Z} = \mathbb{Q}$$

$$\mathbb{Q} \setminus \mathbb{Z} = \mathbb{N}$$

$$\mathbb{Q} \cap \mathbb{R} = \mathbb{Q}$$

$$\mathbb{Z} \setminus \mathbb{N} = \{-1, -2, -3, ...\}$$
b)

$$\mathbb{N} = [1, \infty)$$

$$3 \in (3, 4)$$

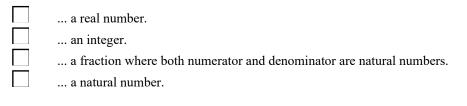
$$[3, 4] \cup (3, 4) = (3, 4)$$

$$[3, 4] \setminus (3, 4) = \{3, 4\}$$
c)
(see next page)

c)

03.02.2021

c) Assume that x is a rational number. Therefore, it can be concluded that x is ...



Answers

2.1	a)	true	b)	true	c)	false
	d)	true	e)	true	f)	true
	g)	true	h)	true	i)	true
	j)	true	k)	true	l)	false

2.2 a) $\mathbb{Z} \setminus \mathbb{N} = \{0, -1, -2, -3, ...\}$

- b) $\mathbb{Z} \cup \mathbb{N} = \mathbb{Z}$
- c) $\mathbb{Z} \cap \mathbb{N} = \mathbb{N}$
- d) $\mathbb{Q} \cap (\mathbb{R} \setminus \mathbb{Q}) = \{\}$
- e) $\mathbb{Q} \cup (\mathbb{R} \setminus \mathbb{Q}) = \mathbb{R}$
- f) $(\mathbb{Q} \setminus \mathbb{Z}) \cap \mathbb{N} = \{\}$
- 2.3 see Harshbarger/Reynolds (page A1)

Note:

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

- 2.4 a) 3rd statement
 - b) 4th statement
 - c) 1st statement