

1. Consider the following indexed sets:

$$A_1 = \{1\}$$

$$A_2 = \{2x : x \in \mathbb{N}, x > 1\} = \{4, 6, 8, 10, 12, \dots\}$$

$$A_3 = \{3x : x \in \mathbb{N}, x > 1\} = \{6, 9, 12, 15, \dots\}$$

$$A_4 = \{4x : x \in \mathbb{N}, x > 1\} = \{8, 12, 16, 20, \dots\}$$

$\vdots$

(a) In a few words, describe the set  $\bigcup_{i \in \mathbb{N}} A_i$ .

This is the set of all composite numbers, and 1

(b) Suppose  $\mathbb{N}$  is the universal set. In just a few words, describe the set  $\overline{\bigcup_{i \in \mathbb{N}} A_i}$ .

This is the set of all prime numbers

2. In parts a-d below, a sentence or expression is given. For each, say whether it is a statement, an open sentence, or neither. Also say whether it is true or false, neither true nor false, or whether that depends on the circumstances.

	Sentence or expression	Statement? Open sentence? Neither?	True? False? Neither? Depends?
(a)	$\emptyset \in \mathcal{P}(\mathbb{Z}) - \mathcal{P}(\mathbb{N})$	Statement	True
(b)	$\mathcal{P}(\mathbb{Z}) - \mathcal{P}(\mathbb{N})$	Neither	Neither
(c)	There exist integers $a$ and $b$ for which $3a + 5b = 1$ .	Statement	True
(d)	There exist integers $a$ and $b$ for which $3a + 6b = 1$ .	Statement	False

3. Complete the truth tables.

(a)

$P$	$Q$	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

(b)

$P$	$Q$	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

(c)

$P$	$Q$	$P \Rightarrow Q$
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(a) In a few words, describe the set  $\bigcup_{i \in \mathbb{N}} A_i$ .

This is the set of all composite numbers and 1

(b) In just a few words, describe the set  $\mathbb{N} - \bigcup_{i \in \mathbb{N}} A_i$ .

This is the set of all prime numbers

2. In parts a-d below, a sentence or expression is given. For each, say whether it is a statement, an open sentence, or neither. Also say whether it is true or false, neither true nor false, or whether that depends on the circumstances.

	Sentence or expression	Statement? Open sentence? Neither?	True? False? Neither? Depends?
(a)	$\{-2, 0, 1\} \in \mathcal{P}(\mathbb{Z}) - \mathcal{P}(\mathbb{N})$	statement	True
(b)	$X \cup \bar{X}$	Neither	Neither
(c)	$3a + 5b = 1.$	Open sentence	Depends
(d)	There exist integers $a$ and $b$ for which $3a + 5b = 1.$	Statement	True

3. Complete the truth tables.

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