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Assignment2-Sec1.4-1.7: Problem 7

(5 points) Library/UMN/LogicAndSetTheory/prob04.pg

This set is visible to students.

Consider the universal set \mathbb{R} , define the interval $A = [-8, 1]$, interval $B = (-1, 5)$, and C be the negative real numbers. Complete the following exercises in interval notation.

- $A \cup B =$
- $A \cap B \cap C =$
- $A \cap (B \cup C) =$
- $A^c \cup B^c \cup C^c =$
- $(C - A) \cup (B - C) =$

Note: You may write the empty set \emptyset as "EmptySet".

$|A| = \infty$
 $A = \{ -8, -7, \dots, -1, 0, 1, \dots \}$
 $|B| = \infty$
 $|C| = \infty$

$A \cap B \cap C = \{ -0.5 \}$
 any # from -1 to 0
 not including -1 or 0

$A \cap B \cap C = (-1, 0)$



$A^c \cup B^c \cup C^c = (-\infty, -1] \cup [0, \infty)$

4:38 PM Thu Sep 9

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Assignment2-Sect4-1.7

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15 points Library/Proctored/Assignments/11/Inclusion/Work_08_11_19.jpg

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There are 355 students in a college who have taken a course in calculus, 227 who have taken a course in discrete mathematics, and 122 who have taken a course in both calculus and discrete mathematics. How many students at this college have taken a course in either calculus or discrete mathematics?

105

227

355

122

105

227 - 122 = 105

355 + 122 = 233

355 + 227 = 582

233 + 105 = 460

Show Fast Answers

Email Instructor

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Pinch out for a bigger view

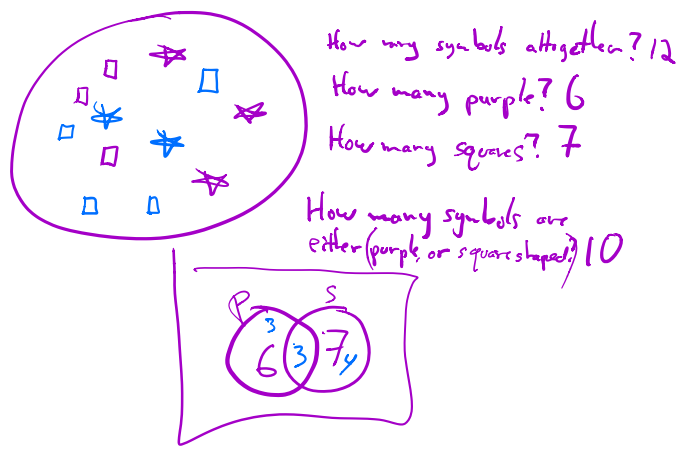
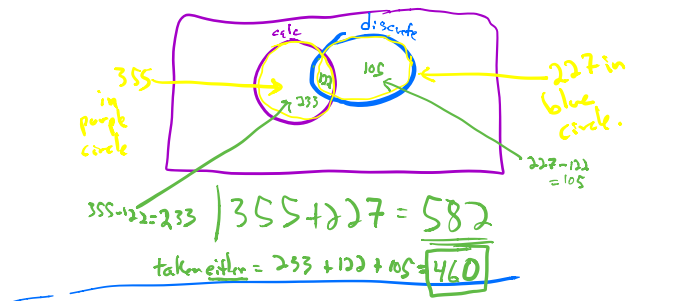
Show: Correct Answers Problem Grader

Preview My Answers Check Answers Submit Answers

You have attempted this problem 0 times. You have unlimited attempts remaining.

Not cool. So let's move back in right and right Give me just a second so I can grab a copy of it.

Jones Reitz's screen



Vocabulary

- indices - indexed sets - index set I	- logic - correct logic vs correct information - statements
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Indexed Sets

Definitions and Notation

- **Indexed sets** are sets that are distinguished by attaching subscript numbers instead of using different letters, such as A_1, A_2, A_3, A_4, A_5 . We call the number 1,2,3,4 and 5 the **indices**.
- Unions and intersections of many sets. Suppose $A_1, A_2, A_3, \dots, A_n$ are sets. Then
 - $A_1 \cup A_2 \cup A_3 \cup \dots \cup A_n = \{x : x \in A_i \text{ for at least one set } A_i, \text{ for } 1 \leq i \leq n\}$
 - $A_1 \cap A_2 \cap A_3 \cap \dots \cap A_n = \{x : x \in A_i \text{ for every set } A_i, \text{ for } 1 \leq i \leq n\}$
- Notation. Given sets $A_1, A_2, A_3, \dots, A_n$, we define
$$\bigcup_{i=1}^n A_i = A_1 \cup A_2 \cup A_3 \cup \dots \cup A_n \text{ and } \bigcap_{i=1}^n A_i = A_1 \cap A_2 \cap A_3 \cap \dots \cap A_n$$
- Definition. The **index set I** is the set of all indices (of a collection of sets).
- Notation. If I is an index set, and for each $\alpha \in I$ we have a corresponding set A_α , then
 - $\bigcup_{\alpha \in I} A_\alpha = \{x : x \in A_\alpha \text{ for at least one set } A_\alpha \text{ with } \alpha \in I\}$
 - $\bigcap_{\alpha \in I} A_\alpha = \{x : x \in A_\alpha \text{ for every set } A_\alpha \text{ with } \alpha \in I\}$

Example 1

Suppose $A_1 = \{0, 2, 5\}$, $A_2 = \{1, 2, 5\}$ and $A_3 = \{2, 5, 7\}$. Find $\bigcup_{i=1}^3 A_i$ and $\bigcap_{i=1}^3 A_i$.

Example 2

Consider the following infinite list of sets:

$$A_1 = \{-1, 0, 1\}, A_2 = \{-2, 0, 2\}, A_3 = \{-3, 0, 3\}, \dots, A_i = \{-i, 0, i\}, \dots$$

Find $\bigcup_{i=1}^{\infty} A_i$ and $\bigcap_{i=1}^{\infty} A_i$.

Example 3

Let the index set I be the interval $[4, 5)$, that is $I = [4, 5) = \{x : 4 \leq x < 5\}$.

For each number $\alpha \in I$, let the set $A_\alpha = \{x \in \mathbb{R} : \alpha \leq x \leq 6\}$.

Find $\bigcup_{\alpha \in [4, 5)} A_\alpha$ and $\bigcap_{\alpha \in [4, 5)} A_\alpha$.

Example 4

Let the index set I be the closed interval $[0, 2]$, that is $I = [0, 2] = \{x : 0 \leq x \leq 2\}$.

For each number $\alpha \in I$, let the set $A_\alpha = \{(x, \alpha) : x \in \mathbb{R}, 1 \leq x \leq 2\}$.

Find $\bigcup_{\alpha \in [0, 2]} A_\alpha$ and $\bigcap_{\alpha \in [0, 2]} A_\alpha$.

Sec 2.1 - Definitions (informal)

- The word **logic** refers to the way that humans *reason* - how we combine old information to deduce new information.
- A **statement** is a sentence or a mathematical expression that is either *definitely true* or *definitely false*.

Example 1

Suppose $A_1 = \{0, 2, 5\}$, $A_2 = \{1, 2, 5\}$ and $A_3 = \{2, 5, 7\}$. Find $\bigcup_{i=1}^3 A_i$ and $\bigcap_{i=1}^3 A_i$.

$$\bigcup_{i=1}^3 A_i = A_1 \cup A_2 \cup A_3 = \{0, 1, 2, 5, 7\}$$

$$\bigcap_{i=1}^3 A_i = A_1 \cap A_2 \cap A_3 = \{2, 5\}$$

Example 2

$$A_1 = \{-1, 0, 1\}$$

$$A_2 = \{-2, 0, 2\}$$

$$A_3 = \{-3, 0, 3\}$$

$$A_4 = \{-4, 0, 4\}$$

$$A_5 = \{-5, 0, 5\}$$

$$A_6 = \{-6, 0, 6\}$$

⋮

$$A_{127} = \{-127, 0, 127\}$$

⋮

For each natural number i ,

$$A_i = \{-i, 0, i\}$$

$$A_1 \cup A_2 \cup A_3 \cup A_4 \cup \dots =$$

$$\{-1, 0, 1\} \cup \{-2, 0, 2\} \cup \{-3, 0, 3\} \cup \{-4, 0, 4\} \cup \dots =$$

$$\bigcup_{i=1}^{\infty} A_i = \{-1, -2, -3, \dots, -2, -1, 0, 1, 2, 3, \dots\} = \mathbb{Z}$$

$$\bigcap_{i=1}^{\infty} A_i = \{0\} \rightarrow \text{or rewrite: } \bigcap_{i \in \mathbb{N}} A_i = \bigcap_{i=1}^{\infty} A_i = \{0\}$$

what is the set of all indices?

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

Ex: consider $I = [2, 4]$ the interval of the real line.

$$|I| = \infty$$

For $i \in [2, 4]$,

$$\text{let } A_i = \{(s, i)\}$$

$$A_3 = \{(s, 3)\}$$

$$A_{2.5} = \{(s, 2.5)\}$$

$$A_{2.55} = \{(s, 2.55)\}$$

$$\bigcup_{i \in I} A_i = A_2 \cup A_4 \cup A_3 \cup A_{2.5} \cup A_{2.55} \cup \dots$$

$$= \{(s, 3), (s, 2.5), (s, 2.55), \dots\}$$

$$\bigcap_{i \in I} A_i = \emptyset$$

