Algebra & Trigonometry - Sullivan (Answers)

Lucas Rocha

February 2025

0 Definitions

0.1 Intersection

If A and B are sets, the intersection of A with B, denoted $A \cap B$, is the set of all elements that belong to both A and B.

0.2 Union

The union of A with B, denoted $A \cup B$, is the set consisting of elements that belong to either A or B, or both.

0.3 Complement

If A is a set, the complement of A, denoted $\overline{A}$, is the set consisting of all the elements in the universal that are not in A.

0.4 Integers

The integers are the set of numbers $\{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$.

0.5 Rational Numbers

A rational number is a number that can be expressed as a quotient $\frac{a}{b}$ of two integers. The integer a is called the numerator, and the integer b is called the denominator. The set of rational numbers is defined as:

$$\mathbb{Q} = \left\{ x \mid x = \frac{a}{b}, \text{ where } a, b \text{ are integers and } b \neq 0 \right\}.$$

0.6 Real Numbers

The set of Real Numbers is the union of the sets of rational numbers with the sets of irrational numbers.

1 Real Numbers

1.1 Exercises 9-20

Problem: 13.
Solution:

1. Start visualizing the given sets:

$$U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\},$$
$$A = \{1, 3, 4, 5, 9\},$$
$$B = \{2, 4, 6, 7, 8\},$$
$$C = \{1, 3, 4, 6\}.$$

2. Doing the first part of this question, we have:

$$A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}, \quad \text{by the definition of union (0.2).}$$

3. Doing the second part of this question, we have:

$$(A \cup B) \cap C = \{1, 3, 4, 6\}, \quad \text{by the definition of intersection (0.1).}$$

4. **Answer:**

$$(A \cup B) \cap C = \{1, 3, 4, 6\}.$$

Problem: 17.

1. Start visualizing the given sets:

$$U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\},$$
$$A = \{1, 3, 4, 5, 9\},$$
$$B = \{2, 4, 6, 7, 8\},$$
$$C = \{1, 3, 4, 6\}.$$

2. Doing $(A \cap B)$:

$$(A \cap B) = \{4\}, \quad \text{by the definition of intersection (0.1).}$$

3. Doing $\overline{(A \cap B)}$:

$$\overline{(A \cap B)} = \{0, 1, 2, 3, 5, 6, 7, 8, 9\}, \quad \text{by the definition of intersection (0.3).}$$

4. **Answer:**

$$\overline{(A \cap B)} = \{0, 1, 2, 3, 5, 6, 7, 8, 9\}.$$

1.2 Exercises 21-26

Problem: 21. **Answer:**

$$\begin{aligned}
\text{Natural numbers} &= \{1\},\\
\text{Integers} &= \{0,1\},\\
\text{Rational numbers} &= \left\{\frac{1}{2},\frac{1}{3},\frac{1}{4}\right\},\\
\text{Irrational numbers} &= \emptyset,\\
\text{Real numbers} &= \left\{0,1,\frac{1}{2},\frac{1}{3},\frac{1}{4}\right\}.
\end{aligned}$$

1.3 Exercises 27-38

Problem: 27. **Answer:**

$$\text{(a)} : 18.953, \quad \text{(b)} : 18.952$$

Problem: 28. **Answer:**

$$\text{(a)} : 25.861, \quad \text{(b)} : 25.861$$

Problem: 29. **Answer:**

$$\text{(a)} : 28.653, \quad \text{(b)} : 28.653$$

Problem: 30. **Answer:**

$$\text{(a)} : 99.052, \quad \text{(b)} : 99.052$$

Problem: 31. **Answer:**

$$\text{(a)} : 0.063, \quad \text{(b)} : 0.062$$

Problem: 32. **Answer:**

$$\text{(a)} : 0.054, \quad \text{(b)} : 0.053$$

Problem: 33. **Answer:**

$$\text{(a)} : 9.999, \quad \text{(b)} : 9.998$$

Problem: 34. **Answer:**

$$\text{(a)} : 1.001, \quad \text{(b)} : 1.000$$

Problem: 35. **Answer:**

$$\text{(a)} : 0.429, \quad \text{(b)} : 0.428$$

Problem: 36. **Answer:**

(a) : 0.556, (b) : 0.555

Problem: 37. **Answer:**

(a) : 34.733, (b) : 34.733

Problem: 38. **Answer:**

(a) : 16.200, (b) : 16.200