

## Precalculus Worksheet 0 - Set Operations

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Two sets are *disjoint* if their intersection is empty. Write your answer either as a finite set, an interval, the union of disjoint intervals, or the union of a finite set and one or more disjoint intervals.

**Exercise 1.** Consider the following sets of natural numbers.

$$A = \{n \in \mathbb{N} \mid n \leq 25\}$$

$$E = \{n \in A \mid n \text{ is even}\}$$

$$O = \{n \in A \mid n \text{ is odd}\}$$

$$P = \{n \in A \mid n \text{ is prime}\}$$

$$S = \{n \in A \mid n \text{ is a square}\}$$

Compute the following sets.

(a)  $P$

(b)  $S$

(c)  $S \cup P$

(d)  $E \cap S$

(e)  $(P \cup S) \cap O$

(f)  $(O \setminus P) \cap (O \setminus S)$

(g)  $(O \cap S) \times (E \cap S)$

**Exercise 2.** Consider the following intervals of real numbers.

$$A = [0, 10]$$

$$B = (4, 12)$$

$$C = (-5, 7]$$

$$D = [-3, 13)$$

$$E = (5, 15]$$

Compute the following sets.

(a)  $A \cup B$

(b)  $A \cap B$

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

(d)  $(C \cup D) \setminus B$

(e)  $(C \cap D) \cup B$

(f)  $C \setminus D$

(g)  $A \cup E$

(h)  $A \cap E$

(i)  $D \setminus A$

**Exercise 3.** Compute the following sets of real numbers.

(a)  $A = [1, 20] \cap \mathbb{Z}$

(b)  $B = (5, 10) \cap A$

(c)  $C = [8, 11] \cap A$

(d)  $D = (B \cup C) \setminus (B \cap C)$

(e)  $E = [3, 10] \setminus D$

(f)  $F = (5, 18) \setminus E$

**Answer 1.** Answers to Exercise 1.

- (a)  $\{2, 3, 5, 7, 11, 13, 17, 19, 23\}$
- (b)  $\{1, 4, 9, 16, 25\}$
- (c)  $\{1, 2, 3, 4, 5, 7, 9, 11, 13, 16, 17, 19, 23, 25\}$
- (d)  $\{4, 16\}$
- (e)  $\{1, 3, 5, 7, 9, 11, 13, 17, 19, 23\}$
- (f)  $\{15, 21\}$
- (g)  $\{(1, 4), (1, 16), (9, 4), (9, 16), (25, 4), (25, 16)\}$

**Answer 2.** Answers to Exercise 2.

- (a)  $[0, 12)$
- (b)  $(4, 10]$
- (c)  $[0, 4] \cup (10, 12]$
- (d)  $(-5, 4] \cup [12, 13)$
- (e)  $[-3, 12)$
- (f)  $(-5, -3)$
- (g)  $[0, 15]$
- (h)  $(5, 10]$
- (i)  $[-3, 0) \cup (10, 13)$

**Answer 3.** Answers to Exercise 3.

- (a)  $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$
- (b)  $\{6, 7, 8, 9\}$
- (c)  $\{8, 9, 10, 11\}$
- (d)  $\{6, 7, 10, 11\}$
- (e)  $[3, 6) \cup (6, 7) \cup (7, 10)$
- (f)  $\{6, 7\} \cup [10, 18)$