Homework 5

MATH 215 | (due October 7) | September 30, 2022

Problem 1. Compute the following sets. No proof required.

1. $\Big\{a + b : a \in \{0, 5\}, b \in \{2, 4\}\Big\} \setminus \{7, 10\}$.
2. $(1, 3) \cup [2, 4)$
3. $\mathbb{Z} \cap [0, \infty)$
4. $\mathbb{N}_{even} \Delta \mathbb{N}_{+}$

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Problem 2. Suppose that $A = \{1,2,3\}$, $B = \{1,1,2,3\}$, $C = \{1,3,\pi\}$, $D = \{x \in \mathbb{Z} \mid x \notin \mathbb{N}\}$, $E = \{1,\{1,2,3\},3\}$.

1. Determine the truth and falsity of each of the following statements. No proof required

   (a) $A = B$.

   (b) $A = C$.

   (c) $A \subseteq E$.

   (d) $A \in E$.

   (e) $E \subseteq D$.

2. List all the subsets of the set E.

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Problem 3. Let X and Y be sets.

(i) Prove that $Y \setminus (Y \setminus X) = X \cap Y$.

(ii) Prove that $X \subseteq Y$ if and only if $X \cup Y = Y$.

(iii) Deduce that $X \subseteq Y$ if and only if $Y \setminus (Y \setminus X) = X$.

Problem 4. Prove that for all sets A, X, Y we have

$$A \setminus (X \cap Y) = (A \setminus X) \cup (A \setminus Y).$$

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Problem 5. Prove that if $A \cap B \subseteq C$ and $x \in A \setminus C$, then $x \notin B$.

[Hint: Prove it by contradiction.]