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11.

True/False [1 pt each] For each of the following statements, decide whether it is true or false. Put **T** or **F** on the answer sheet.

1. Let the universal set be the set of digits $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. If $A = \{4, 3, 6, 7, 1, 9\}$ and $B = \{5, 6, 8, 4\}$ then $\overline{A} \cup B = \{0, 2, 4, 5, 6, 8\}$.

2. If $A = \{a, b, c, d, e\}$, $B = \{d, e, f\}$ and $C = \{1, 2, 3\}$, then

$$(B - A) \times C = \{(e, 1), (e, 2), (e, 3), (d, 3), (d, 2), (d, 1)\}.$$

3. $\{\{\emptyset\}\} \subseteq \{\emptyset, \{\emptyset\}, \{\emptyset, \{\emptyset\}\}\}$

4. $|\{x \in \mathbb{Z} : |2x - 1| < 6\}| > |\mathcal{P}(\{2, 6\})|$

5. For each $n \in \mathbb{N}$, define a set $A_n \subseteq \mathbb{Z}$ by $A_n = \{-n, \ldots, -2, -1, 0, 1, 2, \ldots, n\}$. Then

$$\bigcup_{n \in \mathbb{N}} A_n = \mathbb{Z} \text{ and } \bigcap_{n \in \mathbb{N}} A_n = \{-1, 0, 1\}.$$

6. Let P and Q be propositions. The propositions $P \Rightarrow Q$ and $(\sim P) \vee Q$ are logically equivalent.

7. If P and Q are propositions that are true then $(P \vee Q) \wedge \sim (P \wedge Q)$ is also true.

8. $\forall x \in \mathbb{Z}\ \exists y \in \mathbb{Z}\ (x + y = 0)$

9. $\exists y \in \mathbb{Z}\ \forall x \in \mathbb{Z}\ (x + y = x)$

10. For all sets A, B, C $(A \subseteq B \wedge A \subseteq C) \Rightarrow (A \cap B = A \cap C)$.

Short answer [2 points]

11. Choose one of the true/false problems above and explain why it is true or false. Write your answer clearly and carefully. Neatness counts.