Problem §1.1: 8(a,d,f,h): Let p and q be the propositions

p: I bought a lottery ticket this week.
q: I won the million dollar jackpot.

Express each of these propositions as an English sentence.

(a) $\neg p$

(d) $p \wedge q$

(f) $(\neg p) \implies (\neg q)$

(h) $(\neg p) \vee (p \wedge q)$

Problem §1.2: 6: Use a truth table to verify the first De Morgan law $\neg(p \wedge q) \equiv \neg p \vee \neg q$.

Problem §1.4: 14(a,d): Express each of these quantifications in English, if the domain consists of all real numbers. Then, determine the truth value of the statement

(a) $\exists x(x^3 = -1)$

(d) $\forall x(2x > x)$

Problem §2.1: 10(a,c,e,g): Determine whether the following statements are true or false.

(a) $\emptyset \in \{\emptyset\}$

(c) $\{\emptyset\} \in \{\emptyset\}$

(e) $\{\emptyset\} \subset \{\emptyset, \{\emptyset\}\}$

(g) $\{\{\emptyset\}\} \subset \{\{\emptyset\}, \{\emptyset\}\}$

Problem §2.1: 16: Use a Venn diagram to illustrate the relationships $A \subset B$ and $A \subset C$.

Problem §2.1: 20: What is the cardinality of each of the following sets?

(a) $\emptyset$

(b) $\{\emptyset\}$

(c) $\{\emptyset, \{\emptyset\}\}$

(d) $\{\emptyset, \{\emptyset\}, \{\emptyset, \{\emptyset\}\}\}$

Problem §2.1: 26: Show that if $A \subseteq C$ and $B \subseteq D$, then $A \times B \subseteq C \times D$.

Problem §2.1: 32(a,c): Let $A = \{a, b, c\}$, $B = \{x, y\}$, and $C = \{0, 1\}$. Find the following Cartesian products.

(a) $A \times B \times C$

(c) $C \times A \times B$

Problem §2.2: 4: Let $A = \{a, b, c, d, e\}$ and $B = \{a, b, c, d, e, f, g, h\}$. Find:

(a) $A \cup B$.

(b) $A \cap B$.

(c) $A - B$.

(d) $B - A$.

Problem §2.2: 14: Find the sets A and B if $A - B = \{1, 5, 7, 8\}$, $B - A = \{2, 10\}$, and $A \cap B = \{3, 6, 9\}$.

Problem §2.2: 15: Prove the second De Morgan law in Table 1 by showing that if A and B are sets, then $\overline{A \cup B} = \overline{A} \cap \overline{B}$ (a) showing each side is a subset of the other side and (b) by using a membership table.

Problem §2.2: 24: Let A, B, and C be sets. Show that $(A - B) - C = (A - C) - (B - C)$.

Problem §2.2: 26: Draw the Venn diagrams for each of the following combinations of the sets A, B, and C.

(a) $A \cap (B \cup C)$

(b) $\overline{A} \cap \overline{B} \cap \overline{C}$

(c) $(A - B) \cup (A - C) \cup (B - C)$