NOTE: ALL ANSWERS TEMPORARY AND NOT CHECKED

Question 1: (Section 2.3, #2b) $B = \{ -\pi^x \mid x \leq 0 \}$.

Question 2: (Section 2.3, #5)

(a) $S = \{ x \in \mathbb{Z} \mid x \geq 5 \}$.

(b) $S = \{ 2x + 1 \mid x \in \mathbb{Z} \}$.

(c) $S = \{ x \in \mathbb{Q} \mid x > 0 \}$.

(d) $S = \{ x \in \mathbb{R} \mid 1 < x < 7 \}$.

(e) $S = \{ x \in \mathbb{R} \mid x^2 > 0 \}$.

Question 3: (Section 5.3, #2)

Proof. In order to prove equality, we show that $A \cup (B \cap C) \subseteq (A \cap B) \cup (A \cap C)$ and $(A \cap B) \cup (A \cap C) \subseteq A \cup (B \cap C)$.

($\rightarrow$) Suppose x is an arbitrary element in $A \cap (B \cup C)$. Then, $x \in A \wedge (x \in B \vee x \in C)$. By the distributive property of conjunctions and disjunctions, $(x \in A \wedge x \in B) \vee (x \in A \vee x \in C)$. By the definition of

$\square$

Question 4: (Should be question 6)

(a) False. $11 \notin B$.

(b) True. Every element in A is also in $\mathbb{Z}^+$.

(c) False. A is not an integer, and therefore is not a subset of $\mathbb{Z}^+$.

(d) True.

Question 5: (Should be question 7)

(a) False. The empty set has no elements, and the set on the RHS has 1 element.

(b) True. The empty set is a subset of every set.

(c) True. The empty set appears in the set on the RHS, and therefore is an element.

Question 6: (Should be question 8)

Proof. Suppose A and B are sets, and $A \subseteq B$. Let X be an arbitrary element of $\mathcal{P}(A)$. Then, $X \subseteq A \subseteq B$, so $X \subseteq B$. Thus, $X \in \mathcal{P}(B)$. So, an aribtrary element of $\mathcal{P}(A)$ is in $\mathcal{P}(B)$, so $\mathcal{P}(A) \subseteq \mathcal{P}(B)$.

$\square$

Question 7: (Should be question 9)

Proof. In order to show that $\mathcal{P}(A \cap B) = \mathcal{P}(A) \cap \mathcal{P}(B)$, we show that they are both are a subset of each other.

($\subseteq$) Suppose A and B are sets, and $C \in \mathcal{P}(A \cap B)$. Then, $C \subseteq (A \cap B) \to C \subseteq A$ and $C \subseteq B$. $C \subseteq A \to C \in \mathcal{P}(A)$. Similarly, $C \subseteq B \to C \in \mathcal{P}(B)$. Thus, $C \in \mathcal{P}(A) \cap \mathcal{P}(B)$.

($\supseteq$) The argument is symmetric.

□

Question 8: (Should be question 10)

$$X \times Y = \{\ (a,a),(a,b),(a,d),(c,a),(c,b),(c,d)\ \}.$$
$$Y \times X = \{\ (a,a),(b,a),(d,a),(a,c),(b,c),(d,c)\ \}.$$
$$X \times X = \{\ (a,a),(a,c),(c,a),(c,c)\ \}.$$

Question 9: (Should be question 12)

$$\bigcap_{k=1}^{\infty} A_k = \{1\}$$
$$\bigcup_{k=1}^{\infty} A_k = [1,2]$$
$$\bigcap_{k=1}^{\infty} B_k = \varnothing$$
$$\bigcup_{k=1}^{\infty} A_k = (1,2)$$

Question 10: (Should be question 13)

Proof. Let S be square with vertices $ABCD$ and side length 1, and let there be 5 points, $p_1, p_2, \ldots, p_5$. Construct 4 circles of radius $\frac{\sqrt{2}}{2}$, centered about A, B, C, D respectively. We notice that there a

□