CISC 102 (Fall 21)
Homework #1: LaTeX (20 Points)

Student Name/ID: Ryan Pleava (20279636)

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Question 1

A) $\{-2, -1, 0, 1, 2\}$

B) $\{0, 1, 4, 9, 16\}$

C) $\varnothing$

Question 2

A) There are 18 elements of $A \times B \times C$:
(1, 1, 1), (1, 1, 2), (1, 1, 3)
(1, 3, 1), (1, 3, 2), (1, 3, 3)
(2, 1, 1), (2, 1, 2), (2, 1, 3)
(2, 3, 1), (2, 3, 2), (2, 3, 3)
(3, 1, 1), (3, 1, 2), (3, 1, 3)
(3, 3, 1), (3, 3, 2), (3, 3, 3)

B) There are 4 elements of $(A \times B) \cap (B \times A)$:
(1, 1), (1, 3),
(3, 1), (3, 3)

C) There are 3 elements of $(A \times A) \backslash (A \times B)$:
(1, 2), (2, 2), (3, 3)

Question 3

A) The set $\{x \in \mathbb{N} | x > 10\}$ is infinite.
B) The set $\{x \in \mathbb{N} | x \leq 10\}$ is finite: $|\{x \in \mathbb{N} | x \leq 10\}| = 11$
C) The set $\{4, \{4\}, \{4, \{4\}\}, \{\mathbb{N}\}\}$ is finite: $|\{4, \{4\}, \{4, \{4\}\}, \{\mathbb{N}\}\}| = 4$

Question 4

$\forall x \{x \in A \to x \in B\}$
$\forall x \{x \in B \to x \in C\}$
$\therefore \forall x \{x \in A \to x \in C\}$ *By def'n of transitivity

Question 5

A) $\{\mathbb{Z}\}$ is finite: False, because $\mathbb{Z}$ is the set of integers and there are infinite integers.
B) $\{\{\mathbb{Z}\}\}$ is finite: True, because $\{\{\mathbb{Z}\}\}$ contains only one set, $\{\mathbb{Z}\}$, the set of integers itself.
C) $\{x \in \mathbb{Q} | x^2\}$ is finite: True, as there are no rational numbers that satisfy the initial condition, the cardinality of the set would be 0, and therefore be finite.
D) If A is a finite set then $| \mathcal{P}(A)| > |A|$: True, the power set will always have a greater cardinality than the set itself. $\forall n, n \in \mathbb{R} : n < 2^n$

Question 6

$\mathcal{P}(A) =$
$\{\{\varnothing\},$
$\{1\}, \{2\}, \{3\}, \{4\},$
$\{1, 2\}, \{1, 3\}, \{1, 4\}, \{2, 3\}, \{2, 4\}, \{3, 4\},$
$\{1, 2, 3\}, \{1, 2, 4\}, \{1, 3, 4\}, \{2, 3, 4\},$
$\{1, 2, 3, 4\}\}$

$|\mathcal{P}(A)| = 2^4 = 16$

Question 7

A) The number of students who speak Spanish and love dogs is 17.
B) The number of students who love dogs and cannot cook is 29.
C) The number of students who speak Spanish, are excellent cooks, and love dogs is 3.