Math 2001 - Assignment 1

Due September 4, 2020

(1) Element, subset or neither? Explain for each of the following whether $A \in B$ and $A \subseteq B$ are true or false:
   (a) $A = 4, B = \mathbb{Z}$ (b) $A = \{1, 2, 3\}, B = \mathbb{Z}$
   (c) $A = \{1, 2\}, B = \{1, 2, \{1, 2\}\}$

(2) Are the following true for $A = \{1, \{2, 3\}\}$ or not?
   (a) $\{2, 3\} \in A$ (b) $\{2, 3\} \subseteq A$ (c) $\emptyset \in A$ (d) $|A^2| = 9$.

(3) [1, Section 1.1]: Exercises 1,12,15, 29,38

(4) Write each of the following sets using a defining property (Axiom of Specification) and using a function (Axiom of Replacement):
   (a) $A = \{\ldots, -8, -4, 0, 4, 8, 12, \ldots\}$
   (b) $B = \{0, 1, 2\}$
   (c) $C =$ the set of even squares

(5) Let $A = \{0, 1\}$ and $B = \{a, b, c\}$. Enumerate the elements of the following sets:
   (a) $B \times A$ (b) $A \times \emptyset$ (c) A^3

(6) Sketch the following Cartesian products in the plane $\mathbb{R}^2$. Be careful to denote whether the boundaries of your figures are contained in the sets or not (Use dashed lines for boundaries that are not included, solid lines for boundaries that are included; read up on the notation for intervals in [1, Section 1.1] if necessary).
   (a) $\{1, 2\} \times \{0, 1, 2\}$ (b) $[0, 2] \times (1, 2]$ (b) $\mathbb{R} \times \mathbb{Z}$

REFERENCES

[1] Richard Hammack. The Book of Proof. Creative Commons, 3nd edition, 2018. Available for free: http://www.people.vcu.edu/~rhammack/BookOfProof/