MATH 140 - Lecture 1 Worksheet

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1. (a) Write out the following sets as lists:
   i. $\{n \in \mathbb{Z} : n \text{ is even}\}$
   ii. $\{n^2 : n \in \mathbb{N}\}$
   iii. $\{x \in \mathbb{Z} : |x| < 4\}$
   iv. $\{x \in \mathbb{Z} : x^2 - 1 = 0\}$
   v. $\{x \in \mathbb{Q} : x^2 - 2 = 0\}$
   vi. $\{x \in \mathbb{R} : x^2 - 2 = 0\}$

   (b) Write out the following sets in interval notation:
   i. $\{x \in \mathbb{R} : |x| < 4\}$
   ii. $\{x \in \mathbb{R} : -2 < x \leq 3\}$
   iii. $\{x \in \mathbb{R} : x > -3\}$

   (c) Are the following two sets equal?
   i. $\{2, 3, 5, 7\}$ and $\{7, 5, 2, 3\}$
   ii. $\{3n : n \in \mathbb{Z}\}$ and $\{\ldots, -6, -3, 0, 3, 6, \ldots\}$
   iii. $\{2, 3, 5, 7\}$ and $\{2, 3, 6, 7\}$
   iv. $\mathbb{Z}$ and $\{0, 1, -1, 2, -2, 3, -3, \ldots\}$

   (d) What is the cardinality or size of the following sets?
   i. $\{x \in \mathbb{N} : |x| < 5\}$
   ii. $\varnothing$
   iii. $\{\varnothing, A\}$
   iv. $\{\square, 0, B, Tom\}$

2. (a) Suppose $A = \{a, b\}$ and $B = \{c, d\}$, what are the sets $A \times B$ and $B \times A$?

   (b) Suppose $A = \{\square, \triangle\}$ and $B = \{X, Y, Z\}$, what are the sets $A \times B$ and $B \times A$?

**The examples, section numbers are from Richard Hammack's "Book of Proof".*

3. (a) List all the subsets of the set $\{a, b, c\}$.

   (b) Is it true that $\{1\} \subseteq \{1, \{1\}\}$? Why or why not?

Additional Problems

1. Suppose $A = \{\square, \lozenge, \triangle\}$, which of the following is correct or incorrect use of notation $\in, \notin, \subseteq$?

   (a) $\square \in A$

   (b) $\lozenge \subseteq A$

   (c) $\{\square, \triangle\} \subseteq A$

   (d) $\{\lozenge\} \in A$

   (e) $\{\triangle\} \subseteq A$

   (f) $\{\square, \lozenge, \triangle\} \subseteq A$

   (g) $O \notin A$

   (h) $\varnothing \subseteq A$

2. Let $A = \{x \in \mathbb{Z} : x^2 = 4\}$ and $B = \{\text{letters in English alphabet : vowels}\}$. What is the set $B \times A$? What is $|B \times A|$?

3. Write the following in set builder notation:

   (a) $\{2, 4, 8, 16, 32, 64, \ldots\}$

   (b) $\{3, 4, 5, 6, 7, 8\}$

   (c) $[-6, 7]$

   (d) The domain of the function $f(x) = \sqrt{x - 2}$

**The examples, section numbers are from Richard Hammack's "Book of Proof".*