

Math 300 In-Class Worksheet 3: Introduction to Sets

1) Let $U = \{1, 2, 3, \dots, 14, 15\}$ and $E^c = U \setminus E$. Let $A = \{1, 5, 9, 13\}$ and $B = \{3, 9, 13\}$. Determine the following:

(a) $A \cup B$

(b) $A \cap B$

(c) $A \setminus B$

(d) $B \setminus A$

(e) A^c

2) For the following sets,

- (i) compute their cardinality.
 - (ii) list all of their proper subsets
 - (iii) use part (ii) to compute the cardinality of their power sets.
- (a) $\{0, 1, 2\}$
 - (b) $\{0, \{1, 2\}\}$
 - (c) $\{1, \{2, \{3\}\}\}$

Do you see a relationship between the cardinality of these sets and the cardinality of their power sets?

3) Determine whether the following statements are true or false.

(a) $2 \in \mathbb{N}$

(b) $1/2 \in \mathbb{N}$

(c) $1/2 \in \mathbb{Q}$

(d) $2 \in \mathbb{R}$

(e) $\{1/2, 2\} \in \mathbb{R}$

4) a) The Collector has a balancing scale and seven orbs that he can't open, one of which contains the Reality Gem (or Stone, if you must). He knows that the orb with the Reality Gem in it must be heavier than the other six, but he can't perceive it. He could weigh them two at a time, but unfortunately, he only has time for two weighings before Thanos busts in and steals all the orbs from him, and he can only carry one orb with him.

How does the Collector determine which orb contains the Reality Gem?

b) Now suppose the Collector knows either six of the orbs have Infinity Gems in them or only one does, but he doesn't know which. Can he figure out which case he is in with only two weighings, or is he doomed no matter what?