

Name: _____
MATH 307
Spring 2023
HW 1: Due 02/13 (14)

"I am always doing that which I cannot do, in order that I may learn how to do it."

–Pablo Picasso

Problem 1. (10pt) Define the following sets:

A = the set of geometric objects colored blue

B = the set of triangles

C = the set of circles

D = the set of 'large' geometric objects

E = the set geometric objects colored red

Describe the shapes found in the following sets:

(a) $A \cap C$

(b) $B \cap D$

(c) $B \cup C$

(d) $C \cap E^c$

(e) $B \cap A \cap D$

Problem 2. (10pt) Define the following subsets of the integers: $S = \{n : n = 3k+1 \text{ for some integer } k\}$, T is the set of even numbers, and $U = \{1, 2, 3, 4, 5, 6\}$.

- (a) Is $5 \in S$? Explain.
- (b) Is $10 \in S$? Explain.
- (c) Find $S \cap U$.
- (d) What is the value of $|U - T|$?

Problem 3. (10pt) You are teaching a class where you are introducing the concept of cardinality or 'size' of a set.

- (a) You define a set S to be the set of grains of sand found in all the beaches across the world. You ask students whether or not S is finite. Your class decides that the set S is infinite. Are they correct? Explain.
- (b) You ask your students whether the set $[1, 6)$ is finite or infinite. You break your students into groups. One of the groups states that because $[1, 6) = \{1, 2, 3, 4, 5, 6\}$ that the set is finite. Are they correct? If they are correct, explain why. If they are not correct, state everything they have done incorrectly and give the correct answer.

Problem 4. (10pt) Students are studying for their state exams. They are given the sets $A = \{1, 2, 3, 4, 2, 3\}$, $B = \{1, 2, 3, 4\}$, and $C = \{5, 4, 3, 2, 1\}$.

- (a) Students claim that $A \neq B$ because A has more elements than B . Are they correct? Explain.
- (b) Students claim that $B \not\subseteq C$ because the elements of C appear in the reverse order of the elements of B . Are they correct? Explain.