Our goal is to review our highschool *set theory* and, using what we have learned thus far in Math 300, make a transition from a high school to an advanced math viewpoint.

Defs. **Definitions.** Let A_1 and A_2 be subsets of a universal set U. $\langle$eg, $U = \mathbb{R}^2$ & draw 2 subsets A_1 and A_2 in $\mathbb{R}^2\rangle$ §5.1 p216

a. The **union** of A_1 and A_2, denoted $A_1 \cup A_2$, is the set of all elements that are in A_1 or A_2. Thus

$$A_1 \cup A_2 \overset{\text{def}}{=} \{x \in U \colon x \in A_1 \ \text{ or } \ x \in A_2\} \underset{\text{notation}}{\overset{\text{other}}{=}} \bigcup_{i=1}^{2} A_i$$

$$\overset{\text{note}}{=} \{x \in U \colon \text{there exists an } i \in \{1,2\} \text{ such that } x \in A_i\} \underset{\text{notation}}{\overset{\text{other}}{=}} \bigcup_{i \in \{1,2\}} A_i$$

b. The **intersection** of A_1 and A_2, denoted $A_1 \cap A_2$, is the set of all elements in both A_1 and A_2. So

$$A_1 \cap A_2 \overset{\text{def}}{=} \{x \in U \colon x \in A_1 \ \text{ and } \ x \in A_2\} \underset{\text{notation}}{\overset{\text{other}}{=}} \bigcap_{i=1}^{2} A_i$$

$$\overset{\text{note}}{=} \{x \in U \colon \text{ for all } i \in \{1,2\} \text{ we have that } x \in A_i\} \underset{\text{notation}}{\overset{\text{other}}{=}} \bigcap_{i \in \{1,2\}} A_i$$

c. The **relative complement of** A_1 **with respect to** A_2, also called A_2 **set minus** A_1, is the set

$$A_2 - A_1 \overset{\text{def}}{=} \{x \in U \colon x \in A_2 \ \text{ and } \ x \notin A_1\} \underset{\text{notation}}{\overset{\text{other}}{=}} A_2 \setminus A_1.$$

d. The **complement** of A_1, denoted $(A_1)^C$, is the set of all elements of U that are not in A_1. So

$$(A_1)^C \overset{\text{def}}{=} \{x \in U \colon x \notin A_1\} \overset{\text{note}}{=} U - A_1$$

▹. Read the beginning of section 5.1, up to but not including **Set Equality, Subsets, and Proper Subsets**. §5.1 p215–218

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►. Let the universe be $\mathbb{N}$ and consider the follow subsets of $\mathbb{N}$. (Recall that $\mathbb{N} \underset{\text{Method}}{\overset{\text{Roster}}{=}} \{1, 2, 3, 4, 5, 6, 7, \ldots\}$.)

$A_1 = \{x \in \mathbb{N} \colon x \geq 7\}$ $\qquad$ $A_2 = \{x \in \mathbb{N} \colon x \text{ is odd}\}$

$A_3 = \{x \in \mathbb{N} \colon x \text{ is a multiple of } 3\}$ $\qquad$ $A_4 = \{x \in \mathbb{N} \colon x \text{ is even}\}$

Use the roster method to list all of the elements of each of the below 5 sets. (Can do on copy of this ER.)

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1. $A_1 \cap A_2 =$ ______________________________

2. $A_1 \cup A_2 =$ ______________________________

3. $(A_1 \cup A_2)^C =$ ______________________________

4. $(A_1)^C \cap (A_2)^C =$ ______________________________

5. $A_1 - A_4 =$ ______________________________