1. Find the union and intersection of each of the following pairs of sets:

(a) $\{1, 2\}$ and $\{1, 0\}$

(b) $\varnothing$ (empty set) and $\{-1, 0, 1, 2\}$

(c) $\mathbb{R}$ (real numbers) and $\mathbb{Q}$ (rational numbers)

(d) $(-\infty, 0]$ (all the negative real numbers and 0), and $[0, \infty)$ (all the positive real numbers and 0)

(e) $(-\infty, 0)$ and $(0, \infty)$. Note that the only difference between these ones and the previous sets is these ones don't include 0.

(f) $\{n \in \mathbb{Z} : n \text{ is odd}\}$ and $\{n \in \mathbb{Z} : n \text{ is even}\}$. In case it's useful the formal definition of an odd number is a number that can be written $2k + 1$ for some integer k, and an even number can be written $2k$ (could be different k).

(g) $\mathbb{Q}$ (rational numbers) and $\mathbb{Z}$ (integers).

2. Which of the pairs of sets in problem 1 are disjoint?

3. For some of the pairs of sets in problem 1, one of the sets is a subset of the other one. Which pairs of sets have this property, and for those pairs, which set is a subset of the other one? *For example, in part (c) $\mathbb{Q}$ is a subset of $\mathbb{R}$, since every rational number is also a real number. We write this $\mathbb{Q} \subset \mathbb{R}$. In (a), neither set is a subset of the other one because* 2 *is in the first set but not the second, and* 0 *is in the second set but not the first.*

4. Find the complement of the following sets:

(a) $\{0, 1\}$, the universe set is $\{0, 1, 2, 3, 4, 5, 6, 7\}$.

(b) $\{n \in \mathbb{Z} : n \text{ is even}\}$, the universe set is $\mathbb{Z}$.

(c) $[0, 1]$ (the interval from 0 to 1 including the endpoints), the universe set is $\mathbb{R}$.

(d) $(0, 1)$ (the interval from 0 to 1 not including the endpoints), the universe set is $\mathbb{R}$.

5. What is the cardinality of the following sets? It will either be a positive integer (could be 0 but only if it's the empty set) or infinite (∞).

(a) $\{0, 2, 4, 6\}$

(b) $\{0\}$

(c) $\mathbb{R}$

(d) $\mathbb{Z} \cap (\mathbb{R} - \mathbb{Q})$

6. Write the sets in (d) and (e) of problem 1 in set-builder notation:

$\{x \in \{\text{bigger set}\} : \text{ condition on } x\}$

The sets in part (f) of problem 1 are the odd integers and even integers (respectively) written in set builder notation, for an example.