# Homework 3

1. Below are pictures of three boxes: a small box inside a medium box inside a large box. Inside some of those boxes are up to three black cats: Tofu, Porco and Dragon. These are my brother's cats, and they received a considerable amount of edible compensation for their work on this project.

   For each picture, write down the set representing each of these, as discussed in the chapter. For example, one answer might be {Tofu, {{Porco}}}.

(a)

(d)

(b)

(e)

(c)

(f)
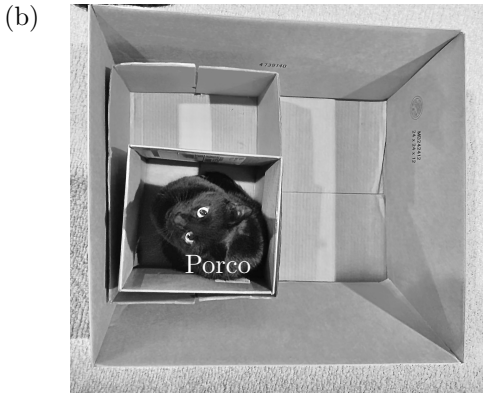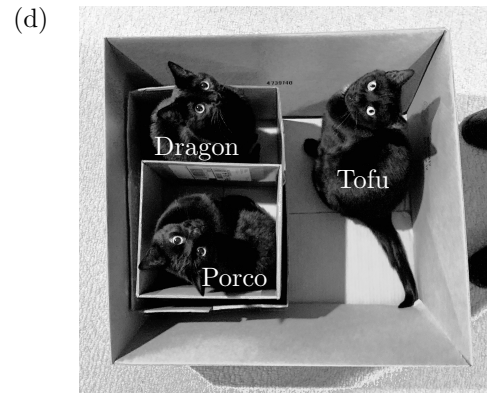
2. Rewrite each of the following sets by listing their elements between braces. If it is an infinite set, write out enough elements for the reader to see the pattern, then use ellipses.

   (a) $\{n \in \mathbb{Z} : -5 \leq n < 4\}$

   (b) $\{n \in \mathbb{N} : -5 \leq n < 4\}$

   (c) $\{1, 3, 4, 5\} \times \{\odot, \text{math}\}$

   (d) $\mathcal{P}(\{a, 2, \square\})$

3. The set $\{5a + 3b : a, b \in \mathbb{Z}\}$ is equal to a familiar set. By examining which elements are possible, determine the familiar set.

4. For sets A, B and C, and a universal set U, draw the Venn diagram representing each of the following.

   (a) $(A \setminus B)^c$

   (b) $A \cup (B \setminus C)$.

5. Prove that
$$\{n \in \mathbb{Z} : n \equiv 1 \pmod 4\} \nsubseteq \{n \in \mathbb{Z} : n \equiv 1 \pmod 8\}.$$

6. Prove that
$$\{8a + 17b : a, b \in \mathbb{Z}\} = \mathbb{Z}.$$