

# Math 3A03 - Tutorial 5 Questions - Winter 2019

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**Problem 1.** Which of the following sets are countable:

(a)  $\mathbb{R} \setminus \mathbb{Q}$ .

(b)  $\{\frac{1}{n} : n \in \mathbb{N}\}$ .

(c)  $A \times B = \{(a, b) : a \in A, b \in B\}$ , where  $A$  and  $B$  are countable.

(d)  $\mathbb{Q} \cup (\sqrt{2}\mathbb{Q})$ , where  $\sqrt{2}\mathbb{Q} = \{\sqrt{2}q : q \in \mathbb{Q}\}$ .

**Problem 2.** Let  $A, B$  be countable sets, and  $\mathcal{C} = \{a + bi : a \in A, b \in B\}$ , where  $i^2 = -1$ , prove that  $\mathcal{C}$  is countable.

**Problem 3.** Show that every interior point is an accumulation point.

**Problem 4.** Write the open interval  $(0, 2)$  as a union of closed sets. Can it be expressed as an intersection of closed sets?

**Problem 5.** (a) Find the closure, interior points, accumulation points, and boundary points of the set  $[0, \sqrt{5}] \cap \mathbb{Q}$ . Is this set open? Is it closed?

(b) Show that  $(0, 3)$  is open.

(c) Show that  $[0, 3]$  is closed.