NB: Please deposit your solutions in the appropriate box **by 4 p.m. on the due date.** Late assignments or assignments placed into incorrect boxes will not be marked. Use a mathematics department cover sheet. These are available from outside the Resource Centre. PLEASE SHOW ALL WORKING. Also if we believe you have COPIED someone else's script or that you have let someone else COPY YOUR SCRIPT, then you will get NO MARKS.

1. Suppose that X is a poset with a partial ordering $\leq$. Show that X has at most one least element.

2. Explain why the collection of sets $A = \{2, 3, 7\}, B = \{4, 5, 6\}, C = \{1, 8, 3\}$ is not a partition of the set $\{1, 2, 3, 4, 5, 6, 7, 8\}$.

3. Define a relation $\sim$ on the Cartesian plane $\mathbb{R}^2$ by,

$$(x, y) \sim (u, v) \text{ if and only if } 3x + 2y = 3u + 2v,$$

for (x, y) and (u, v) elements of $\mathbb{R}^2$.

(a) Show that $\sim$ is an equivalence relation.

(b) Give a geometrical description of the equivalence class $[(a, b)]$.

4. Prove that if functions $f : A \to B$ and $g : B \to C$ are one-to-one then so is $g \circ f$.

5. Suppose that X is a poset with a partial ordering $\leq$ and A a subset of X. Define L_A by,

$$L_A := \{x \in X \ : \ x \text{ is a lower bound for A}\}.$$

Suppose that L_A has a least upper bound b. Show that b is a greatest (or largest) lower bound for A.