NB: You are to work individually on assignments. You may do all your other work together. If we believe you have **worked together**, let alone COPIED someone else's script or let someone else COPY YOUR SCRIPT, then you will get NO MARKS.

1. Let G be a group and let H be a subgroup of G. The partition Ω of Lemma 1.86 gives, (and is given by) an equivalence relation, $\sim$, say.

(a) (6 marks) Show that for all x and y in G, $x \sim y \Leftrightarrow x^{-1}y \in H$.

(b) (3 marks) Let $n \in \mathbb{N}$ be given. We know the relation $\sim$ of congruence modulo n, which gives the partition $\mathbb{Z}_n$ of $\mathbb{Z}$. See class notes on Natural Numbers, etc, page 24. Find the subgroup H of $(\mathbb{Z}, +)$ which gives congruence modulo n as an example of the equivalence relation in (a).

2. In S_3, using the notation of Ex 1.20,

(a) (6 marks) show which of these subsets are subgroups. $H_1 = \{e\},\ H_2 = \{e, \alpha\},\ H_3 = \{e, \beta\},\ H_4 = \{e, \gamma\},\ H_5 = \{e, \phi\},\ H_6 = \{e, \psi\},\ H_7 = \{e, \phi, \psi\},\ H_8 = \{e, \alpha, \beta\},\ H_9 = \{e, \alpha, \beta, \phi\}$.

(b) (4 marks) For the subgroups H_2 and H_7, list their left cosets.