

**Homework # 12- Due Tuesday 2/28/06, Assigned Thursday  
2/23/06**

1. Let  $\phi : G \rightarrow H$  be a homomorphism and  $K = \ker\phi$ . We proved in class that  $K \trianglelefteq G$ . Let  $g \in G$ . Prove that:

$$gK = \phi^{-1}(\phi(g)).$$

I.e. we are proving that the elements of the coset  $gK$  are exactly the elements of  $G$  that map to  $\phi(g)$ . Hint: You are proving an equality of two sets. Thus you should show the LHS is contained in the RHS and vice versa.

2. Let  $H \trianglelefteq G$  and define  $\phi : G \rightarrow G/H$  by:

$$\phi(g) = gH.$$

Show that  $\phi$  is onto and the kernel of  $\phi$  is  $H$ .