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Quiz for November 17, 2011

Let $\varphi\colon G \to G'$ be a group homomorphism. Consider $\bar{\varphi} : \frac{G}{\ker\varphi} \to \operatorname{im}\varphi$, which is given by $\bar{\varphi}(g\ker\varphi) = \varphi(g)$. Prove that $\bar{\varphi}$ is a FUNCTION. That is, if $g_1\ker\varphi$ and $g_2\ker\varphi$ are equal cosets, then prove that $\bar{\varphi}(g_1\ker\varphi) = \bar{\varphi}(g_2\ker\varphi)$.

Answer: We are given that $g_1 = g_2k$ for some element $k \in \ker\varphi$. We see that

$$\bar{\varphi}(g_1\ker\varphi) = \varphi(g_1) = \varphi(g_2k) = \varphi(g_2)\varphi(k) = \varphi(g_2) = \bar{\varphi}(g_2\ker\varphi).$$