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Mathematics 309a: Abstract Algebra
Winter Semester 2009
David Haines
Quiz #10
March 5

Define a function $\phi : Z_5 \times Z_5 \to Z_5 \times Z_5$ by $\phi(x, y) = (x - y, x + y)$

A. What is $\phi((a,b) + (c,d))$?

B. What is $\phi((a,b)) + \phi((c,d))$?

C. Let $(x, y) \in Z_5 \times Z_5$. Prove that ϕ is onto by finding an element (a,b) in $Z_5 \times Z_5$ such that $\phi(a,b) = (x, y)$. Note that your formulas for a and b will be in terms of x and y.

D. Determine $\ker\phi$, the kernel of ϕ, i.e. all elements (a,b) such that $\phi(a,b) = (0,0)$

E. What do your answers to A-D prove about ϕ ?