

MAT 261 HOMEWORK 9: DUE **Monday**, Nov. 13

- (1) Let $\phi : \mathbf{R} \rightarrow \mathbf{R}$ be defined by the formula $\phi(x) = 2x + 1$. Prove that ϕ is both 1-1 and onto.
- (2) Let $h : \mathbf{R} \rightarrow \mathbf{R}$ be defined by the formula $h(x) = -2x^2 - 4x + 3$. Prove that h is neither 1-1 nor onto.

- (3) Let $F : \mathbf{R}^2 \rightarrow \mathbf{R}$ be defined by the formula

$$F(x, y) = 2x + 5y + 1.$$

Determine whether or not F is 1-1, and whether or not F is onto.

- (4) For sets A, B and C , suppose $f : A \rightarrow B$ and $g : B \rightarrow C$ are functions, so that

$$g \circ f : A \rightarrow C.$$

Prove or give a counterexample for each statement:

- (a) If $g \circ f$ is 1-1, then g is 1-1.
- (b) If $g \circ f$ is 1-1, then f is 1-1.
- (c) If $g \circ f$ is onto, then f is onto.
- (d) If $g \circ f$ is onto, then g is onto.