1. State each definition and draw helpful pictures.

   (a) The relation R from A to B is a function if

   (b) The function f from A to B injective if

   (c) The function f from A to B surjective if

2. Let $f : \mathbb{R} - \{0\} \to \mathbb{R} - \{1\}$ be a function defined by $f(x) = \frac{x+1}{x}$. Prove that f is injective and surjective.

3. Let $f : \mathbb{Z} \times \mathbb{Z} \to \mathbb{Z}$ be a function defined by $f(m,n) = 2m - 6n$. Prove that f is neither injective nor surjective.

4. For each function below, determine if it is injective or surjective and prove your answer is correct. If the function is not surjective, determine its range.

   (a) $f : \mathbb{Z} \times \mathbb{Z} \to \mathbb{Z}$ defined as $f(m,n) = 2m - 3n$.

   (b) $\theta : \{0,1\} \times \mathbb{N} \to \mathbb{Z}$ defined as $\theta(a,b) = (-1)^a b$.

   (c) $g : \mathbb{N} \to \mathbb{Z}$ defined as $g(n) = \begin{cases} \frac{n}{2} & n \text{ even} \\ (-1)^{\frac{n-1}{2}} & n \text{ odd} \end{cases}$