

## Math 300 – Relations

1. For each of the following relations find the domain and range and **prove** that the sets you found are the domain and range for the given relation.
  - (a) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $A = \{(x, y) \mid y = 3(x - 1)^2 + 2\}$ .
  - (b) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $B = \{(x, y) \mid y = x^2 - 8x + 9\}$ .
  - (c) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $C = \{(x, y) \mid x^2 - y^2 = 1\}$ .
  - (d) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $D = \{(x, y) \mid xy = x^2 - 1\}$ .
  - (e) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $E = \{(x, y) \mid \sqrt{1 - x} = (x + 1)y\}$ .
  - (f) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $F = \{(x, y) \mid xy = 0\}$ .
  - (g) From  $\mathbf{Z}$  to  $\mathbf{Z}$ ,  $G = \{(x, y) \mid x \geq y\}$
  - (h) From  $\mathbf{N}$  to  $\mathbf{N}$ ,  $H = \{(x, y) \mid 2 \text{ divides } xy\}$ .
  - (i) From  $\mathbf{Z}$  to  $\mathbf{Z}$ ,  $J = \{(x, y) \mid x - y \text{ is odd}\}$
  - (j) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $K = \{(x, y) \mid x - y \text{ is irrational}\}$ .
  - (k) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $L = \{(x, y) \mid x \geq y\}$ .
  - (l) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $M = \{(x, y) \mid y = \sqrt{x^2}\}$ .
  - (m) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $P = \{(x, y) \mid x - y \text{ is an integer}\}$ .
  - (n) From  $\mathbf{R}$  to  $\mathbf{R}$ ,  $Q = \{(x, y) \mid xy = \pm 1\}$ .
  - (o) From  $\mathbf{Z}$  to  $\mathbf{Z}$ ,  $R = \{(x, y) \mid x - y \text{ is divisible by } 7\}$
  - (p) From  $\mathbf{Z}$  to  $\mathbf{Z}$ ,  $S = \{(x, y) \mid x + y \text{ is even}\}$
  - (q) From  $\mathbf{R}^2$  to  $\mathbf{R}^2$ ,  $T = \{((a, b), (c, d)) \mid db = ac\}$ .
  - (r) Let  $A \subseteq \mathbf{N}$ . From  $\mathbf{N}$  to  $\mathbf{N}$ ,  $U = \{(x, y) \mid (x \in A \wedge y \in A) \vee (x \notin A \wedge y \notin A)\}$ .