Worksheet 6

RELATIONS: INVERSES, COMPOSITIONS, ETC.

DR. M. P. M. M. MCLOUGHLIN

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Def. 14.1 : Let the universe be $U = \mathbb{R}$ and let $k \in \mathbb{R}$. Define the set $\mathbb{Z}_k^*$ be defined as $\{x : x \in \mathbb{Z} \wedge |x| \leq k\}$.
For example, we can readily see (we hope) that $\mathbb{Z}_\pi^* = \mathbb{Z}_3^* = \{-3, -2, -1, 0, 1, 2, 3\}$

Exercise 14.1 : Let the universes $L = U \times V$ and $K = V \times W$ be defined from the well defined universes $U = \mathbb{N}_5, V = \mathbb{Z}_1^*$, and $W = \{-4, -2, 2, 4\}$.

14.1.1: Let $P \subseteq L \ni P = \{(a, b) : b = |a - 1|\}$ Find $dom(P)$, $cod(P)$, $cor(P)$, and $ran(P)$.

14.1.2: Let the universe $J = V \times U$. Find P^{-1} $dom(P^{-1})$, $cod(P^{-1})$, $cor(P^{-1})$, and $ran(P^{-1})$.

14.1.3: Find $P^{-1} \circ P$. Of what universe is this a subset?

14.1.4: Find $P \circ P^{-1}$. Of what universe is this a subset?

Exercise 14.2 : Let the universes $L = U \times V$ and $K = V \times W$ be defined from the well defined universes $U = \mathbb{N}_5, V = \mathbb{Z}_1^*$, and $W = \{-4, -2, 2, 4\}$.

14.2.1: Let $R \subseteq L \ni R = \{(5, 1), (4, 0), (4, 1), (3, -1)\}$.
Let $M \subseteq K \ni M = \{(0, -4), (0, -2), (-1, -4)\}$.

14.2.2: Find $M \circ R$, if it exists. Of what universe is this a subset?

14.2.3: Find $R \circ M$, if it exists. Of what universe is this a subset?

14.2.4: Find $M^{-1} \circ R^{-1}$, if it exists. Of what universe is this a subset?

14.2.5: Find $R^{-1} \circ M^{-1}$, if it exists. Of what universe is this a subset?

14.2.6: Find $dom(R)$, $cod(R)$, $cor(R)$, and $ran(R)$.
Find $dom(M)$, $cod(M)$, $cor(M)$, and $ran(M)$.