Q0804. For each of the following binary relations on a set S, figure out whether or not the relation is reflexive. Then figure out whether or not it is symmetric. Finally figure out whether or not the relation is transitive.

(i) $S = \mathbf{R}$, $a \sim b$ if and only if $a \leq b$.

(ii) $S = \mathbf{Z}$, $a \sim b$ if and only if $a - b$ is the square of an integer.

(iii) $S = \mathbf{R}$, $a \sim b$ if and only if $a = b^2$.

(iv) $S = \mathbf{Z}$, $a \sim b$ if and only if $a + b = 0$.

(v) $S = \mathbf{R}$, $a \sim b$ if and only if $a - b$ is an integer.

(vi) $S = \{1, 2, 3, 4\}$, $a \sim b$ if and only if $a = 1$ and $b = 3$.

(vii) S is the empty set (and $\sim$ is the only possible binary relation on that set, the empty binary relation).