1. The relation is symmetric. Suppose . That means there is a prime number p such that and . Which means that .

The relation is reflexive. Suppose . Let . That means there is a prime number such that and . Since they are the same, if one is false then the other is and if one is true then the other is. Which means .

The relation is not irreflexive. For example, Let and . There is a prime number p such that and , namely . Therefore the relation holds true.

The relation is not antisymmetric. For example, let and . There is a prime number such that and , namely . Then, let and . There is a prime number such that and , namely . Therefore the relation holds true.

The relation is not transitive. Let , , and . There is a prime number such that and , namely . There is also a prime number such that and , namely . However, there is no prime number such that and .

1. Suppose and are relations such that .

Let . That means . So, . Therefore, . Thus,

⊇ Let . That means . So, . Therefore, . Thus, .

Therefore .

1. ⇒ Suppose the relation on set is symmetric. That means .

⊆ Let . By the definition of the inverse of a relation, . Since is symmetric, as well. Which means . Therefore .

⊇ Let . By the definition of the inverse of a relation, . Since is symmetric, as well. Therefore .

Therefore .

⇐ On the other hand, suppose . That means that and . By the definition of the inverse of a relation, we know that since then . Therefore is symmetric.

1. Suppose that such that By definition of the relation, . That means there is an integer such that . , or , which means there is an integer such that , namely . That means Therefore , which means the relation is symmetric.

The relation is reflexive since . This is true because there is an integer such that , namely .

Suppose that and . Let and . That means and . So, there is an integer such that and there is an integer such that , and . So Which means there is an integer such that , namely . So, . Therefore and the relation is transitive.

1. Suppose that such that By definition of the relation, or . That means or . So, by definition of the relation, . Therefore the relation ∘ is symmetric.

The relation ∘ is irreflexive because there is no such that or .

The relation ∘ is not reflexive because and . For example, and .

The relation ∘ is not antisymmetric. For example, and but .

The relation ∘ is not transitive. For example, but .

1. Suppose that sets and are subsets of ℤ and That means |A| = |B|, which can also be written as |B| = |A|. So . Therefore the relation is symmetric.

The relation is reflexive since .

Suppose that sets and are subsets of ℤ and and . That meansand Since, So . Therefore the relation is transitive.

The relation is not irreflexive because for all subsets of ℤ. For example, let Then and , so .

The relation is not antisymmetric. For example, let and let }. Then and and . so , but .

1. 1. The relation is not reflexive because there is no .

The relation is not irreflexive because .

The relation is not symmetric because but not .

The relation is not antisymmetric because and and .

The relation is not transitive because and but not .

1. The inverse of “less than or equal to” is “greater than”. Its complement is “greater than”.