

Practice with Transitivity, Symmetry, and Reflexivity

A relation R is **transitive** if and only if, whenever aRb and bRc , then aRc .

Example: $5 > 4$ and $4 > 0$ then $5 > 0$. The “greater than” relation in arithmetic is transitive.

A relation R is **symmetric** if and only if, whenever aRb , then bRa .

Example: $12/4 = 3$, and $3 = 12/4$. The equality relation in arithmetic is symmetric.

A relation R is **reflexive** if and only if, whenever aRb , we also have aRa and bRb .

Example: In arithmetic, equality is reflexive ($12/4 = 12/4$ and $3 = 3$), but the greater than relation is not (If $5 > 4$, then $4 \not> 5$).

I. Determine whether the following relations are transitive, or not transitive. Circle the appropriate choice.

a. _____ loves _____ [transitive not transitive]

b. _____ is the brother of _____ [transitive not transitive]

c. _____ sits beside _____ [transitive not transitive]

d. _____ is taller than _____ [transitive not transitive]

e. _____ weighs the same as _____ [transitive not transitive]

f. _____ is the same person as _____ [transitive not transitive]

II. Determine whether the following relations are symmetric, or not symmetric. Circle the appropriate choice.

a. ____ loves ____ [symmetric not symmetric]

b. ____ is the brother of ____ [symmetric not symmetric]

c. ____ sits beside ____ [symmetric not symmetric]

d. ____ is taller than ____ [symmetric not symmetric]

e. ____ weighs the same as ____ [symmetric not symmetric]

f. ____ is the same person as ____ [symmetric not symmetric]

III. Determine whether the following relations are reflexive, or not reflexive. Circle the appropriate choice.

a. ____ loves ____ [reflexive not reflexive]

b. ____ is the brother of ____ [reflexive not reflexive]

c. ____ sits beside ____ [reflexive not reflexive]

d. ____ is taller than ____ [reflexive not reflexive]

e. ____ weighs the same as ____ [reflexive not reflexive]

f. ____ is the same person as ____ [reflexive not reflexive]

IV. An **equivalence relation** is a relation which is transitive, symmetric, and reflexive.

Which two of the six relations above are equivalence relations?