

Provide a clear and organized presentation.

1. Determine if each of the following relations is reflexive, symmetric, or transitive:

i) xRy means that the plane shape x is similar to the plane shape y .

ii) xRy means person x is a next door neighbor to person y .

iii) xRy means planet x is in the same solar system as planet y .

2. Consider the following relations:

i) fRg means that the graph of the function f is the mirror image of the graph of g through the line $y = x$. Under what conditions is this relation reflexive? Symmetric? Transitive? (an appropriate answer might be always, or never)

ii) xRy means the real number x is not equal to the real number y .

iii) xRy means the natural number x is a factor of the natural number y .

3. Determine the explicit formula for the following sequence two different ways (the reverse side of the page is blank):

$$a_n = a_{n-1} + 12a_{n-2} \text{ and } a_0 = 2, a_1 = 3$$

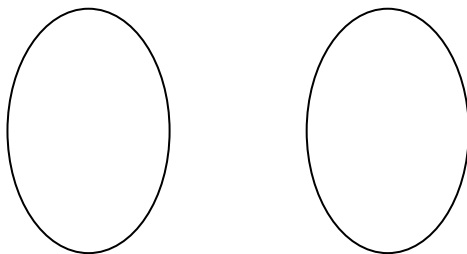
4. My cat Pythagoras two pet mice and my other cat Theta has three rats. My third cat, Jolie, wishes to play with some of these critters. Use generating functions to determine how many ways can she choose an odd number of these critters?

5. Consider two functions $g: A \rightarrow B$ and $f: B \rightarrow C$. Let $f \circ g$ be 1-1. Is g necessarily 1-1? If so, prove it. Otherwise, provide a counterexample.

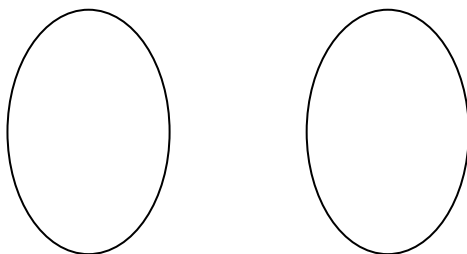
6. Consider the functions $g : A \rightarrow B$ and $f : B \rightarrow C$. Let both f and $f \circ g$ both be onto. Is g necessarily onto? If so, prove it. Otherwise, provide a counterexample.

7. Use the following Venn diagrams to provide an example of the type of function identified:

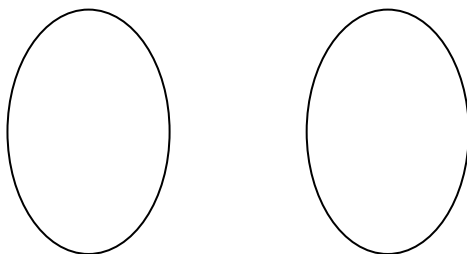
i) f is 1-1, but not onto:



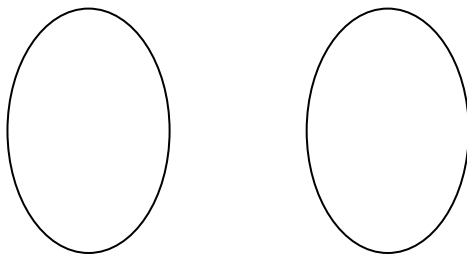
ii) f is onto, but not 1-1:



iii) f is neither 1-1 nor onto:



iv) f is both 1-1, and onto:



8. What is the difference between a Hamiltonian circuit and a Euler circuit?