

4.1 Definitions, Diagrams, and Inverses

4.1.1 Function Terminology

Question 1

Given the function:

$$g : \mathbb{Z} \rightarrow \mathbb{N} \quad \dots \text{with the rule} \dots \quad g(x) = x^2$$

- a. What is the function name? g
 - b. What is the domain? \mathbb{Z}
 - c. What is the codomain? \mathbb{N}
 - d. Is 2 a valid domain value? **Yes**
 - e. Is -2 a valid domain value? **Yes**
 - f. Is 4 a valid codomain value? **Yes**
 - g. Is -4 a valid codomain value? **No**
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Question 2

- a. Define a function where the inputs and outputs are integers, and the relationship is that the output is the *square* of the input provided to the function.

$$f : \mathbb{Z} \rightarrow \mathbb{Z}, \text{ with } f(x) = x^2$$

- b. Draw a diagram of the function. Include 5 values in the domain and in the co-domain.
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4.1.2 Binary Relations

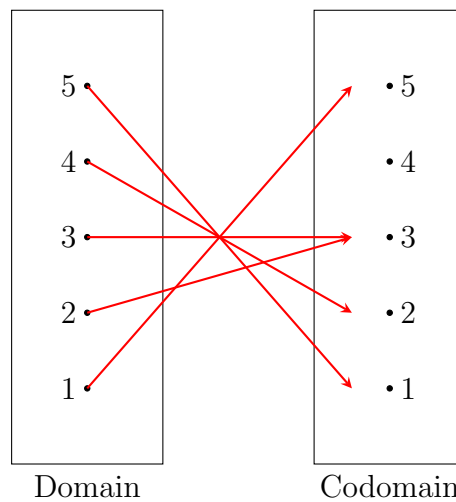
Question 3

Finish the arrow diagram for the following Binary Relation.

Domain: $\{1, 2, 3, 4, 5\}$

Codomain: $\{1, 2, 3, 4, 5\}$

Rule: $\{ (1,5), (2,3), (3,3), (4,2), (5,1) \}$



Question 4

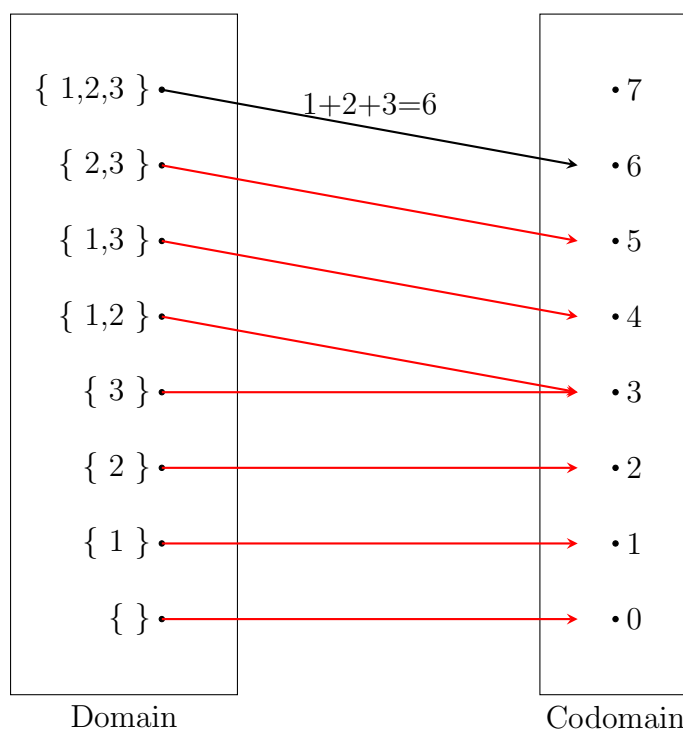
Finish the arrow diagram for the following Binary Relation.

Domain: $\wp(\{1, 2, 3\})$, the Power Set of $\{1, 2, 3\}$.

Codomain: The set $B = \{0, 1, 2, 3, 4, 5, 6, 7\}$.

Rule: $(S, n) \in \mathbb{R}$

This means that n is the **sum** of elements in the the set S given as an input. For example, with the input set $\{1, 2\}$, the output will be $1 + 2$, or 3.



Question 5

Identify which of the following relations are also functions. Explain why not, if the relation is not a function. Also complete the diagrams given.

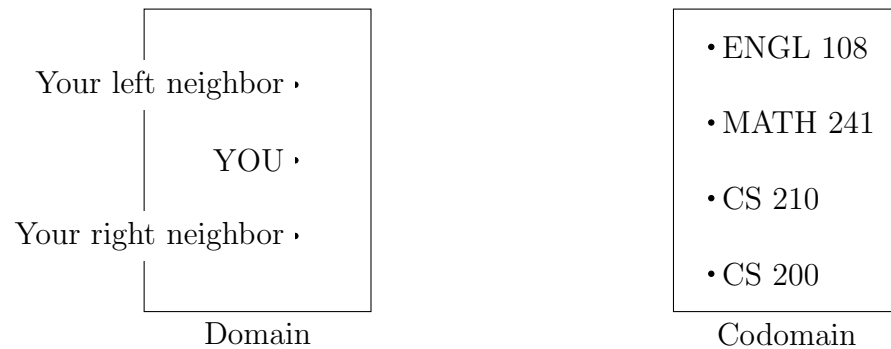
a. Relation R_1

Domain: The set \mathbb{S} of all students at your college this semester.

Codomain: The set \mathbb{C} of all classes offered at your college this semester.

Rule: (x, y) is in R_1 if student x is enrolled in class y this semester.

Let's use a small sample set. Fill it out to help you figure out if this is a function. **Not a function; a student can take more than 1 class.**

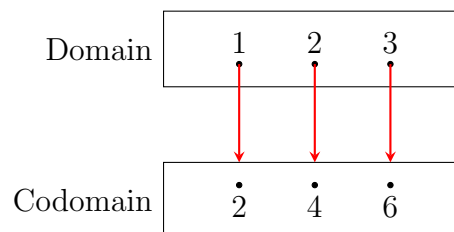


b. Relation R_2

Domain: The set $A = \{1, 2, 3\}$.

Codomain: The set $B = \{2, 4, 6\}$.

Rule: (x, y) is in R_2 if $2x = y$. **This is a function**



Question 6

Identify which of the following relations are also functions. Explain why not, if the relation is not a function. Also complete the diagrams given.

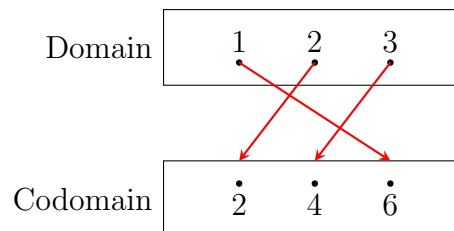
a. Relation R_3

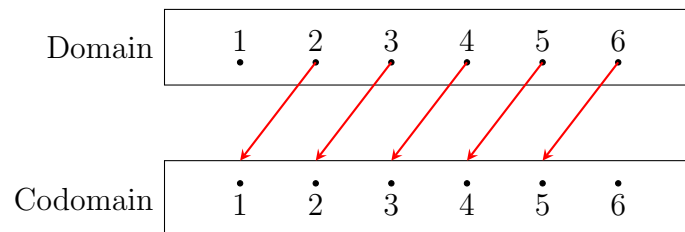
Domain: The set $A = \{1, 2, 3\}$.

Codomain: The set $B = \{2, 4, 6\}$.

Rule: $\{ (1,6), (2,2), (3,4) \}$

Let's use a small sample set. Fill it out to help you figure out if this is a function. **This is a function.**



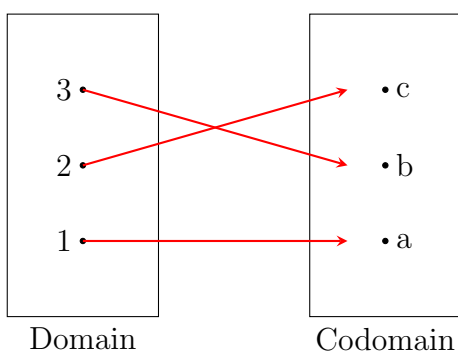
b. Relation R_4 Domain: The set $A = \{1, 2, 3, 4, 5, 6\}$.Codomain: The same set A .Rule: (x, y) is in R_3 if $x - 1 = y$. This is not a function; 1 doesn't point to anything, and 6 isn't pointed to by anything.

4.1.3 Inverse Relations

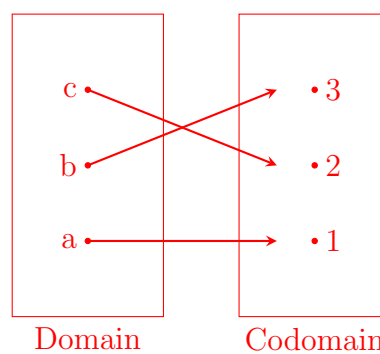
Question 7

Draw the inverse of each diagram. Identify if the original, and/or the inverse, are functions.

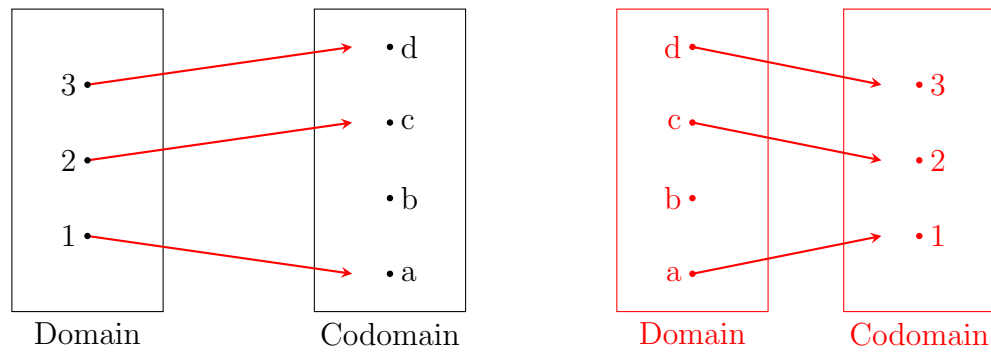
a.



Both are functions.



b.



The original is a function, but the inverse is not a function.