Functions

We know: A relation is a set of ordered pairs.

A function is a relation in which each member of the domain is paired with exactly one (one and only one) member in the range.

Since functions are relations, they can be represented using ordered pairs, tables, or graphs.

<table>
<thead>
<tr>
<th>Relation</th>
<th>Diagram</th>
<th>Is the relation a function?</th>
</tr>
</thead>
<tbody>
<tr>
<td>{(-10, -34), (0, -22), (10, -9), (20, 3)}</td>
<td><img src="image1" alt="Diagram" /></td>
<td>Yes. Every domain value is paired with exactly one (OAOO) range value.</td>
</tr>
<tr>
<td>{(-10, -34), (-10, -22), (10, -9), (20, 3)}</td>
<td><img src="image2" alt="Diagram" /></td>
<td>No, because -10 in the domain is paired with two range values, -34 and -22.</td>
</tr>
</tbody>
</table>

Determining if a relation is a function

If all x-values have one and only one (OAOO) y-value, then we have a function. If we can find an instance of a domain value (x value) that has more than one range value (y value), then we have shown a relation is not a function.

Examples: Function, or not a function? Explain.

a) {(-3, 1), (-2, 4), (-1, 7), (0, 10), (1, 13)}

Function? (yes/no) Why?

b) ![Table](image3)

Function? (yes/no) Why?

c) Mapping Diagram:

Function? (yes/no) Why?

d) Mapping Diagram:

Function? (yes/no) Why?

**CAUTION:** It does not matter in a function if a y-value appears more than once - each x-value may only appear once in the domain.**
Graphs

Graphs can be analyzed to determine if a function is represented. If an x-value has more than one y-value, then it is not a function.

One way to determine this is by using the **vertical line test**. Place a pencil or other vertical object at the left of a graph. Move it slowly towards the right of the graph. **If the pencil ever passes through more than one point, than the relation is not a function.**

Are the following relations functions? Explain your answer.

- **a)**

- **b)**

- **c)**

- **d)**

- **e)**

- **f)** \{((1, 1), (2, 4), (3, 9), (-1, 1), (-2, 4), (-3, 9))\}