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# Homework 9

## CISP440

# *Section 2.82*

## *Determine weather each relation is a function fom X={1, 2, 3, 4} to Y = {a, b, c, d}*

**5.**

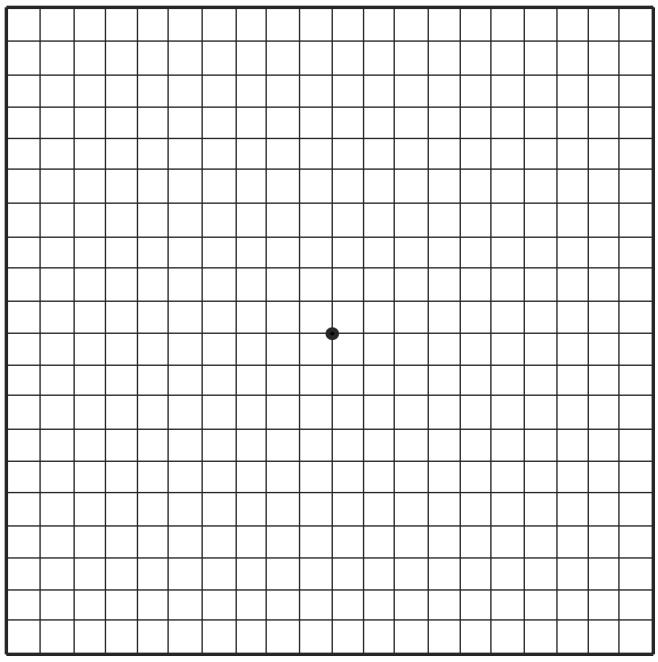
$$\{(1, b), (2, b), (3, b), (4, b)\}$$

This relation is not a function, because there are multiple $y$ values which correspond to each $x$ value.

## *Draw the graphs of the functions in exercises 6-9*

**8.**

$$f(x) = \lceil x^2 \rceil$$



***Determine weather each function in Exercises 10-15 is one-to-one. The domain of each function is the set of all real numbers. If the function is not one-to-one, exhibit distinct numbers a and b with f(a) = f(b). Also, determine weather f is onto the set of all real numbers. If f is not onto, exhibit a number y for which f(x) $\neq$ y for all real x.***

**15.**

$$f(x) = \frac{x}{1+x^2}$$

This function is one-to-one, which can be seen when the function is graphed. For each $x$ value, there is one unique $y$ value. This function is not onto the set of all real numbers. $f(x) \neq 10$ for all real $x$.

**28.**

Let $f$ and $g$ be functions from the positive real numbers to the positive real numbers defined by the equations

$$f(x) = \lfloor 2x \rfloor, \quad g(x) = x^2$$

Find the compositions of $f \circ f$, $g \circ g$, $f \circ g$, and $g \circ f$.

$$f \circ f = f(f(x)) = f(\lfloor 2x \rfloor) = \lfloor 2(\lfloor 2x \rfloor) \rfloor$$
$$g \circ g = g(g(x)) = g(x^2) = ((x^2)^2) = x^4$$
$$f \circ g = f(g(x)) = f(x^2) = \lfloor 2x^2 \rfloor$$
$$g \circ f = g(f(x)) = g(\lfloor 2x \rfloor) = (\lfloor 2x \rfloor)^2$$

**36.**

How many functions are there from $\{1, 2\}$ into $\{a, b\}$? Which are one-to-one? Which are onto?

Functions: 8

$$\{(1, a)\}$$
$$\{(2, a)\}$$
$$\{(1, b)\}$$
$$\{(2, b)\}$$

$$\{(1, a), (2, a)\}$$
$$\{(1, b), (2, b)\}$$
$$\{(1, a), (2, b)\}$$
$$\{(1, b), (2, a)\}$$

One-to-one: 6

$$\{(1, a)\}$$
$$\{(2, a)\}$$
$$\{(1, b)\}$$
$$\{(2, b)\}$$
$$\{(1, a), (2, b)\}$$
$$\{(1, b), (2, a)\}$$

Onto: 2

$$\{(1, a), (2, b)\}$$
$$\{(1, b), (2, a)\}$$