

Name: Caleb McWhorter — Solutions

MATH 100

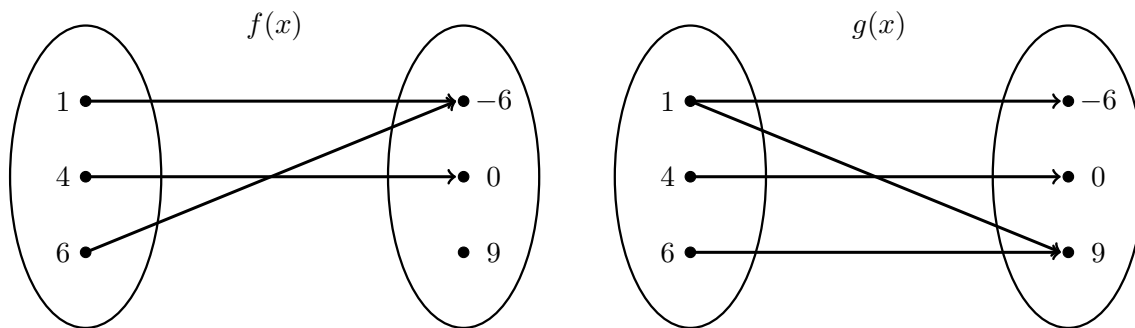
Fall 2021

HW 4: Due 10/06

"I am serious. And don't call me Shirley."

—Dr. Rumack, Airplane

Problem 1. (10pt) Determine if the relations $f(x)$ and $g(x)$ shown below are functions. Explain why or why not.



The relation $f(x)$ is a function—for each input, there is precisely one output. It does not matter that two of the inputs (namely 1 and 6) both map to -6 under $f(x)$. The relation $g(x)$ is not a function—the input 1 maps to both -6 and 9, i.e. for this input, there is more than one output.

Problem 2. (10pt) Determine if the relations $f(x)$ and $g(x)$ shown below are functions. Explain why or why not.

x	$f(x)$	x	$g(x)$
1	5	5	2
2	-5	6	e
3	4	8	-3
4	1	9	2.43
5	0	5	1

The relation $f(x)$ is a function—for each input, there is precisely one output. The relation $g(x)$ is not a function—for the input 5, there is more than one output.

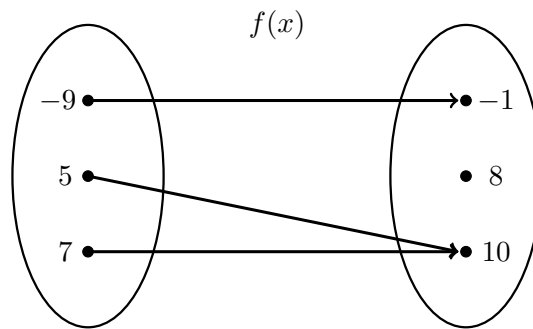
Problem 3. (10pt) Determine if the relations $f(x)$ and $g(x)$ shown below are functions. Explain why or why not.

$$f(x) = 9.87x + 10$$

$$g(x) = x^2 - x + 1$$

Both relations $f(x)$ and $g(x)$ are functions—for each input, there is one output. Namely, the output is the value obtained after plugging in the value for x and following order of operations.

Problem 4. (10pt) Suppose $f(x)$ is the function given below.



- (a) What is the domain of $f(x)$?
- (b) What is the codomain of $f(x)$?
- (c) What is the range of $f(x)$?

Solution.

- (a) The domain of $f(x)$ is $\{-9, 5, 7\}$.
- (b) The codomain of $f(x)$ is $\{-1, 8, 10\}$.
- (c) The range of $f(x)$ is $\{-1, 10\}$.

Problem 5. (10pt) Suppose $f(x)$ and $g(x)$ are the functions given below.

x	-2	0	1	3	4	5	10
$f(x)$	-1	-7	5	-2	π	19	10
$g(x)$	17	1	12	0	4	8	6

Compute the following:

(a) $f(1) = 5$

(b) $g(0) = 1$

(c) $(f + g)(5) = f(5) + g(5) = 19 + 8 = 27$

(d) $(f - g)(-2) = f(-2) - g(-2) = -1 - 17 = -18$

(e) $(6f)(1) = 6f(1) = 6(5) = 30$

(f) $\left(\frac{f}{g}\right)(10) = \frac{f(10)}{g(10)} = \frac{10}{6} = \frac{5}{3}$

(g) $f(4)g(5) = \pi \cdot 8 = 8\pi$

(h) $f(2 - g(0)) = f(2 - 1) = f(1) = 5$

(i) $(f \circ g)(0) = f(g(0)) = f(1) = 5$

(j) $(g \circ f)(3) = g(f(3)) = g(-2) = 17$

Problem 6. (10pt) Suppose $f(x)$ and $g(x)$ are the functions given below.

$$f(x) = 5x - 1$$

$$g(x) = x^2 + 2x + 3$$

Compute the following:

(a) $f(1) = 5(1) - 1 = 5 - 1 = 4$

(b) $g(0) = 0^2 + 2(0) + 3 = 0 + 0 + 3 = 3$

(c) $f(1) - 2g(1) = (5(1) - 1) - 2(1^2 + 2(1) + 3) = 4 - 2(6) = 4 - 12 = -8$

(d) $f(x) - g(x) = (5x - 1) - (x^2 + 2x + 3) = 5x - 1 - x^2 - 2x - 3 = -x^2 + 3x - 4$

(e) $f(x)g(x) = (5x - 1)(x^2 + 2x + 3) = 5x^3 + 10x^2 + 15x - x^2 - 2x - 3 = 5x^3 + 9x^2 + 13x - 3$

(f) $\left(\frac{f}{g}\right)(x) = \frac{5x - 1}{x^2 + 2x + 3}$

(g) $(g \circ f)(1) = g(f(1)) = g(4) = (4)^2 + 2(4) + 3 = 16 + 8 + 3 = 27$

(h) $f(g(0)) = f(3) = 5(3) - 1 = 15 - 1 = 14$

(i) $(f \circ g)(x) = f(g(x)) = f(x^2 + 2x + 3) = 5(x^2 + 2x + 3) - 1 = 5x^2 + 10x + 15 - 1 = 5x^2 + 10x + 14$

(j) $(g \circ f)(x) = g(f(x)) = g(5x - 1) = (5x - 1)^2 + 2(5x - 1) + 3 = 25x^2 - 10x + 1 + 10x - 2 + 3 = 25x^2 + 2$