

Section 1.4: Building functions from functions

- Perform the following operations on the given functions:

- $f(x) = 2x - 3 \quad g(x) = 3x - 1$
- $f+g = 2x-3 + 3x-1 = 5x-4$
- $f-g = 2x-3 - (3x-1) = -x-2$
- $f.g = (2x-3)(3x-1) = 6x^2 - 11x + 3$
- $f/g = \frac{2x-3}{3x-1} \quad (x \neq \frac{1}{3}) \quad (-\infty, \frac{1}{3}) \cup (\frac{1}{3}, \infty)$

Composition of functions

$f \circ g$

The composition f of g , denoted $f \circ g$, is defined by the rule

$$(f \circ g)(x) = f(g(x)).$$

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{ The function g is applied first and then f . This is the reverse of the order in which we read the symbols.

Calculate the value of the function f of g for $x=3$.

Example: $f(x) = 2x - 3$ $g(x) = \sqrt{x+1}$

$$(F \circ g)(3) = F(\underbrace{g(3)}_{\text{value}}) =$$

start with g : $g(3) = \sqrt{3+1} = \sqrt{4} = 2$.

$$f(2) = 2(2) - 3 = 4 - 3 = 1$$

$$F \circ g(3) = 1$$

$$g \circ f(3) = g(f(3)) =$$

$$f(3) = 2(3) - 3 = 3$$

$$g(3) = \sqrt{3+1} = \sqrt{4} = 2$$

$$(g \circ f)(3) = 2$$

$$\begin{aligned}(g \circ f)(7) &= g(f(7)) = g(2(7) - 3) \\&= g(11) = \sqrt{11+1} = \sqrt{12} \\&= 2\sqrt{3}.\end{aligned}$$

$$\begin{aligned}(g \circ f)(-1) &= g(f(-1)) = g(2(-1) - 3) = g(-5) \\&= \sqrt{-5+1} = \sqrt{-4} \quad \text{No real solution} \\&= \pm 2i\end{aligned}$$

- $f(x) = x^2 - 1$ $g(x) = \sqrt{x}$
- $(f \circ g)(x) = f(g(x)) = f(\sqrt{x}) = (\sqrt{x})^2 - 1$
 $= x - 1$ ↓
 $\text{Plug in } \sqrt{x} \text{ to } f$
- $(g \circ f)(x) = g(f(x)) = \sqrt{x^2 - 1}$
 $\text{put } f(x)$
 $\text{inside } g$ ↓
 $\text{F}(x)$

Homework

- Page 116 1-4, 11-14 (Ignore the domain)