

①

10/17/16

4.1 Fxn Composition

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

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

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

$$f(x) = x^2$$

$$\begin{aligned} f(g(x)) &= (2x+3)^2 \\ &= (2x+3)(2x+3) \\ &= 4x^2 + 12x + 9 \end{aligned}$$

ex) $f(x) = \frac{1}{x}$ $g(x) = x - 2$

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

$$f(x) = \frac{1}{x}$$

$$f(g(x)) = \frac{1}{x-2}$$

② Domain of fxn Composition (= fxn composition)

The domain of $f \circ g$ is the set of all numbers x in the domain of g such that $g(x)$ is in the domain of f .

ex) find domain of $f \circ g$ if ...

$$a) f(x) = x^2 + 3x - 1, g(x) = 2x + 3$$

$$D \text{ of } f : (-\infty, \infty) \quad D \text{ of } g : (-\infty, \infty)$$

$$(f \circ g)(x) = f(g(x)) = (2x+3)^2 + 3(2x+3) - 1$$

$$D \text{ of } f \circ g \text{ is } (-\infty, \infty)$$

$$ex) f(x) = \frac{1}{x+2}, g(x) = \frac{4}{x-1}$$

$$D \text{ of } f \{x | x \neq -2\}$$

$$D \text{ of } g \{x | x \neq 1\}$$

$$g \rightarrow \frac{4}{x-1} \neq \frac{-2}{1}$$

← domain restriction of f

$$-2(x-1) \neq 4$$

③

$$\begin{array}{r} -2x + 2 \neq 4 \\ \underline{-2} \quad \underline{-2} \end{array}$$

$$\begin{array}{r} -2x \neq 2 \\ \underline{-2} \quad \underline{-2} \end{array}$$

$$\boxed{x \neq -1}$$

D of $f \circ g$ is $\{x \mid x \neq -1\}$

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

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

$$f(g(x)) = \frac{1}{\left(\frac{4}{x-1}\right) + 2} \rightarrow \frac{2}{1} \cdot \frac{x-1}{x-1} = \frac{2x-2}{x-1}$$

$$= \frac{1}{4 + (2x-2)}$$

$$= \frac{1}{2x+2}$$

$$= 1 \cdot \frac{x-1}{2x+2}$$

4

$$(f \circ g)(x) = \frac{x-1}{2x+2}$$

$\text{D } f \circ g \text{ is } \{x \mid x \neq -1\}$
OR

$(-\infty, -1), (-1, \infty)$

Evaluating fn compositions

find $(f \circ g)(x)$, then evaluate

OR find $g(a)$, then evaluate $f(g(a))$

ex) If $f(x) = 2x^2 - 3$, $g(x) = 4x$

a) find $(f \circ g)(1)$

$$f(g(1)) = f(4) = 2(4)^2 - 3 = 32 - 3 = 29$$

$$\rightarrow g(1) = 4(1) = 4$$

$$(f \circ g)(1) = 29$$

b) find $(f \circ f)(-2) = f(f(-2))$

5

$$f(-2) = 2(-2)^2 - 3 = 5$$

$$f(5) = 2(5)^2 - 3$$

$$= 47$$

$$(f \circ f)(-2) = 47$$

fxn Composition from table

x	-2	-1	0	1	2
f(x)	0	-2	-3	0	1
g(x)	5	4	0	-1	0

a) find $(f \circ g)(1) = f(g(1))$

① find inside function
② then, evaluate outside fxn based on output of ①

$$g(1) = -1$$
$$f(g(1)) = f(-1) = -2$$
$$(f \circ g)(1) = -2$$

⑥

Review of Rationals

Remember $\frac{\frac{1}{2}}{\frac{3}{4}} = \frac{1}{2} \cdot \frac{4}{3} = \frac{4}{6}$

$$\frac{\frac{1}{x}}{x+1} = \frac{1}{1} \cdot \frac{x+1}{x} = \boxed{\frac{x+1}{x}}$$

If $f(x) = \frac{3}{x-1}$, $g(x) = \frac{2}{x}$

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

$$f(g(x)) = \frac{3}{g(x)-1}$$

$$= \frac{3}{\frac{2}{x}-1} \rightarrow \frac{2}{x}-1 = \frac{2}{x} - \frac{1 \cdot x}{x}$$
$$= \frac{2-x}{x}$$
$$= \frac{2-x}{x}$$

$$= \frac{3}{1} \cdot \frac{x}{2-x} = \boxed{\frac{3x}{2-x}}$$

