1.4 Function Composition

Frequently we place one function into another.

Ex $f(x) = 2x^2 + 1$

$g(x) = x + 3$

Add'n: $f(x) + g(x)$

$= (2x^2 + 1) + (x + 3)$

$= \boxed{2x^2 + x + 4}$

Subt: $f(x) - g(x)$

$= (2x^2 + 1) - (x + 3)$

$= \boxed{2x^2 - x - 2}$

mult: $f \cdot g$

$= (2x^2 + 1)(x + 3)$

$= 2x^3 + x + 6x^2 + 3$

$= \boxed{2x^3 + 6x^2 + x + 3}$

Div: f/g

$= \dfrac{(2x^2 + 1)}{(x + 3)}$

$= \boxed{\dfrac{2x^2 + 1}{x + 3}}$

Ex Cont.

$(f \circ g)(x)$ "f" composited with "g"

$f[\ ] = 2[\ ]^2 + 1$

$g[\ ] = [\ ] + 3$

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

x

$(f \circ g)(x) = 2[g(x)]^2 + 1$

$$\boxed{(f \circ g)(x) = 2[[x]+3]^2 + 1}$$

$= 2(x+3)^2 + 1$

$= 2[x^2 + 6x + 9] + 1$

$$f \circ g = \boxed{2x^2 + 12x + 19}$$

Ex $(g \circ f)(5)$

$= g(f(5))$

$= [f(5)] + 3$

$= [2[5]^2 + 1] + 3$

$$\Rightarrow \boxed{(g \circ f)(5) = 2s^2 + 4}$$

$f[\ ] = 2[\ ]^2 + 1$

$g[\ ] = [\ ] + 3$

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⊛ Decomposition

Write a more complicated function as a composite of two simpler functions:

Ex let $h(x) = \left(\frac{1}{2x-3}\right)^2$, decompose into simpler functions

let $\begin{cases} f[\ ] = \frac{1}{[\ ]^2} \leftarrow \text{reciprocate} \\ g[\ ] = 2[\ ] - 3 \end{cases}$

then

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

$$= \frac{1}{[g(x)]^2}$$

$$= \frac{1}{(2x-3)^2}$$

$$(f \circ g)(x) = \frac{1}{4x^2 - 12x + 9}$$

Not unique

let $\begin{cases} f(\ ) = (\ )^2 \\ g(x) = \frac{1}{2x-3} \end{cases}$

-OR-

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

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

⊛ Composit Tables of relationships

EX Let g & f have the following tabular results

x	0	1	2	3	4	5	6	7	8	9
f(x)	7	6	5	8	4	0	2	1	9	3
g(x)	9	5	6	2	1	8	7	3	4	0

(a) Find $(f \circ g)(8)$

$\equiv f(g(8))$ ← start at the inside

$= f(4)$

$= \boxed{4}$

(b) Find $(g \circ f)(5)$

$\equiv g(f(5))$

$= g(0)$

$= \boxed{9}$

(c) $(f \circ f)(1)$

$\equiv f(f(1))$

$= f(6)$

$= \boxed{2}$