

10.3 Composite Functions

$$C = \pi d \quad d = 2r \quad \rightarrow \quad C = \pi(2r) = 2\pi r$$

$$f(x) = \frac{1}{x} \quad \longrightarrow \quad h(x) = \frac{1}{x+3}$$

If $g(x) = x+3$, then $f(g(x))$ or $f(x+3) = h(x)$.

$f(g(x))$ means that $g(x)$ replaces the x in $f(x)$.

$(f \circ g)(x)$ means the same thing. (f of g)

Ex) Consider $f(x) = \sqrt{x}$ and $g(x) = x-4$.

a) write $(f \circ g)(x) = f(g(x)) = \sqrt{x-4}$

b) Write $(g \circ f)(x) = g(f(x)) = \sqrt{x} - 4$

Ex) Consider $f(x) = 5x$, $g(x) = x-3$, $h(x) = x^2$.

Evaluate: i) $f(g(10)) = 35$

ii) $g(h(-1)) = -2$

iii) $h(h(f(2))) = ((5x)^2)^2$

$$= 625x^4$$

$$= 10000$$

Ex) $f(x) = \sqrt{x-1}$, $g(x) = x^2$

D: $x \geq 1$ D: $x \in \mathbb{R}$

a) $(f \circ g)(x) = \sqrt{x^2-1}$ b) $(g \circ f)(x) = (\sqrt{x-1})^2$

D: $x \geq 1, x \leq -1$

$$\left(\begin{array}{l} = x-1 \\ D: x \in \mathbb{R} \\ \downarrow \\ x \geq 1 \end{array} \right.$$

Ex) Consider $m(x) = \frac{1}{x}$ and $n(x) = \sqrt{x}$.
 $D: x \neq 0$ $D: x \geq 0$

$$i) (m \circ n)(x) = \frac{1}{\sqrt{x}} \quad ii) (n \circ m)(x) = \sqrt{\frac{1}{x}}$$

$$D: x > 0$$

$$D: x > 0$$

Ex) Consider $h(x) = (f \circ g)(x)$. Find $f(x)$ & $g(x)$.

$$i) h(x) = (2^x)^3 - 7(2^x)^2 + 14(2^x) - 8$$

$$f(x) = x^3 - 7x^2 + 14x - 8$$

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

$$ii) h(x) = \sin^2 x + 2 \sin x - 3$$

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

$$g(x) = \sin x$$

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