

6.6 FUNCTION OPERATIONS

$$\text{LET } f(x) = x^2 - 1$$

$$\text{AND } g(x) = x + 1$$

$$\begin{aligned} \text{ADD } f(x) + g(x) &= (x^2 - 1) + (x + 1) \\ &= x^2 + x \end{aligned}$$

$$\begin{aligned} \text{SUBTRACT } f(x) - g(x) &= (x^2 - 1) - (x + 1) \\ &= x^2 - x - 2 \end{aligned}$$

$$\begin{aligned} \text{MULTIPLY } f(x) \cdot g(x) &= (x^2 - 1)(x + 1) \\ &= x^3 + x^2 - x - 1 \end{aligned}$$

$$\begin{aligned} \text{DIVIDE } \frac{f(x)}{g(x)} &= \frac{x^2 - 1}{x + 1} = \frac{(x - 1)(x + 1)}{(x + 1)} \\ &= x - 1 \quad x \neq -1 \end{aligned}$$

$$\text{NOTE: } f(2) = 3 \quad g(3) = 4$$

$$g(f(2)) = g(f(2)) = g(3) = 4$$

FUNCTION COMPOSITION

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

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

Ex: Let $f(x) = x^2 - 2x + 1$ and

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

Find $(f \circ g)(x)$ and $(g \circ f)(x)$

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

$$\begin{aligned} &= (x-3)^2 - 2(x-3) + 1 \\ &= x^2 - 6x + 9 - 2x + 6 + 1 \\ &= x^2 - 8x + 16 \end{aligned}$$

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

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

$$= x^2 - 2x - 2$$

RECALL: $f(g(x)) = x^2 - 8x + 16$

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

NOTE: $f(g(x)) \neq g(f(x))$

Ex: FIND $f(g(3))$ AND $g(f(3))$

$$f(g(3)) = 3^2 - 8(3) + 16 = 9 - 24 + 16 = 1$$

OR

$$f(g(3)) = f(0) = 0^2 - 2(0) + 1 = 1$$

↑ FROM LAST SLIDE

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

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

$$g(f(3)) = 3^2 - 2(3) - 2 = 9 - 6 - 2 = 1$$