

# 1.3 Combinations & Composition of Functions

$$(f + g)(x) = f(x) + g(x)$$

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

$$(fg)(x) = f(x) \cdot g(x)$$

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$$

Combinations  
of  
functions

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EX1  $f(x) = x^2 + 2x$   $g(x) = 2x + 1$

Find the following:

a.)  $(f+g)(x)$   
 $f(x) + g(x) = (x^2 + 2x) + (2x + 1)$   
 $= x^2 + 4x + 1$

b.)  $(f-g)(x)$   
 $f(x) - g(x) = (x^2 + 2x) - (2x + 1)$   
 $= x^2 + 2x - 2x - 1$   
 $= x^2 - 1$

c.)  $(fg)(x)$   
 $f(x) \cdot g(x) = (x^2 + 2x)(2x + 1)$   
 $= 2x^3 + 5x^2 + 2x$

$$\begin{array}{r|l} & x^2 \quad 2x \\ 2x & 2x^3 \quad 4x^2 \\ & 1 \quad x^2 \quad 2x \\ \hline & 2x^3 + 5x^2 + 2x \end{array}$$

d.)  $\left(\frac{f}{g}\right)(x)$   
 $\frac{f(x)}{g(x)} = \frac{x^2 + 2x}{2x + 1}$

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Composition

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

input  
into the  
function "f"

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$$f(x) = 2x + 5$$

$$f(n) = 2n + 5$$

$$\begin{aligned} f(3) &= 2(3) + 5 \\ &= 6 + 5 \\ &= 11 \end{aligned}$$

$$\begin{aligned} f(2x) &= 2(2x) + 5 \\ &= 4x + 5 \end{aligned}$$

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EX 2)  $f(x) = x^2 + 2x$  and  $g(x) = 2x + 1$

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

$$\begin{aligned} f(g(x)) &= (2x+1)^2 + 2(2x+1) \\ &= (4x^2 + 4x + 1) + 4x + 2 \\ &= \boxed{4x^2 + 8x + 3} \end{aligned}$$

$$\begin{array}{r|l} 2x & 2x + 1 \\ & 4x^2 + 2x \\ \hline 1 & 2x + 1 \\ & 4x^2 + 4x + 1 \end{array}$$

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

$$\begin{aligned} g(f(x)) &= 2(x^2 + 2x) + 1 \\ &= \boxed{2x^2 + 4x + 1} \end{aligned}$$

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

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