

## 1.4 Building Functions from Functions

- Obj: 1. Build new fncs from basic fncs by adding, subtracting, multiplying & dividing
2. Find compositions.

$$f(x) \quad g(x)$$

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

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

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

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, \quad g(x) \neq 0$$

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If  $f(x) = x^2$      $g(x) = \sqrt{x+1}$   
 find  $f+g$ ,  $f-g$ ,  $fg$ ,  $\frac{f}{g}$ ,  $gg$

$$(f+g)(x) = x^2 + \sqrt{x+1}$$

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

$$(fg)(x) = x^2 \sqrt{x+1}$$

$$\left(\frac{f}{g}\right)(x) = \frac{x^2}{\sqrt{x+1}} \quad \text{D: } x+1 > 0$$

$$(gg)(x) = (\sqrt{x+1} \sqrt{x+1})$$

$$= x+1 \quad \text{D: } x+1 \geq 0$$

$$x \geq -1$$

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## Composition S

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

$$f(g(x))$$

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

$$g(f(x))$$

$$f(x) = e^x$$

$$g(x) = \sqrt{x}$$

$$f(2) = e^2$$

$$f(z) = e^z$$

$$f(g(x)) = e^{\sqrt{x}}$$

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

$$g(f(x)) = \sqrt{e^x}$$

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

$$\text{Find } (f \circ g)(x) \quad (g \circ f)(x)$$

$$\begin{aligned} f(g(x)) &= (2x-3)^2 - 1 \\ &= (2x-3)(2x-3) - 1 \\ &= 4x^2 - 6x - 6x + 9 - 1 \\ &= 4x^2 - 12x + 8 \end{aligned}$$

$$\begin{aligned} g(f(x)) &= 2(x^2-1) - 3 \\ &= 2x^2 - 2 - 3 \\ &= 2x^2 - 5 \end{aligned}$$

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

Find  $(f \circ g)(2)$        $(g \circ f)(3)$

$$(f \circ g)(x) = 4x^2 - 12x + 8$$

$$\begin{aligned} (f \circ g)(2) &= 4(2)^2 - 12(2) + 8 \\ &= 16 - 24 + 8 \\ &= 0 \end{aligned}$$

$$(g \circ f)(x) = 2x^2 - 5$$

$$\begin{aligned} (g \circ f)(3) &= 2(3)^2 - 5 \\ &= 18 - 5 \\ &= 13 \end{aligned}$$

OR

$$f(g(2))$$

$$g(2) = 2 \cdot 2 - 3 = 1$$

$$f(1) = 1^2 - 1 = 0$$

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## Decomposition:

For  $h(x)$ , find  $f(x)$  and  $g(x)$  so

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

$$h(x) = (\underline{x+1})^2 - 3(\underline{x+1}) + 4$$

inside:  $g(x) = x+1$

outside:  $f(x) = x^2 - 3x + 4$

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$$h(x) = \sqrt{x^3 + 1}$$

inside:  $g(x) = x^3$   
 outside:  $f(x) = \sqrt{x+1}$     or    inside:  $x^3 + 1$   
 outside:  $f(x) = \sqrt{x}$

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Solve for  $y$ !

Find 2 fncs defined implicitly by  
 the given relation:

$$x^2 + 2xy + y^2 = 1$$

$$(x+y)(x+y) = 1$$

$$\sqrt{(x+y)^2} = \sqrt{1}$$

$$x+y = \pm 1$$

$$-x \quad -x$$

$$y = -x \pm 1$$

$$y = -x + 1 \quad y = -x - 1$$

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$$x + |y| = 1$$

$$|y| = -x + 1$$

$$y = -x + 1 \quad y = -(-x + 1)$$

$$y = -x + 1 \quad y = x - 1$$

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