

# 1.3 Composition of Functions

Ex  $f(x) = \frac{1}{x} \leftarrow \begin{matrix} \text{domain} = (-\infty, 0) \cup (0, \infty) \\ \text{of } f \end{matrix}$

$g(x) = \sqrt{2-x} \leftarrow \begin{matrix} \text{domain} = (-\infty, 2] \\ \text{of } g \end{matrix}$

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$$f \circ g(x) = f(g(x)) = f(\sqrt{2-x}) = \frac{1}{\sqrt{2-x}}$$

domain of  $f \circ g$  =  $(-\infty, 2)$

all values in domain of  $g$  such that  $g(x)$  is in domain of  $f$ .

we need  $\sqrt{2-x} \neq 0$   
so  $x \neq 2$

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$$g \circ f(x) = g(f(x)) = g\left(\frac{1}{x}\right) = \sqrt{2 - \frac{1}{x}}$$

domain of  $g \circ f$  =  $(-\infty, 0) \cup \left[\frac{1}{2}, \infty\right)$

all values  $x$  in domain of  $f$  such that  $f(x)$  is in the domain of  $g$ .

we need

$$2 - \frac{1}{x} \geq 0$$

$$\text{so } 2 \geq \frac{1}{x} \rightarrow$$

all  $x < 0$  work  
if  $x > 0$  need  $\frac{1}{x} \leq 2$   
so  $\frac{1}{2} \leq x$