

$$31. f(x) = x^2, \quad g(x) = x + 1$$

$f$		$g$
$D: -\infty < x < \infty$		$D: -\infty < x < \infty$
$R: x^2 \geq 0$	←	$R: -\infty < x+1 < \infty$

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$\begin{array}{l l} -\infty < x < 0 & \text{or} \\ x^2 > 0 & 0 \leq x < \infty \\ & 0 \leq x^2 \end{array}$	$f(g(x)) = (x+1)^2$ $D: -\infty < x < \infty$ $-\infty < x+1 < \infty$ $R: 0 \leq (x+1)^2$
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$$33. f(x) = \frac{1}{x}, \quad g(x) = 2x + 4$$

$f$		$g$
$D: x < 0 \text{ or } 0 < x$		$D: -\infty < x < \infty$
↓		↓
$-\infty < x < 0$	$0 < x < \infty$	$R: -\infty < 2x+4 < \infty$
$0 > \frac{1}{x} > -\infty$	$\infty > \frac{1}{x} > 0$	
$R: \frac{1}{x} < 0 \text{ or } \frac{1}{x} > 0$		

$$\begin{array}{l}
 \begin{array}{l}
 f \\
 D: \cancel{x \neq 0} \\
 R: y \neq 0
 \end{array}
 \quad \rightarrow \quad
 \begin{array}{l}
 g \\
 D: -\infty < x < \infty \\
 R: -\infty < y < \infty
 \end{array} \\
 \\
 f(g(x)) = \frac{1}{2x+4} \quad \begin{array}{l} 2x+4 \neq 0 \\ x \neq -2 \end{array} \\
 D: x \neq -2 \\
 \\
 \begin{array}{l}
 x < -2 \quad \text{or} \quad x > -2 \\
 2x < -4 \quad \therefore \\
 -\infty < 2x+4 < 0 \quad \downarrow \\
 0 > \frac{1}{2x+4} > -\infty \quad \infty > \frac{1}{2x+4} > 0 \\
 R: \frac{1}{2x+4} < 0 \quad \text{or} \quad \frac{1}{2x+4} > 0
 \end{array}
 \end{array}$$

$$-2 < x < 7$$

$$0 \leq x^2 < 49$$

$$f(x) = \frac{1}{x} \quad f \quad f$$

$$f \circ f = \frac{1}{\frac{1}{x}} = x \quad D: x \neq 0 \quad D: x \neq 0$$

$$R: y \neq 0 \quad R: y \neq 0$$

$$D: x \neq 0$$

$$R: x \neq 0$$

$$39. f(x) = \sqrt[3]{x}, \quad g(x) = \sqrt[4]{x}$$

$$f \quad g$$

$$D: -\infty < x < \infty \quad D: x \geq 0$$

$$R: -\infty < \sqrt[3]{x} < \infty \quad R: \sqrt[4]{x} \geq 0$$

$$f \cdot g = \sqrt[3]{\sqrt[4]{x}} = \sqrt[12]{x}$$

$$D: x \geq 0$$

$$R: \sqrt[12]{x} \geq 0$$