

Find $f \circ g$, $g \circ f$, and the domain of each for the following functions.

$$1. f(x) = x + 3 \quad g(x) = \sqrt{9 - x^2} \qquad 4. f(x) = x^2 + 2 \quad g(x) = \sqrt{x - 5}$$

$$2. f(x) = \sqrt{x + 3} \quad g(x) = 2x - 5 \qquad 5. f(x) = \frac{2}{x - 3} \quad g(x) = \frac{5}{x + 2}$$

$$3. f(x) = \frac{-3}{x} \quad g(x) = \frac{x}{x - 2} \qquad 6. f(x) = \frac{1}{\sqrt[3]{x - 2}} \quad g(x) = x^2 - 3$$

1. $f(g(x)) = \sqrt{9 - x^2} + 3$ domain: $-3 \leq x \leq 3$
 $g(f(x)) = \sqrt{-x^2 - 6x}$ domain: $-6 \leq x \leq 0$
2. $f(g(x)) = \sqrt{2x - 2}$ domain: $x \geq 1$
 $g(f(x)) = 2\sqrt{x + 3} - 5$ domain: $x \geq -3$
3. $f(g(x)) = \frac{-3(x - 2)}{x}$ domain: $x \neq 2$ and $x \neq 0$
 $g(f(x)) = \frac{3}{3 + 2x}$ domain: $x \neq 0$ and $x \neq -3/2$
4. $f(g(x)) = x - 3$ domain: $x \geq 5$
 $g(f(x)) = \sqrt{x^2 - 3}$ domain: $x \geq \sqrt{3}$ or $x \leq -\sqrt{3}$
5. $f(g(x)) = \frac{-2(x + 2)}{3x + 1}$ domain: $x \neq -2$ and $x \neq -1/3$
 $g(f(x)) = \frac{5(x - 3)}{2x - 4}$ domain: $x \neq 3$ and $x \neq 2$
6. $f(g(x)) = \frac{1}{\sqrt[3]{x^2 - 3} - 2}$ domain: $x \neq \pm\sqrt{11}$
 $g(f(x)) = \frac{1}{(\sqrt[3]{x - 2})^2} - 3$ domain: $x \neq 8$

