Composite Functions

$f \circ g$

Read "f circle g of x"

$f(g(x))$

"f of g of x"

$f(x) = 4x + 2$ and $g(x) = x - 4$

a) $(f \circ g)(2)$

$g(2) = 2 - 4$

$= -2$

$f(-2) = 4(-2) + 2$

$= -6$

$(f \circ g)(2) = -6$

b) $(g \circ f)(-3)$

$f(-3) = 4(-3) + 2$

$= -10$

$g(-10) = -10 - 4$

$= -14$

$(g \circ f)(-3) = -14$

$f(x) = \frac{2x}{5x+3}$ and $g(x) = x^2 - 4$

a) $(f \circ g)(1)$

$g(1) = 1^2 - 4$

$= -3$

$f(-3) = \frac{2(-3)}{5(-3)+3}$

$= \frac{-6}{-12}$

$\frac{1}{2}$

b) $(g \circ f)(-3)$

$f(-3) = \frac{1}{2}$

$g\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^2 - 4$

$= \frac{1}{4} - 4$

$\frac{1}{4} - \frac{16}{4}$

$-\frac{15}{4}$

$(-\infty,\infty)$ $(-\infty,2)\cup(2,\infty)$

$f(x) = x^2 + 2$ and $g(x) = \frac{3}{x-2}$

Find each of the following and state the domain of each

a) f(g(x))

$f\left(\frac{3}{x-2}\right) = x^2 + 2$

$f(g(x)) = \left(\frac{3}{x-2}\right)^2 + 2$

D: $(-\infty, 2)\cup(2,\infty)$

b) g(f(x))

$g(x^2+2) = \frac{3}{x-2}$

$= \frac{3}{x^2+2-2}$

$= \frac{3}{x^2}$

Domain $(-\infty,0)\cup(0,2)\cup(2,\infty)$

$(-\infty,\infty)$ $[0,\infty)$

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

Find each of the following and state the domain of each

a) f(g(x))

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

$(\sqrt{x})^2 - 1$

$= x - 1$

Domain $[0,\infty)$

b) g(f(x))

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

$= \sqrt{x^2-1}$

$x^2 - 1 \geq 0$

$x^2 \geq 1$

$x \geq 1$ or ~~$x \leq -1$~~

Domain $[1,\infty)$

For each function h, find functions f and g such that h(x) = f(g(x))

a) $h(x) = (x+1)^2 - 3(x+1) + 4$

$f(x) = x^2 - 3x + 4 \quad g(x) = x+1$

$f(x+1) = (x+1)^2 - 3(x+1) + 4$

$f(g(x))$

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

$f(x) = x$

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

$f(x) = \sqrt{x} \qquad g(x) = x^3+1$

$f(x) = \sqrt{x+1} \qquad g(x) = x^3$

$h(x) = \dfrac{3}{x-2}$

$f(x) = \dfrac{3}{x}$

$g(x) = x-2$