Graphing Composite Functions

Consider f(x) = $\sqrt{x}$ and g(x) = $x^2 + 2$
Determine f(g(x)) and g(f(x))

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

g(x) D: $\{x \mid x \in \mathbb{R}\}$
D: $\{x \mid x \in \mathbb{R}\}$

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

f(x) D: $[0, \infty)$
D: $[0, \infty)$

★ To find the domain of f(g(x)) you must consider the restrictions on the domain of g(x) and the new restrictions for (f(g(x))

Ex) Consider f(x) = $\frac{1}{x+3}$ and g(x) = $\frac{1}{x}$
Determine f(g(x)) and g(f(x)) and state its domain.

$\frac{1}{x} + 3 = 0$
$\frac{1}{x} = -3$

$f(g(x)) = f\left(\frac{1}{x}\right)$
$= \frac{1}{\frac{1}{x} + 3}$

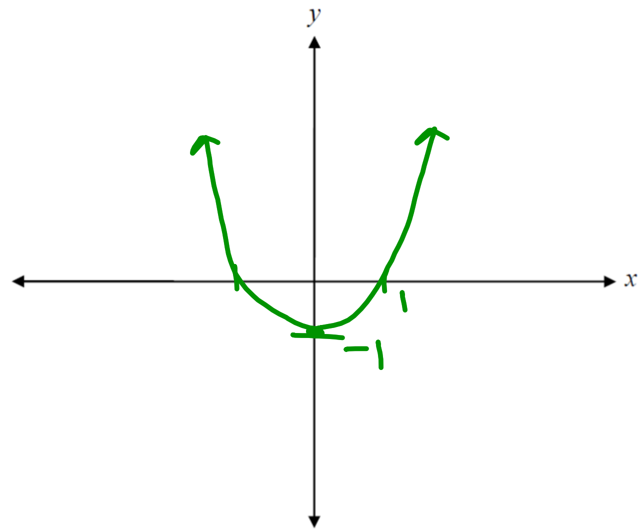
g(x) D: $\{x \mid x \in \mathbb{R}, x \neq 0\}$
D: $\{x \mid x \in \mathbb{R}, x \neq 0, -\frac{1}{3}\}$

$g(f(x)) = g\left(\frac{1}{x+3}\right)$
$= \frac{1}{\frac{1}{x+3}}$
$= x + 3$

f(x) D: $\{x \mid x \in \mathbb{R}, x \neq -3\}$
D: $\{x \mid x \in \mathbb{R}, x \neq -3\}$

Given $f(x) = x - 1$ and $g(x) = x^2$, write the equation of $y = f(g(x))$ and sketch the graph.

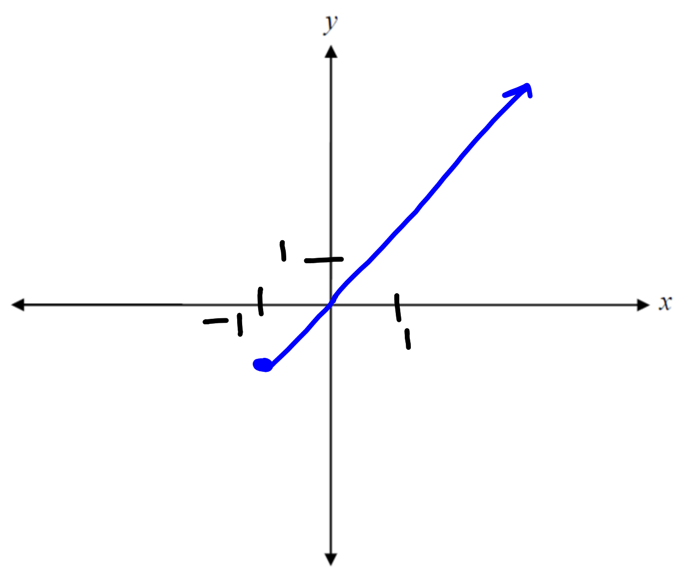
$y = f(g(x))$
$= f(x^2)$
$= x^2 - 1$



Given $f(x) = x^2 - 1$ and $g(x) = \sqrt{x+1}$, sketch the graph of $y = f(g(x))$ and state its domain.

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

D: $\{x \mid x \geq -1\}$



Ex) Determine possible functions f(x) and g(x) so that:

a) $f(g(x)) = (x - 2)^2$

b) $f(g(x)) = \sqrt{x + 3}$

c) $f(g(x)) = x^2 + 4x + 3$

a) $g(x) = x - 2$

$f(x) = x^2$

b) $g(x) = x + 3$

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

c) $g(x) = x^2 + 4x + 3$

$f(x) = x$

p.314

#3-6, 9