Section 1.4: Building Functions from Functions

Ex 1) Find $(f \circ g)(3)$ and $(g \circ f)(-2)$ when

$f(x) = x^2 + 4$ and $g(x) = \sqrt{x+1}$

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

$g(3) = \sqrt{3+1} = \sqrt{4} = 2$

$f(2) = (2)^2 + 4 = 4 + 4 = 8$

So $(f \circ g)(3) = 8$ *

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

$f(-2) = (-2)^2 + 4 = 4 + 4 = 8$

$g(8) = \sqrt{8+1} = \sqrt{9} = 3$

So $(g \circ f)(-2) = 3$ *

Ex 2) Find $(f \circ g)(x)$ and $(g \circ f)(x)$. State the domain of each

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

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

$= x + 1 - 2$

$f(g(x)) = x - 1$ *

Domain: $x + 1 \geq 0$, $x \geq -1$

D: $[-1, \infty)$

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

$= \sqrt{x^2 - 1}$ ← cannot simplify further

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

Domain $x^2 - 1 \geq 0$

D: $(-\infty, -1] \cup [1, \infty)$

Ex 3) In the medical procedure known as angioplasty, doctors insert a catheter into a heart vein and inflate a small spherical balloon on the tip of the catheter. Suppose the balloon is inflated at a constant rate of 44 cubic millimeters per second.

a) Find the volume after t seconds $V = 44t$

b) When the volume is V, what is the radius? (Write an equation that gives the radius r as a function of the volume V) $V = \frac{4}{3}\pi r^3$ solve for r

$$\sqrt[3]{\frac{3V}{(4\pi)}} = r$$

c) Write an equation that gives the radius r as a function of time t. replace V with 44t

$$r = \sqrt[3]{\frac{3 \cdot 44t}{(4\pi)}}$$

$$r = \sqrt[3]{\frac{33t}{\pi}}$$

d) What is the radius after 5 seconds?

$$r = \sqrt[3]{\frac{33 \times 5}{\pi}}$$

$$\approx 3.74 \text{ mm}.$$