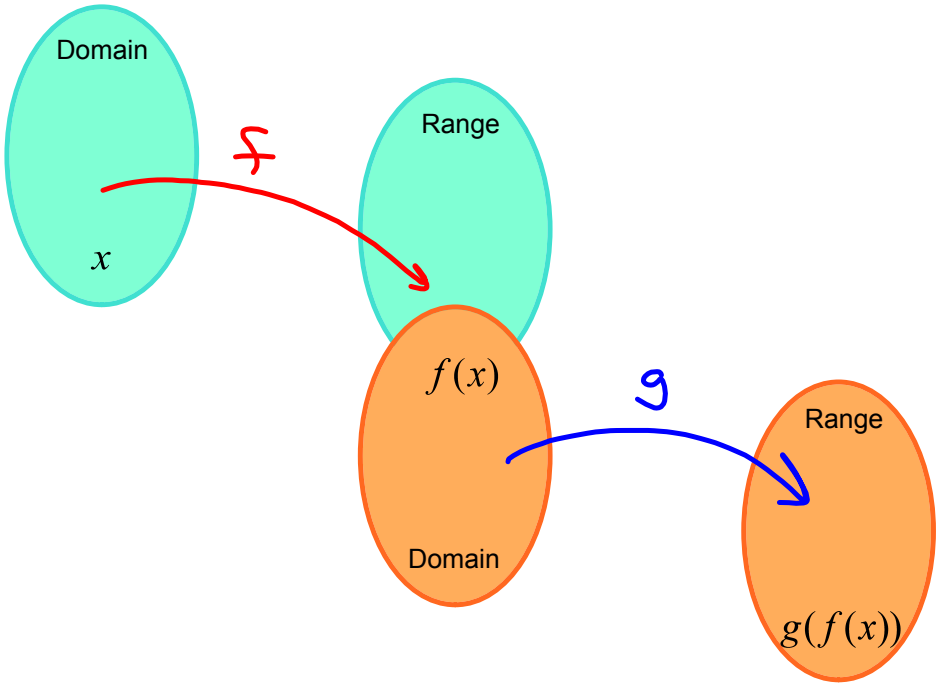
6.3 Perform Function Composition

Composition of Functions $h(x) = g(f(x))$



EXAMPLE 4

Let $f(x) = 2x - 7$ and $g(x) = x^2 + 4$. What is the value of $g(f(3))$?

$g(f(3))$ → "g of f of 3"

$f(3) = 2(3) - 7 = -1$

$g(-1) = (-1)^2 + 4 = 5$

$g(f(3)) = \boxed{5}$

EXAMPLE 4

Let $f(x) = 3x - 8$ and $g(x) = 2x^2$. Find the following.

$f(g(5))$

$g(5) = 2(5)^2 = 50$

$f(50) = 3(50) - 8 = 142$

$f(g(5)) = 142$

$g(f(5))$

$f(5) = 3(5) - 8 = 7$

$g(7) = 2(7)^2$

$= 98$

$g(f(5)) = 98$

$f(f(5))$

$f(5) = 3(5) - 8 = 7$

$f(7) = 3(7) - 8 = 13$

$g(g(5))$

$g(5) = 2(5)^2 = 50$

$g(50) = 2(50)^2 = 5000$

EXAMPLE 5 Find compositions of functions

Let $f(x) = 4x^{-1}$ and $g(x) = 5x - 2$. Find the following.

a. $f(g(x))$

$4(5x-2)^{-1}$

$\frac{4}{5x-2}$

Dom: $\mathbb{R}$ $x \neq \frac{2}{5}$

b. $g(f(x))$

$5(4x^{-1})-2$

$\frac{5}{1}\left(\frac{4}{x}\right)-2$

$\frac{20}{x}-2$

$x \neq 0$

$\mathbb{R}$ $x \neq 0$

c. $f(f(x))$

$4(4x^{-1})^{-1}$

$4\left(\frac{4}{x^{1}}\right)^{-1}$

$4\left(\frac{4^{-1}}{x^{-1}}\right)$

$4\left(\frac{x}{4}\right) = \frac{4x}{4}$

x

Dom: $\mathbb{R}$ $x \neq 0$

d. the domain of each composition

EVALUATE COMPOSITIONS OF FUNCTIONS Let $f(x) = 3x + 2$, $g(x) = -x^2$, and $h(x) = \frac{x-2}{5}$. Find the indicated value.

20. $f(g(-3))$

$g(-3) = -(-3)^2 = -9$

$f(-9) = 3(-9) + 2$

$= -25$

26. $h(h(-4))$

$h(-4) = \frac{-4-2}{5} = \frac{-6}{5}$

$h\left(\frac{-6}{5}\right) = \frac{\frac{-6}{5} - 2}{5} \cdot \frac{5}{5}$

$= \frac{-6 - 10}{5} = \frac{\frac{-16}{5}}{5}$

$= \frac{-16}{5} \cdot \frac{1}{5} = \frac{-16}{25}$