

Function Operations and Composition

- The domain of a function is the set of all "first coordinates" of the ordered pairs of a relation. x-values
- The range of a function is the set of all "second coordinates" of the ordered pairs of a relation. y-values
- A relation is a function if all values of the domain are unique (they do not repeat).
- A test to see if a relation is a function is the vertical line (pencil test)

Example 1: If $f(x) = 3x$ and $g(x) = x - 5$. Perform the indicated operation and give the domain.

a) Find $f(x) + g(x)$

$$\begin{array}{r} 3x + x - 5 \\ \hline 4x - 5 \end{array}$$

D: All IR's

What about $f(x) \div g(x)$?

$$\frac{3x}{x-5}$$

b) Find $f(x) - g(x)$

$$3x - (x - 5)$$

$$3x - x + 5$$

$$2x + 5$$

D: All IR's

Are there any numbers that are NOT acceptable for x?

All IR's except $x \neq 5$

$$x - 5 \neq 0$$

$$x \neq 5$$

c) Find $f(x) \cdot g(x)$

$$3x(x - 5)$$

$$3x^2 - 15x$$

D: All IR's

Your Turn!! $f(x) = 6x^2$ $g(x) = -3x^2$

a) $f + g$

b) $f - g$

c) $f \cdot g$

d) $\frac{f}{g}$

$$\frac{6x^2}{-3x^2} = \boxed{-2}$$

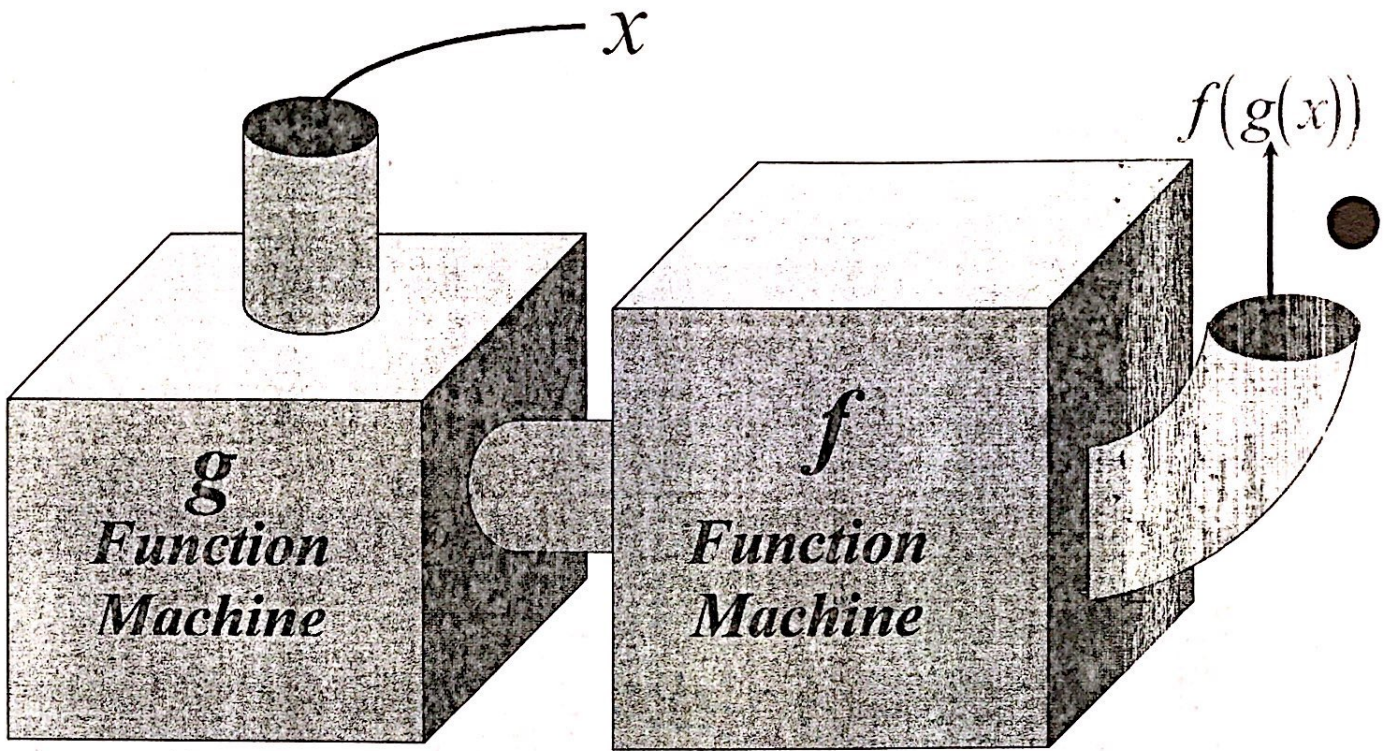
$$\begin{array}{r} -3x^2 \neq 0 \\ \hline -3 \neq 0 \\ \hline x^2 \neq 0 \\ x \neq 0 \end{array}$$

D: All IR's except $x \neq 0$

What is function composition??

Occurs when you insert one function into another function. The range of the one function becomes the domain of the second function.

Notation: $f(g(x))$ OR $f \circ g(x)$



Example 1:

$f(x) = 2x^3$ $g(x) = x^{-1}$

find $f(g(x))$ $2x^3$
 $2(x^{-1})^3$
 $2x^{-3}$

find $g(f(x))$ x^{-1}
 $(2x^3)^{-1}$
 $2^{-1}x^{-3}$

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

D: All \mathbb{R} 's
 except $x \neq 0$

$\frac{1}{2x^3}$

D: All \mathbb{R} 's
 except $x \neq 0$

Example 3:

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

find $f(g(x))$

find $g(f(x))$

Example 2:

$f(x) = 3x^2$ $g(x) = x^2 + 5$

find $f(g(x))$ $3x^2$
 $3(x^2 + 5)^2$
 $3(x^2 + 5)(x^2 + 5)$
 find $g(f(x))$ $3(x^4 + 5x^2 + 5x^2 + 25)$
 $3(x^4 + 10x^2 + 25)$

$3x^4 + 30x^2 + 75$

D: All \mathbb{R} 's

Example 4:

$f(x) = 2x + 1$ $g(x) = \frac{x+1}{4}$

find $f(g(x))$

find $g(f(x))$