

Given $f(x) = x^2 + 2x - 3$ and $g(x) = 5x + 2$, find:

1 $(f + g)(x)$

2 $(f - g)(x)$

3 $(f \cdot g)(x)$

4 $\left(\frac{f}{g}\right)(x)$

5 Given $f(x) = 2x + 7$ and $g(x) = 5x^2 + 1$, find $(f \cdot g)(-2)$

5-2: Composition of Functions



Mathematical Practices

4 Model with mathematics.

7 Look for and make use of structure.

Content Standards

F.BF.1c Compose functions.

Domain $f(x)$
 (x, y)

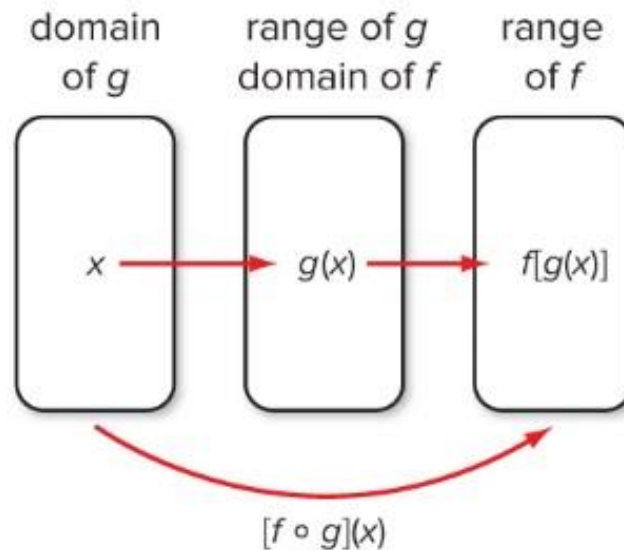
Range of $g(x)$
 (x, y)

Key Concept Composition of Functions

Words Suppose f and g are functions such that the range of g is a subset of the domain of f . Then the composition function $f \circ g$ can be described by

$$[f \circ g](x) = f[g(x)].$$

Model



Evaluate Compositions of Functions

Given $f(x) = -x + 8$ and $g(x) = 2x^2 + x$ find:

$[f \circ g](2)$

$[g \circ f](x)$

$$\begin{aligned}
 [f \circ g](x) &= -(2x^2 + x) + 8 \\
 &= -2x^2 - x + 8 \\
 &= -2(2)^2 - (2) + 8 \\
 &= -8 - 2 + 8 \\
 &= -10 + 8 \\
 &= -2
 \end{aligned}$$

Replace the x-values in $f(x)$ with $g(x)$.

$[f \circ g](x)$

Replace the x-values with 2.

Simplify

.

Evaluate Compositions of Functions

Given $f(x) = -x + 8$ and $g(x) = 2x^2 + x$, find each value.

$[g \circ f](2)$

$$2(-x+8)^2 + (-x+8)$$

$$2(x^2 - 16x + 64) - x + 8$$

$$2x^2 - 32x + 128 - x + 8$$

$$2x^2 - 33x + 136$$

$$\uparrow$$

$$(2)$$

$$\uparrow$$

$$(2)$$

• Replace the x-values in $g(x)$ with $f(x)$.

$$[g \circ f](x)$$

• Simplify

• Replace the x-values with 2.

Simplify

$$78$$

Perform Compositions of Functions

For each pair of functions, find $[f \circ g](x)$ and $[g \circ f](x)$, if they exist. State the domain and range for each combined function.

$f = \{(2, 6), (9, 4), (7, 7), (0, -1)\}$ and $g = \{(7, 0), (-1, 7), (4, 9), (8, 2)\}$

To find $[f \circ g](x)$

List the x-values of g	List the y-values of g	Use the y-values of g to find the same x-values of f. Replace with the y-values of f.	Use the x-values of g and the y-values of f to find the point.
7	0	-1	(7, -1)
-1	7	7	(-1, 7)
4	9	4	(4, 4)
8	2	6	(8, 6)

Domain: $\{7, -1, 4, 8\}$ Range: $\{-1, 7, 4, 6\}$

Perform Compositions of Functions

$f = \{(2, 6), (9, 4), (7, 7), (0, -1)\}$ and $g = \{(7, 0), (-1, 7), (4, 9), (8, 2)\}$

To find $[g \circ f](x)$

List the x-values of f	List the y-values of f	Use the y-values of f to find the same x-values of g . Replace with the y-values of g .	Use the x-values of f and the y-values of g to find the point.
2	6	no $x=6$ in g	_____
9	4	9	$(9, 9)$
7	7	0	$(7, 0)$
0	-1	7	$(0, 7)$

Domain: $\{0, 7, 9\}$

Range: $\{0, 7, 9\}$

Perform Compositions of Functions

For each pair of functions, find $[f \circ g](x)$ and $[g \circ f](x)$, if they exist. State the domain and range for each combined function.

$$f(x) = 3x^2 - x + 4 \text{ and } g(x) = 2x - 1$$

$$[f \circ g](x)$$

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

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

$$12x^2 - 12x + 3 - 2x + 5$$

$$12x^2 - 14x + 8$$

$$\frac{-b}{2a} = \frac{14}{24} = .58$$

Replace the x-values in $f(x)$ with $g(x)$.

$$\text{Domain} = \{ \mathbb{R} \}$$

$$\text{Range} = \{ y \mid y > 3.91 \}$$

Simplify

$$12(.58)^2 - 14(.58) + 8$$

$$3.91$$