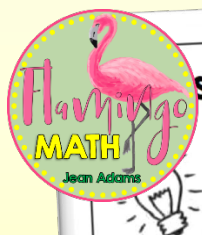


Algebra 2 Honors

Function Operations



Lesson 6: Function Operations

A combination of two functions such that the output from the first function becomes the input for the second function is called a **composite function**.

Example: $f(x) = 2x + 1$
 $g(x) = \sqrt{x}$

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

Function Operations

Addition

$$(f + g)(x) = f(x) + g(x)$$

Subtraction

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

Multiplication

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

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Lesson 6.6: Function Operations



A combination of two functions such that the output from the first function becomes the input for the second function is called a **composite function**.

Example:

Function Operations	
Addition	$(f+g)(x) =$
Subtraction	$(f-g)(x) =$
Multiplication	$(f \cdot g)(x) =$
Division	$\left(\frac{f}{g}\right)(x) =$

The domains of the sum, difference, product and quotient functions consist of the x -values that are in the domains of both f and g . Also, the domain of the quotient function does not contain any x -value where $g(x) = 0$.

Adding and Subtracting Functions

EX #1: Let $f(x) = 2x^2 + 8$ and $g(x) = x - 4$.

A. Find $f + g$. State the domain.

Multiplying and Dividing Functions

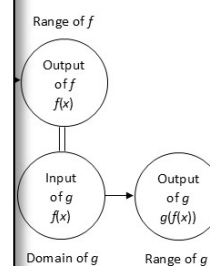
EX #2: Let $f(x) = 3x^2 - 11x - 4$ and $g(x) = 3x + 1$.

A. Find $f \cdot g$. State the domain.

B. Find $\frac{f}{g}$. State the domain.

Composition of Functions

comes the input for the second function when a composite function



NOTATION:

The composition of function g with function f is written as $(g \circ f)(x) = g(f(x))$. The domain of $g \circ f$ contains the x -values in the domain of f where $f(x)$ is in the domain of g .

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

1. Evaluate $f(x)$ first.
2. Then use $f(x)$ as the input for g .

NOTE: Function composition is not commutative since $f(g(x))$ does not always equal $g(f(x))$.

Using Compositions

EX #4: A store is offering a 15% discount on all items. Write a composite function to model the total cost of an item after the discount.

Let $C(x)$ be 15% discount:

Let $E(x)$ be 20% discount:

A. To model taking the 15% discount first and then the 20% discount, write $(E \circ C)(x)$.

B. To model taking the 20% discount first and then the 15% discount, write $(C \circ E)(x)$.

Composing Functions

EX. #3: Let $f(x) = x^2 + 2$ and $g(x) = x - 4$.

A. **METHOD #1:** Find $(f \circ g)(-3)$.

B. **METHOD #2:** Find $(f \circ g)(-3)$.

A Challenging Problem

EX #5: Your teacher offers to give the whole class a bonus if everyone passes the next math test. The teacher says she will give everyone a 10-point bonus and increase everyone's grade by 9% of their score.

A. You earned a 75 on the test. Would you rather have the 10-point bonus first and then the 9% increase, or the 9% increase first and then the 10-point bonus?

B. Is this the best plan for all students? Explain your reasoning.

NOTES

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Function Operations Practice

Problems 1–6, let $f(x) = x + 3$ and $g(x) = 2x^2 + 5x - 3$. Perform each function operation and then find the domain.

1. $f(x) + g(x)$	2. $f(x) - g(x)$
3. $f(x) \cdot g(x)$	4. $g(x) - f(x)$
5. $\frac{f(x)}{g(x)}$	6. $\frac{g(x)}{f(x)}$

Problems 7–12, let $f(x) = 2 - 3x$, $g(x) = x^2 - 9$, $h(x) = \frac{x}{3}$, and $j(x) = 3 - x$. Find each value or expression.

7. $(g \circ f)(2)$	8. $\frac{g(a)}{j(a)}$
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9. $(g \circ h)(-2)$	10. $f(j(-4))$
11. $2f(x) + 3g(x)$	12. $g(g(2))$

Problems 13–16, let $f(x) = x^2 - 5x + 4$, $g(x) = 2x + 5$. Perform each function operation.

13. $3f(x) - 2$	14. $-2g(x) + f(x)$
15. $f(x) - g(x) + 7$	16. $3f(x) + 2g(x)$

Problems 17–18, for each pair of functions, find $f(g(x))$ and $g(f(x))$.

17. $f(x) = 4x$; $g(x) = x^2 - 3$	18. $f(x) = x^2 + 2x$; $g(x) = x - 1$
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Problems 19–21, solve.

19. Your favorite restaurant is offering a 15% discount on their entrée menu items. You have a coupon valued at \$5.

- Write functions to model the discount and to model applying the coupon.
- Use a composition of your two functions to model how much you pay for a dinner entrée if the cashier applies the discount first and then the coupon.
- Write a composition to represent applying the coupon first and then the discount.
- How much more is an entrée if the cashier applies the discount first?

20. Suppose the function $f(x) = 0.0085x$ represents the number of US dollars equivalent to x Japanese yen and the function $g(x) = 18.27x$ represents the number of Mexican pesos equivalent to x US dollars.

- Write a composite function that represents the number of Mexican pesos equivalent to x Japanese yen.
- Find the value in Mexican pesos of an item that costs 750 Japanese yen.

Practice Sets

- Explain the meaning in context of the problem.

Lesson Warm-Ups

3. Let $f(x) = x + 3$ and $g(x) = x^2 - 5$.
Find $(f \cdot g)(x)$.

4. Let $f(x) = 2x + 3$ and $g(x) = x^2 - 5$.
Find the value of $(g(f(-3)))$.

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Lesson 6.6: Function Operations

Warm-Up #2

1. Let $f(x) = 4x - 1$ and $g(x) = x^2 + 3$.
Find $(f + g)(x)$.

2. Let $f(x) = 4x - 1$ and $g(x) = x^2 + 3$.
Find $(g - f)(x)$.

3. Let $f(x) = x + 2$ and $g(x) = x^2 - 3$.
Find $(f \cdot g)(x)$.

4. Let $f(x) = 2x + 5$ and $g(x) = x^2 - 1$.
Find the value of $(g(f(-2)))$.

Form A

6.6 Function Operations

Form B

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Questions 1 - 3:

Let $f(x) = 2x^2 + 5$ and $g(x) = 3x - 1$

1. What is $f + g$?

2. What is $(f - g)(2)$?

3. What is $f(x) \circ g(x)$?

4. Let $f(x) = x^2 + 2x - 15$ and $g(x) = x - 3$.
Find $f(x)/g(x)$. State domain restrictions.

2. What is $(f - g)(2)$?

3. What is $f(x) \circ g(x)$?

4. Let $f(x) = x^2 + 4x - 12$ and $g(x) = x - 2$.
Find $f(x)/g(x)$. State domain restrictions.

Daily Lesson Quiz