5-1: Operations with Functions

Mathematical Practices

2 Reason abstractly and quantitatively.

Content Standards

F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F.BF.1.b Combine standard function types using arithmetic operations.

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KeyConcept Operations on Functions

Operation	Definition	Example Let $f(x) = 2x$ and $g(x) = -x + 5$.
Addition	$(f + g)(x) = f(x) + g(x)$	$2x + (-x + 5) = x + 5$
Subtraction	$(f - g)(x) = f(x) - g(x)$	$2x - (-x + 5) = 3x - 5$
Multiplication	$(f \cdot g)(x) = f(x) \cdot g(x)$	$2x(-x + 5) = -2x^2 + 10x$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$	$\frac{2x}{-x+5}, x \neq 5$

Given $f(x) = 3x^2 + 7x$ and $g(x) = 2x^2 - x - 1$, find $(f + g)(x)$.

$3x^2 + 7x + 2x^2 - x - 1$

$5x^2 + 6x - 1$

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KeyConcept Operations on Functions

Operation	Definition	Example Let $f(x) = 2x$ and $g(x) = -x + 5$.
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Subtraction	$(f - g)(x) = f(x) - g(x)$	$2x - (-x + 5) = 3x - 5$
Multiplication	$(f \cdot g)(x) = f(x) \cdot g(x)$	$2x(-x + 5) = -2x^2 + 10x$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$	$\frac{2x}{-x+5}, x \neq 5$

Given $f(x) = 3x^2 + 7x$ and $g(x) = 2x^2 - x - 1$, find $(f - g)(x)$.

$3x^2 + 7x - (2x^2 - x - 1)$

$3x^2 + 7x$
$-2x^2 + x + 1$
$x^2 + 8x + 1$

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KeyConcept Operations on Functions

Operation	Definition	Example Let $f(x) = 2x$ and $g(x) = -x + 5$.
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Subtraction	$(f - g)(x) = f(x) - g(x)$	$2x - (-x + 5) = 3x - 5$
Multiplication	$(f \cdot g)(x) = f(x) \cdot g(x)$	$2x(-x + 5) = -2x^2 + 10x$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$	$\frac{2x}{-x+5}, x \neq 5$

Given $f(x) = 3x^2 - 2x + 1$ and $g(x) = x - 4$, find $(f \bullet g)(x)$.
Indicate any restrictions in the domain or range.

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

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

$3x^3 - 12x^2 - 2x^2 + 8x + x - 4$

$3x^3 - 14x^2 + 9x - 4$

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KeyConcept Operations on Functions

Operation	Definition	Example Let $f(x) = 2x$ and $g(x) = -x + 5$.
Addition	$(f + g)(x) = f(x) + g(x)$	$2x + (-x + 5) = x + 5$
Subtraction	$(f - g)(x) = f(x) - g(x)$	$2x - (-x + 5) = 3x - 5$
Multiplication	$(f \cdot g)(x) = f(x) \cdot g(x)$	$2x(-x + 5) = -2x^2 + 10x$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$	$\frac{2x}{-x+5}, x \neq 5$

Given $f(x) = 3x^2 - 2x + 1$ and $g(x) = x - 4$, find $\left(\frac{f}{g}\right)(x)$. Indicate any restrictions in the domain or range.

$\frac{3x^2 - 2x + 1}{x - 4}$, $x \neq 4$

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Given $f(x) = 2x^2 + 3x - 1$ and $g(x) = x + 2$, find $(f \bullet g)(x)$.

$2x^3 + 7x^2 + 5x - 2$

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Given $f(x) = 2x^2 + 3x - 1$ and $g(x) = x + 2$, find $\left(\frac{f}{g}\right)(x)$.

$\frac{2x^2 + 3x - 1}{x + 2}$, $x \neq -2$

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Mrs. Frizzle is buying tickets to an aquarium for a school trip. Adult tickets cost $24 and student tickets cost $15. There will be 3 adult chaperones on the trip.

A. Write a function ***C(x)*** that represents the total cost of the tickets, where x is the number of students on the trip.

$C(x) = 72 + 15x$

B. Everyone who goes on the trip will split the total cost of the tickets evenly. Write a function ***N(x)*** to represent the number of people who will contribute. $N(x) = x + 3$

C. Find $\left(\frac{C}{N}\right)(x)$ and explain what this function represents.

$\frac{C}{N}(x) = \frac{72 + 15x}{x + 3}$ amount each person pays

D. If 20 students go on the trip, how much will each person pay?

$16.17 plug in 20 for x

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Mrs. Frizzle is buying tickets to an aquarium for a school trip. Adult tickets cost $24 and student tickets cost $15. There will be 3 adult chaperones on the trip.

A. Write a function ***C(x)*** that represents the total cost of the tickets, where *x* is the number of students on the trip.

x ←
$15x$ ←
$24(3) = 72$
$C(x) = 72 + 15x$

- Let *x* be the number of students going to the aquarium.
- Represents the cost of the student tickets.
- The cost of the adults going to the aquarium.
- Add the cost of the student and adult ticket to determine the cost of the tickets.

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Mrs. Frizzle is buying tickets to an aquarium for a school trip. Adult tickets cost $24 and student tickets cost $15. There will be 3 adult chaperones on the trip.

A. Write a function ***C(x)*** that represents the total cost of the tickets, where *x* is the number of students on the trip.

B. Everyone who goes on the trip will split the total cost of the tickets evenly. Write a function ***N(x)*** to represent the number of people who will contribute.

$\cdot x$
3
$N(x) = x + 3$

- Let *x* be the number of students going to the aquarium.
- The number of adults going to the aquarium.
- Add the number of students and adults to determine the number of people going to the aquarium.

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Mrs. Frizzle is buying tickets to an aquarium for a school trip. Adult tickets cost $24 and student tickets cost $15. There will be 3 adult chaperones on the trip.

A. Write a function ***C(x)*** that represents the total cost of the tickets, where *x* is the number of students on the trip.

B. Everyone who goes on the trip will split the total cost of the tickets evenly. Write a function ***N(x)*** to represent the number of people who will contribute.

C. Find $\left(\frac{C}{N}\right)(x)$ and explain what this function represents.

$C(x) = 72 + 15x$
$N(x) = x + 3$
$\frac{72 + 15x}{x + 3}$

- Represents the cost of going to the aquarium.
- Represents the number of people going on the trip.
- Substitute the expressions into the formula.

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$$\frac{C}{N}(x) = \frac{72 + 15x}{x + 3}$$

D. If 20 students go on the trip, how much will each person pay?

$= \frac{72 + 15(20)}{20 + 3}$
$= \frac{72 + 300}{23}$
$= \$16.17$

- Substitute 20 in for the value of *x*.
- Simplify.
- Round to the nearest cent.

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