

Topic: Combinations of Functions**Name:** _____**What am I learning today?****Warm-Up:**

Warm-up: Perform the following operation.

$$1) (2x + 3) + (2 - 3x) = \underline{2x} + \underline{3} + \underline{2} - \underline{3x} = \boxed{-x + 5}$$

$$2) (x^2 - 7) - (x^2 + 5x - 6) = \cancel{x^2} - 7 - \cancel{x^2} - \underline{5x} + 6 = \boxed{-5x - 1}$$

$$3) (3x)(x^2 - 4x + 6) = 3x^3 - 12x^2 + 18x \checkmark$$

Operations

Sum

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

Difference

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

Product

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

Quotient

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

Examples

Perform the indicated operation

If $f(x) = 3x + 1$ and $g(x) = 3x - 4$, find:

$$\begin{aligned} \text{Ex 1: } (f + g)(x) &= f(x) + g(x) \\ &= (3x + 1) + (3x - 4) \\ &= \underline{3x} + \underline{1} + \underline{3x} - \underline{4} \\ &= 6x - 3 \end{aligned}$$

$$\begin{aligned} \text{Ex 3: } (fg)(x) &= f(x) \cdot g(x) \\ &= (3x + 1)(3x - 4) \\ &= \underline{9x^2} - \underline{12x} + \underline{3x} - \underline{4} \\ &= \boxed{9x^2 - 9x - 4} \end{aligned}$$

$$\begin{aligned} \text{Ex 2: } (f - g)(x) &= f(x) - g(x) \\ &= (3x + 1) - (3x - 4) \\ &= \underline{3x} + \underline{1} - \underline{3x} + \underline{4} \\ &= \boxed{5} \end{aligned}$$

$$\begin{aligned} \text{Ex 4: } \left(\frac{f}{g}\right)(x) &= \frac{f(x)}{g(x)} \\ &= \frac{3x + 1}{3x - 4} \end{aligned}$$

Topic: Solve by Factoring**Date:** _____**Steps**

Combinations involving evaluating for a function value

If you are given an combination operation that includes a numerical value in place of the variable x , ex. $(f+g)(2)$ your answer should result in a numerical value.

There are two ways to simplify.

- ★ 1: you can simplify by performing the operation first and then plugging the value into your simplified expression, or
 2: you can plug the numerical value in first and then perform the given operation.

For example: If $f(x) = 3x + 1$ and $g(x) = 3x - 4$, find $(f+g)(2)$

$$\begin{aligned} f(x) + g(x) &= f(2) + g(2) \\ &= (3x+1) + (3x-4) \\ &= 3x+1+3x-4 \\ &= 6x-3 = 6(2)-3 = \boxed{9} \end{aligned} \quad \begin{aligned} &= f(2) + g(2) \\ &= (3(2)+1) + (3(2)-4) \\ &= (7) + (2) = \boxed{9} \end{aligned}$$

Examples

Combinations with function values

If $f(x) = x + 15$ and $g(x) = 3 - 4x$, find:

Ex 1: $(f+g)(-1)$

$$\begin{aligned} &= f(-1) + g(-1) \\ &= (-1 + 15) + (3 - 4(-1)) \\ &= (14) + (7) = \boxed{21} \end{aligned}$$

Ex 2: $(f-g)(4)$

$$\begin{aligned} &= f(4) - g(4) \\ &= (4 + 15) - (3 - 4(4)) \\ &= (19) - (-13) = \boxed{32} \end{aligned}$$

Ex 3: $(fg)(3)$

Ex 4: $\left(\frac{f}{g}\right)(0) = \frac{f(0)}{g(0)}$

$$\begin{aligned} &= \frac{0 + 15}{3 - 4(0)} = \frac{15}{3 - 0} \\ &= \frac{15}{3} \\ &= \boxed{5} \end{aligned}$$

② $f(3) \cdot g(3)$

$$\begin{aligned} &= (3+15)(3-4(3)) \\ &= (18)(3-12) \\ &= (18)(-9) \\ &= \boxed{-162} \end{aligned}$$

① $f(x) \cdot g(x)$

$$\begin{aligned} &= (x+15)(3-4x) \\ &= 3x - 4x^2 + 45 - 60x \\ &= -4x^2 - 57x + 45 \\ &= -4(3)^2 - 57(3) + 45 \\ &= -36 - 171 + 45 \\ &= \boxed{-162} \end{aligned}$$

Summary

Summarize the lesson in your own words