Adding and Subtracting Functions

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WHAT'S COVERED

In this lesson, you will learn how to add or subtract two functions. Specifically, this lesson will cover:

1. Adding Two Functions

Suppose we were given two functions $f(x)$ and $g(x)$ and asked to add them together. Because both of these functions are given in terms of the variable x (remember that $f(x)$ means "x is an argument of the function f") we can combine the functions together by adding the like terms in each.

↱ EXAMPLE Suppose $f(x)=2x^2-x+5$ and $g(x)=x^2-5x+1$. If we wanted to find $f(x)+g(x)$, we simply do the following:

$$f(x)+g(x)=(2x^2-x+5)+(x^2-5x+1) \quad \text{Group like terms}$$

$$f(x)+g(x)=2x^2+x^2-x-5x+5+1 \quad \text{Combine like terms}$$

$$f(x)+g(x)=3x^2-6x+6 \quad \text{Our solution}$$

HINT

When trying to add two functions defined by the same variable often times you will see the notation $(f+g)(x)$, which just means $f(x)+g(x)$.

Sometimes we may be asked to evaluate two functions for different values first and then add the result.

↱ EXAMPLE Suppose $f(x)=2x-1$ and $g(x)=3x$. Find the result of $f(2)+g(1)$. In cases like this, since the value of x is different, we first need to evaluate each function of the given value and then add the final results, as shown below:

$f(2)+g(1)$ First evaluate $f(2)$

$f(2)=2(2)-1=3$ Now evaluate $g(1)$

$g(1)=3(1)=3$ Add $f(2)$ and $g(1)$ together

$f(2)+g(1)=3+3$ Simplify

Our solution

$f(2)+g(1)=6$

2. Subtracting Two Functions

When subtracting two functions we follow the same rules outlined above for addition only this time we have a negative sign between the two functions.

↗ EXAMPLE Suppose we had the functions $f(x)=x-1$ and $g(x)=x^3-2x+1$ and asked to find $f(x)-g(x)$ we would need to do the following:

$$f(x)-g(x)=(x-1)-(x^3-2x+1)$$ Subtract functions by distributing the negative

$$f(x)-g(x)=x-1-x^3+2x-1$$ Group like terms

$$f(x)-g(x)=-x^3+x+2x-1-1$$ Combine like terms

$$f(x)-g(x)=-x^3+3x-2$$ Our solution

HINT

Always remember to distribute the negative when subtracting functions, otherwise your calculation will be incorrect.

↗ EXAMPLE Find $f(3)-g(3)$ for the functions $f(x)=x-1$ and $g(x)=x^3-2x+1$.

We can use the same method we did above since both functions are being evaluated for the same value of x and both are in terms of x. We can use the solution in the last step of the above example, $f(x)-g(x)=-x^3+3x-2$, and simply substitute 3 for x and solve evaluate.

$$f(x)-g(x)=-x^3+3x-2$$ Substitute 3 in for x

$$f(3)-g(3)=-(3^3)+3(3)-2$$ Evaluate terms

$$f(3)-g(3)=-27+9-2$$ Simplify

$$f(3)-g(3)=-20$$ Our solution

We could also evaluate each function of the given value and then subtract the final results, as shown below:

$f(x)=x-1$
$g(x)=x^3-2x+1$ First evaluate $f(3)$

$f(3)=3-1=2$ Then evaluate $g(3)$

$g(3)=3^3-2(3)+1=27-6+1=22$ Subtract $f(3)$ and $g(3)$

$f(3)-g(3)=2-22$ Simplify

$f(3)-g(3)=-20$ Our solution

HINT

When trying to subtract two functions defined by the same variable often times you will see the notation $(f-g)(x)$, which just means $f(x)-g(x)$.

Keep in mind that if $f(x)$ is defined using different variables or for different values and you are asked to find $f(x)-g(x)$, you first need to evaluate each function for the given value of its variable separately and then subtract the final results.

SUMMARY

When **adding or subtracting two functions**, evaluate each function separately and combine the values for each function. For a given value a in the domain of $f(x)$ and $g(x)$, $f(a)+g(a)$ equals $(f+g)(a)$ and $f(a)-g(a)$ equals $(f-g)(a)$.

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