Product of functions

You can multiply functions to get their product. There are two ways to multiply functions.

One way to do this is to input the value of x into the expression for each function and compute the outputs for the two functions separately, and then multiply the outputs. The other way is to first multiply the expressions for the functions, and then input the value of x and compute the output. We write the product of functions f and g as

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

Example

Find $(fg)(-4)$ if $f(x) = x + 2$ and $g(x) = x - 5$.

We need to find $(fg)(-4)$, which we could rewrite as $f(-4) \cdot g(-4)$. So we can substitute the value of x (-4) into the expression for each function and then multiply the outputs.

First, let's find $f(-4)$.

$$f(x) = x + 2$$

$$f(-4) = -4 + 2$$

$$f(-4) = -2$$

Now let's find $g(-4)$.

$$g(x) = x - 5$$

$$g(-4) = -4 - 5$$

$$g(-4) = -9$$

Then the product $(fg)(-4)$ is

$$(fg)(-4) = f(-4) \cdot g(-4)$$

$$(fg)(-4) = -2 \cdot -9$$

$$(fg)(-4) = 18$$

We also could have multiplied the expressions for the functions, and then plugged in -4 for x to get the answer.

$$(fg)(x) = (x + 2)(x - 5)$$

$$(fg)(x) = x^2 - 5x + 2x - 10$$

Simplify by combining like terms.

$$(fg)(x) = x^2 - 3x - 10$$

Plug in -4 for x.

$$(fg)(-4) = (-4)^2 - 3(-4) - 10$$

$$(fg)(-4) = 16 + 12 - 10$$

$$(fg)(-4) = 28 - 10$$

$$(fg)(-4) = 18$$

Let's try another example of a product of functions.

Example

Find $(gh)(x)$ if $g(x) = x + 6$ and $h(x) = x - 8$.

We need to find $(gh)(x)$ by multiplying the expressions for the functions. Our answer will be a new function instead of a single number, since there's no numerical value assigned to x.

$$(gh)(x) = (x + 6)(x - 8)$$

$$(gh)(x) = x^2 - 8x + 6x - 48$$

Simplify by combining like terms.

$$(gh)(x) = x^2 - 2x - 48$$