

Function Mashups

Build new functions by combining familiar ones.

HIGH SCHOOL • HSF-BF.A.1b

CCSS.Math.Content.HSF-BF.A.1b "Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model."

NAME _____

DATE _____

COMBINE THE OUTPUTS

To combine functions, perform the operation on their outputs at the same input. For example, $(f - g)(x) = f(x) - g(x)$, and $(fg)(x) = f(x)g(x)$. In a model, a constant function can represent a baseline while another function represents the changing part.

WORKED EXAMPLE

Let $f(x) = 12x + 19$ and $g(x) = 4^x$.
Define $h(x) = f(x) + g(x)$. Find $h(3)$.

1. Write the combined function: $h(x) = (12x + 19) + 4^x$.
2. Substitute 3: $h(3) = 12(3) + 19 + 4^3$.
3. Evaluate: $h(3) = 36 + 19 + 64 = 119$.

Answer: $h(3) = 119$

PRACTICE 6 problems

- 1** Let $f(x) = 2x - 8$ and $g(x) = x^2$. Write $(f + g)(x)$ in simplified form.

ANSWER _____

- 2** Let $p(x) = 5^x$ and $q(x) = 9$. Write $(p - q)(x)$.

ANSWER _____

- 3** Let $a(x) = x + 10$ and $b(x) = x - 2$. Write $(ab)(x)$ in simplified form.

ANSWER _____

- 4** Let $r(x) = 8x$ and $s(x) = x - 10$. Find $(r/s)(5)$.

ANSWER _____

- 5** Let $f(x) = x^2 + 7$ and $g(x) = 2x$. If $m(x) = f(x) - g(x)$, find $m(-2)$.

ANSWER _____

- 6** Let $f(x) = 2^x + 7$ and $g(x) = 5x$. Write $k(x) = f(x) + g(x)$ in simplified form.

ANSWER _____

APPLY IT Show your work

- 1** At a gaming club, a laptop begins at 148 degrees F and cools toward a room temperature of 68 degrees F. Its temperature above room temperature is $A(t) = 80(1/2)^t$ after t hours. Let $R(t) = 68$ and $T(t) = R(t) + A(t)$. Write $T(t)$, state what each addend represents, and find $T(2)$.

WORK SPACE

ANSWER _____

- 2** An esports club has a \$42 sponsor donation for its tournament and earns \$7 for each ticket sold. Let $D(x) = 42$ and $S(x) = 7x$, where x is the number of tickets. Write the total-income function $C(x) = D(x) + S(x)$, then find $C(8)$.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Let $f(x) = 2^x + 8$ and $g(x) = x^2 - 6x$. Define $h(x) = f(x) - g(x)$. Write $h(x)$ in simplified form, then find $h(2)$. Explain which signs change when you subtract $g(x)$.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Let $f(x)=2x-8$ and $g(x)=x^2$. Write $(f+g)(x)$ in simplified form.	x^2+2x-8
2	Let $p(x)=5^x$ and $q(x)=9$. Write $(p-q)(x)$.	5^x-9
3	Let $a(x)=x+10$ and $b(x)=x-2$. Write $(ab)(x)$ in simplified form.	$x^2+8x-20$
4	Let $r(x)=8x$ and $s(x)=x-10$. Find $(r/s)(5)$.	-8
5	Let $f(x)=x^2+7$ and $g(x)=2x$. If $m(x)=f(x)-g(x)$, find $m(-2)$.	15
6	Let $f(x)=2^x+7$ and $g(x)=5x$. Write $k(x)=f(x)+g(x)$ in simplified form.	2^x+5x+7

PART 2 • APPLY IT

- $T(t)=68+80(1/2)^t$. The 68 represents room temperature, and $80(1/2)^t$ represents the temperature above room temperature. $T(2)=88$ degrees F.** Use the constant room-temperature function plus the decaying temperature-above-room-temperature function. At $t=2$, the changing part is 20, so the total is 88.
- $C(x)=42+7x$, and $C(8)=98$ dollars.** Add the fixed donation and ticket-income functions. Eight tickets bring in 56 dollars, and $42+56=98$.

CHALLENGE

$h(x)=2^x-x^2+6x+8$, and $h(2)=20$. Subtracting $g(x)$ changes $+x^2$ to $-x^2$ and $-6x$ to $+6x$.

Accept equivalent forms with terms in a different order. For products and differences, accept correct unsimplified expressions when the required operation and signs are accurate.