LESSON MAKER PRO

Functions Inside Functions

Compose functions and check which inputs work.

HIGH SCHOOL · PC.F.C.27

PC.F.C.27 "Compose functions. Extend to polynomial, trigonometric, radical, and rational functions."

NAME _____ DATE _____

THE INSIDE FUNCTION GOES FIRST

To find f(g(x)), use the output of g as the input of f. After simplifying, check whether the original functions allow every input in your answer.

WORKED EXAMPLE

Let f(x)=sqrt(x+11) and g(x)=5x-8. Find f(g(x)) and its domain.

1. Substitute g(x) into f: f(g(x))=sqrt((5x-8)+11).
2. Combine constants: f(g(x))=sqrt(5x+3).
3. Require 5x+3≥0, so x≥-3/5.

Answer: f(g(x))=sqrt(5x+3); domain: x≥-3/5.

PRACTICE 6 problems

1 Let f(x)=x^2+2x and g(x)=x-1. Find f(g(x)) in simplified form.

ANSWER _____

2 Let f(x)=sin(x) and g(x)=x+pi/2. Find f(g(0)).

ANSWER _____

3 Let f(x)=sqrt(x+4) and g(x)=x^2. Find f(g(x)) and its domain.

ANSWER _____

4 Let f(x)=1/(x-2) and g(x)=x+4. Find f(g(x)) and its domain.

ANSWER _____

5 Let f(x)=x^2-2 and g(x)=sqrt(x+4). Find f(g(x)) and its domain.

ANSWER _____

6 Let f(x)=x/(x+1) and g(x)=2/x. Find f(g(x)) and its domain.

ANSWER _____

APPLY IT Show your work

1 A concert ticket costs $12. A website adds one $4 fee per order, no matter how many tickets you buy. Let g(x)=12x be the ticket cost for x tickets, and let f(x)=x+4 add the fee. Write f(g(x)), then find the total for 2 tickets.

WORK SPACE

ANSWER _____

2 A game download is 12 GB. Its download speed is x+2 GB per hour, where x≥0. Let g(x)=x+2 give the speed, and let f(x)=12/x give the download time at a speed of x GB per hour. Write f(g(x)), then find the time when x=2.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Let $f(x)=(x^2-4)/(x-2)$ and g(x)=sqrt(x+4). Simplify f(g(x)) and state its domain. Explain why one input is excluded even though it works in your simplified expression.

WORK SPACE AND ANSWER

ANSWER KEY

Functions Inside Functions

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Let f(x)=x^2+2x and g(x)=x-1. Find f(g(x)) in simplified form.	**x^2-1**
2	Let f(x)=sin(x) and g(x)=x+pi/2. Find f(g(0)).	**1**
3	Let f(x)=sqrt(x+4) and g(x)=x^2. Find f(g(x)) and its domain.	**f(g(x))=sqrt(x^2+4); domain: all real x.**
4	Let f(x)=1/(x-2) and g(x)=x+4. Find f(g(x)) and its domain.	**f(g(x))=1/(x+2); domain: x≠-2.**
5	Let f(x)=x^2-2 and g(x)=sqrt(x+4). Find f(g(x)) and its domain.	**f(g(x))=x+2; domain: x≥-4.**
6	Let f(x)=x/(x+1) and g(x)=2/x. Find f(g(x)) and its domain.	**f(g(x))=2/(x+2); domain: x≠0 and x≠-2.**

PART 2 · APPLY IT

1. **f(g(x))=12x+4; 2 tickets cost $28.** Substitute 12x into f to get 12x+4. At x=2, the total is 12(2)+4=28.
2. **f(g(x))=12/(x+2); when x=2, the time is 3 hours.** Substitute the speed x+2 into the time function to get 12/(x+2). At x=2, the speed is 4 GB per hour, so the download takes 3 hours.

CHALLENGE

f(g(x))=sqrt(x+4)+2; domain: x≥-4 and x≠0. At x=0, g(x)=2, but f(2) is undefined because its denominator is zero.

Accept equivalent expressions and domain notation. In problem 6 and the challenge, check restrictions before canceling or simplifying.