LESSON MAKER PRO

Functions Inside Functions

Find the steps hidden inside a function.

HIGH SCHOOL · PC.F.2.2

PC.F.2.2 "Rewrite a function as a composition of functions."

NAME _____ DATE _____

THE INSIDE STEP

In h(x)=f(g(x)), g acts first and f acts on the result. To rewrite a function, choose an inside expression for g(x), then make f(x) perform the remaining steps. Check your work by replacing the x in f(x) with all of g(x).

WORKED EXAMPLE

Rewrite h(x)=sqrt(8x-15)+19 as f(g(x)).

1. Choose the expression inside the square root: g(x)=8x-15.
2. Apply the square root, then add: f(x)=sqrt(x)+19.
3. Check: f(g(x))=sqrt(8x-15)+19=h(x).

Answer: f(x)=sqrt(x)+19; g(x)=8x-15

PRACTICE 6 problems

1 Write f(x) and g(x) so that $h(x)=(2x+3)^2=f(g(x))$.

ANSWER _____

2 Write f(x) and g(x) so that h(x)=sqrt(5x-1)=f(g(x)).

ANSWER _____

3 Write f(x) and g(x) so that $h(x)=1/(x^2+4)=f(g(x))$.

ANSWER _____

4 Write f(x) and g(x) so that $h(x)=(x-6)^3+7=f(g(x))$.

ANSWER _____

5 For h(x)=3/(x+2)-5, let g(x)=x+2. Find f(x) so that h(x)=f(g(x)), and state the value of x excluded from the domain of h.

ANSWER _____

6 For $h(x)=\text{sqrt}((x-2)^2+10)$, let f(x)=sqrt(x). Find g(x), then write f(g(x)) to check.

ANSWER _____

APPLY IT Show your work

1 A streaming plan costs $6 per month plus $3 per movie. A 5% tax is added to that subtotal. Let x be the number of movies. Write the total cost as f(g(x)), where g finds the subtotal and f adds tax. Then find the total cost for 2 movies.

WORK SPACE

ANSWER _____

2 An online store takes 25% off a shirt's original price of x dollars, then adds $4 for shipping. Write the final cost as f(g(x)), where g finds the discounted price and f adds shipping. Then find the final cost when x=24.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Rewrite $h(x)=(3x-4)^2+6$ as f(g(x)) in two different ways. Use a nonidentity function for g each time, and check both answers by substitution.

WORK SPACE AND ANSWER

ANSWER KEY

Functions Inside Functions

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write f(x) and g(x) so that $h(x)=(2x+3)^2=f(g(x))$.	**$f(x)=x^2$; $g(x)=2x+3$**
2	Write f(x) and g(x) so that $h(x)=\sqrt{5x-1}=f(g(x))$.	**$f(x)=\sqrt{x}$; $g(x)=5x-1$**
3	Write f(x) and g(x) so that $h(x)=1/(x^2+4)=f(g(x))$.	**$f(x)=1/x$; $g(x)=x^2+4$**
4	Write f(x) and g(x) so that $h(x)=(x-6)^3+7=f(g(x))$.	**$f(x)=x^3+7$; $g(x)=x-6$**
5	For $h(x)=3/(x+2)-5$, let $g(x)=x+2$. Find f(x) so that $h(x)=f(g(x))$, and state the value of x excluded from the domain of h.	**$f(x)=3/x-5$; $x=-2$ is excluded**
6	For $h(x)=\sqrt{(x-2)^2+10}$, let $f(x)=\sqrt{x}$. Find g(x), then write f(g(x)) to check.	**$g(x)=(x-2)^2+10$; $f(g(x))=\sqrt{(x-2)^2+10}$**

PART 2 · APPLY IT

1. **g(x)=6+3x; f(x)=1.05x; f(g(x))=1.05(6+3x); cost for 2 movies: $12.60** The subtotal for 2 movies is $6+$3(2)=$12. Apply the 5% tax by multiplying $12 by 1.05.
2. **g(x)=3x/4; f(x)=x+4; f(g(x))=3x/4+4; final cost: $22** After a 25% discount, the shirt costs 75% of its original price. At x=24, that is $18; adding $4 shipping gives $22.

CHALLENGE

One way: $g(x)=3x-4$ and $f(x)=x^2+6$, so $f(g(x))=(3x-4)^2+6$. Another way: $g(x)=(3x-4)^2$ and $f(x)=x+6$, so $f(g(x))=(3x-4)^2+6$.

Accept other pairs of functions if substitution produces the given function on its stated domain. In the challenge, the two compositions must use different, nonidentity inner functions.