Name:
PCH Decomposition of Functions

Date:
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Do Now:
Given $f(x)=\sqrt{x}$ and $g(x)=\frac{1}{x}$, find
(a) $f(g(4))$
(b) $f(g(x))$

A composite function is a function that brings together two or more functions. For instance, let $h$ be given by

$$
h(x)=\sqrt{x^{2}+2 x+2}
$$

If we let $f(x)=$
and $g(x)=$
, then $(g \circ f)(x)=$

Thus the given function $h$ has been decomposed into the composition of the two functions $f$ and g. Such decompositions are not unique. More than one decomposition is possible.

We could have decomposed $h$ into $f(x)=\quad$ and $g(x)=$.
$f(g(x))=$

We are going to avoid using the identity function $(f(x)=x)$ in our decompositions.

TRY:

$$
\text { Given: } h(x)=\frac{2}{\sqrt{x+1}-3}
$$

(a) Create functions f and g so that $h(x)=(f \circ g)(x)$.
(b) Create functions $\mathrm{f}, \mathrm{g}$, and k so that $h(x)=(f \circ g \circ k)(x)$.

## More Practice

Express the function in the form $f \circ g$

1. $F(x)=(x-9)^{5}$
2. $F(x)=\frac{1}{x+3}$
3. $F(x)=\sqrt{x}+1$
4. $F(x)=\left|1-x^{3}\right|$
5. $F(x)=\frac{x^{2}}{x^{2}+4}$
6. $F(x)=\sqrt{1+\sqrt{x}}$

Express the function in the form $f \circ g \circ h$
7. $F(x)=\frac{1}{x^{2}+1}$
8. Find $f$ and $g$ such that $h=f \circ g$, where $h(x)=\left(\frac{1}{3 x-1}\right)^{5}$ and the inner function is rational.

For each function $h$, find two different ways to decompose the function so that $h=g \circ f$.
9. $h(x)=(8 x-3)^{5}$
10. $h(x)=\sqrt[5]{8 x-3}$
11. $h(x)=\left(\frac{5}{7+4 x^{2}}\right)^{3}$
12. $h(x)=\frac{(2 x+1)^{4}}{(2 x-1)^{4}}$
13. $h(x)=\sqrt{\left(x^{4}-2 x^{2}+1\right)^{3}}$
14. If $f(x)=2 x+1$, find $g(x)$ so that $(f \circ g)(x)=2 x^{2}-4 x+1$.

