Name: \_\_\_\_\_\_ PCH Decomposition of Functions Date: \_\_\_\_\_ Ms. Loughran

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

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

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) = and g(x) =.

f(g(x)) =

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

TRY:

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 f, 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. 
$$F(x) = (x-9)^5$$
  
4.  $F(x) = \frac{1}{x+3}$ 

2. 
$$F(x) = \sqrt{x} + 1$$
 5.  $F(x) = |1 - x^3|$ 

3. 
$$F(x) = \frac{x^2}{x^2 + 4}$$
 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  $h(x) = \left(\frac{1}{3x-1}\right)^5$  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. 
$$h(x) = (8x-3)^5$$
 10.  $h(x) = \sqrt[5]{8x-3}$ 

11. 
$$h(x) = \left(\frac{5}{7+4x^2}\right)^3$$
 12.  $h(x) = \frac{(2x+1)^4}{(2x-1)^4}$ 

13. 
$$h(x) = \sqrt{(x^4 - 2x^2 + 1)^3}$$

14. If f(x) = 2x+1, find g(x) so that  $(f \circ g)(x) = 2x^2 - 4x+1$ .