Name:_____ Date:_____

PC: Decomposition of Functions 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 $f(x)=x^2+2x+2$ and $g(x)=\sqrt{x}$, 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 $f(x)=\sqrt{x+2}$ and $g(x)=x^2+2x$.

$f(g(x))=$

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

1. Find the functions f and g so that $h(x)=f(g(x))$

(a) $h(x)=(3x+1)^2$ (b) $h(x)=\sqrt{1-4x}$ (c) $h(x)=\sqrt[4]{x+9}$

Practice

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

1. $F(x) = (x-9)^5$

2. $F(x) = \sqrt{x} + 1$

3. $F(x) = \dfrac{x^2}{x^2+4}$

4. $F(x) = \dfrac{1}{x+3}$

5. $F(x) = \left|1 - x^3\right|$

6. $F(x) = \sqrt{1+\sqrt{x}}$

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

7. $F(x) = \dfrac{1}{x^2+1}$

8. Express each of the following below as composites of two or more of the following:

$a(x) = x+1$ $\quad g(x) = x^3$ $\quad b(x) = x-2$ $\quad h(x) = \dfrac{1}{x}$

$e(x) = 3x$ $\quad k(x) = \sqrt{x}$ $\quad f(x) = x^2$

(a) $3x+1$

(b) $3x+3$

(c) $3x^2$

(d) $9x^2$

(e) $(x^3-2)^2$

(f) $9x+3$

(g) $\dfrac{1}{\sqrt{x^2+1}}$

(h) $x+2$

(i) $x-1$

(j) x^2-1

(k) $3x+2$

(l) $\sqrt{x^3+1}$

(m) $\sqrt{x+1}$

(n) $\sqrt{x}+1$

(o) $\dfrac{1}{\sqrt{x}}$

(p) $\dfrac{1}{\sqrt{x-2}}$

(q) $\dfrac{1}{\sqrt{x}-2}$

(r) $x^{\frac{3}{2}}$

(s) $\dfrac{1}{3}x$