

Name: _____
PCH: Decomposition

Date: _____
Ms. Loughran

Do Now:

For each function h given below, decompose h into the composition of two functions f and g so that $h = f \circ g$ in **two** different ways.

1. $h(x) = (x+5)^2$

$$f(x) = x^2 \quad \text{OR} \quad f(x) = (x+3)^2$$
$$g(x) = x+5 \quad \text{OR} \quad g(x) = x+2$$

OR ...

2. $h(x) = \sqrt[3]{5x^2+1}$

$$f(x) = \sqrt[3]{x} \quad \text{OR} \quad f(x) = \sqrt[3]{x-1}$$
$$g(x) = 5x^2+1 \quad \text{OR} \quad g(x) = 5x^2+2$$

OR ...

3. $h(x) = 2^{\cos x}$

$$f(x) = 2^x \quad \text{OR} \quad f(x) = 2^{x-1}$$
$$g(x) = \cos x \quad \text{OR} \quad g(x) = \cos x + 1$$

OR ...

4. $h(x) = \cos(2^x)$

$$f(x) = \cos x \quad \text{OR} \quad f(x) = \cos(x-1)$$
$$g(x) = 2^x \quad \text{OR} \quad g(x) = 2^x + 1$$

OR ...

5. $h(x) = \frac{\sqrt{x^2+1}-1}{\sqrt{x^2+1}+1}$

$$f(x) = \frac{\sqrt{x}-1}{\sqrt{x}+1} \quad \text{OR} \quad f(x) = \frac{x-1}{x+1}$$

$$g(x) = x^2+1 \quad \text{OR} \quad g(x) = \sqrt{x^2+1}$$

OR ...

Tonight's hw sheet :

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1. If $g(x) = -9x + 3$, find $f(x)$ so that $(g \circ f)(x) = -9x^4 + 3$.

2. If $g(x) = 3x$, find $f(x)$ so that $(g \circ f)(x) = 3x^2 + 3$.

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

$$g(x) = 2x - 1$$

$$f(g(x)) \rightarrow (g(x))^2 + 1$$

$$\begin{aligned} (g(x))^2 + 1 &= 4x^2 - 4x + 2 \\ (g(x))^2 &= 4x^2 - 4x + 1 \\ (g(x))^2 &= (2x - 1)^2 \\ g(x) &= 2x - 1 \end{aligned}$$

4. If $f(x) = -3x + 7$, find $g(x)$ so that $(f \circ g)(x) = -6x^2 + 31$.

Homework 10-24

For each function h , find two different ways to decompose the function so that $h = g \circ f$.

9. $h(x) = (8x-3)^5$

$$\left. \begin{array}{l} f(x) = 8x-3 \\ g(x) = x^5 \end{array} \right| \left. \begin{array}{l} f(x) = 8x \\ g(x) = (x-3)^5 \end{array} \right.$$

10. $h(x) = \sqrt[5]{8x-3}$

$$\left. \begin{array}{l} g(x) = \sqrt[5]{x} \\ f(x) = 8x-3 \end{array} \right| \left. \begin{array}{l} g(x) = \sqrt[5]{x-3} \\ f(x) = 8x \end{array} \right.$$

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

$$\left. \begin{array}{l} g(x) = x^3 \\ f(x) = \frac{5}{7+4x^2} \end{array} \right| \left. \begin{array}{l} g(x) = \left(\frac{5}{x}\right)^3 \\ f(x) = 7+4x^2 \end{array} \right.$$

$$\left. \begin{array}{l} g(x) = \left(\frac{5}{7+4x}\right)^3 \\ f(x) = x^2 \end{array} \right.$$

12. $h(x) = \frac{(2x+1)^4}{(2x-1)^4}$

$$\left. \begin{array}{l} f(x) = \frac{2x+1}{2x-1} \\ g(x) = x^4 \end{array} \right\} \left. \begin{array}{l} f(x) = \frac{(2x+1)^8}{(2x-1)^8} \\ g(x) = \sqrt{x} \end{array} \right.$$

$$\left. \begin{array}{l} f(x) = 2x \\ g(x) = \frac{(x+1)^4}{(x-1)^4} \end{array} \right| \left. \begin{array}{l} f(x) = 2x+1 \\ g(x) = \frac{x^4}{(x-2)^4} \end{array} \right.$$

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

$$\left. \begin{array}{l} g(x) = \sqrt{(x+1)^3} \\ f(x) = x^4 - 2x^2 \end{array} \right| \left. \begin{array}{l} f(x) = (x^4 - 2x^2 + 1)^3 \\ g(x) = \sqrt{x} \end{array} \right.$$

$$\left. \begin{array}{l} f(x) = x^4 - 2x^2 + 1 \\ g(x) = x^{3/2} \end{array} \right.$$

$$\begin{array}{l} 2(x^2 - 2x) \\ 2x^2 - 4x + 1 \end{array}$$

$$2(\quad) + 1$$

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

$$\underline{g(x) = x^2 - 2x}$$

$$2(x^2 - 2x) + 1$$

From textbook:

$$(43) \quad f(x) = x^4 + 1, \quad g(x) = x - 5, \quad h(x) = \sqrt{x}$$

$f \circ g \circ h$

$$g(\sqrt{x}) = \sqrt{x} - 5$$

$$f(\sqrt{x} - 5) = (\sqrt{x} - 5)^4 + 1$$

(52) Express as $f \circ g \circ h$ various answers

$$F(x) = \sqrt[3]{\sqrt{x} - 1}$$

$$\begin{aligned} h(x) &= \sqrt{x} \\ g(x) &= x - 1 \\ f(x) &= \sqrt[3]{x} \end{aligned}$$

or

$$\begin{aligned} h(x) &= \sqrt{x} - 2 \\ g(x) &= x + 1 \\ f(x) &= \sqrt[3]{x} \end{aligned}$$