Precalculus 5.1 Composite Functions

Objective: able to form a composite functions; find the domain of a composite function

Given two functions f and g, the **composition function**, denoted $f \circ g$ and read 'f composed with g', is defined by $(f \circ g)(x) = f(g(x))$

The domain of $f \circ g$ is the set of all numbers x in the domain of g such that $g(x)$ is in the domain of f.

Let $f(x) = 2x^2 + 1$ and $g(x) = 3x - 2$. Find the following.

1. $(g \circ f)(4) = g(f(4)) = g(2(4)^2+1) = g(33) = 3(33)-2 = 97$

2. $(f \circ g)(4) = f(g(4)) = f(10) = 201$

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⑤ $g(x) = x^4 + 2x^3 - 3x^2$ (degree and behavior)

$g(x) = x^2(x^2 + 2x - 3)$

$g(x) = x^2(x+3)(x-1)$

$(0,0)$ even, $(-3,0)$ odd, $(1,0)$ odd

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y int: $\frac{0-0+1}{0-2} = -\frac{1}{2}$, $(0, -\frac{1}{2})$

$0 = x^2 - x + 1$, no x int, $\sqrt{1-4}$

$f(x) = \frac{x^3+1}{x^2-x-2} = \frac{(x+1)(x^2-1x+1)}{(x-2)(x+1)}$, $(3,7)$

$\frac{1+1+1}{-3} = -1$

$n = m+1$ Oblique

D $\{x \mid x \in \mathbb{R}, x \neq 2, -1\}$

hole $(-1, -1)$: $x+1=0$, $x=-1$

vert $x = 2$

$x + 1 + \frac{3x+3}{x^2-x-2}$

$y = x + 1$

$f(x) \neq f(-x)$

$f(-x) \neq -f(x)$ no symmetry

$f(x) = $ asym.

$\frac{x^2-x+1}{(x-2)} = \frac{(x+1)}{1}$

$1 \neq -2$

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Let $f(x) = 2x^2 + 1$ and $g(x) = 3x - 2$. Find the following.

2. $(f \circ g)(4)$

So, is function composition commutative? NO

3. $(f \circ f)(1) = f(f(1)) = f(2(1)^2+1) = f(3) = 2(3)^2+1 = 19$

4. $(g \circ g)(0) = g(-2) = -8$

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Let $f(x) = \frac{1}{x+3}$ and $g(x) = \frac{-2}{x}$. Find the following, along with the domain.

5. $(f \circ g)(x) = f(g(x)) = f(\frac{-2}{x}) = \frac{1}{\frac{-2}{x} + 3(\frac{x}{x})} = \frac{1}{\frac{-2+3x}{x}} = \frac{x}{-2+3x}$

$f(x)$ $(x \neq -3)$, $g(x)$ $(x \neq 0)$

Domain $f \circ g$: $x \neq 0$ (input function = restriction to $f(x)$); $\frac{-2}{x} = -3$, $-2 = -3x$, $\frac{2}{3} \neq x$

$\{x \mid x \in \mathbb{R}, x \neq 0, \frac{2}{3}\}$

6. $g \circ f = g(f(x)) = g(\frac{1}{x+3}) = \frac{-2}{\frac{1}{x+3}} = -2(x+3) = -2x - 6$

D $\{x \mid x \in \mathbb{R}, x \neq -3\}$

$f(x) \neq$ restrictions $g(x)$: $\frac{1}{x+3} \neq 0$, $1 \neq 0$

7. ~~$f \circ f$~~

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Let $f(x) = \frac{1}{x+3}$ and $g(x) = \frac{-2}{x}$. Find the following, along with the domain.

7. $f \circ f = f(f(x)) = f(\frac{1}{x+3}) = \frac{1}{\frac{1}{x+3} + 3(\frac{x+3}{x+3})} = \frac{1}{\frac{1}{x+3} + \frac{3x+9}{x+3}} = \frac{1}{\frac{3x+10}{x+3}} = 1 \cdot \frac{x+3}{3x+10}$

$\frac{1}{x+3} \neq -3$, $1 \neq -3x - 9$, $10 = -3x$; $\{x \mid x \in \mathbb{R}, x \neq -3, -\frac{10}{3}\}$

$f \circ f = \frac{x+3}{3x+10}$

8. $g \circ g = g(g(x)) = g(\frac{-2}{x}) = \frac{-2}{\frac{-2}{x}} = -2 \cdot \frac{x}{-2} = x$

$\frac{-2}{x}$, $x \neq 0$; $\frac{-2}{x} \neq 0$, $-2 \neq 0$; $\{x \mid x \in \mathbb{R}, x \neq 0\}$

To show that **two composite functions are equal** show that $(f \circ g)(x) = (g \circ f)(x) = x$

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9. Show that $(f \circ g)(x) = (g \circ f)(x) = x$ for the functions

$f(x) = 4x$ and $g(x) = \frac{1}{4}x$

$f \circ g =$
$= f(g(x))$
$= f\left(\frac{1}{4}x\right)$
$= 4\left(\frac{1}{4}x\right)$
$= x$

$g \circ f =$
$= g(f(x))$
$= g(4x)$
$= \frac{1}{4}(4x)$
$= x$ ✓

Find functions f and g so that $f \circ g = H$

10. $H(x) = (1 + x^2)^3$

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Find functions f and g so that $f \circ g = H$

10. $H(x) = (1 + x^2)^3$

$f(x) = x^3$ $g(x) = (1 + x^2)$

$f(g(x))$

$f \circ g = (1 + x^2)^3$

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Rate yourself on how well you understood this lesson.

I don't get it at all	I sort of get it	I understand most, but I need more practice	I understand it pretty well	I got it!!
1	2	3	4	5

What I still need to work on....

Aug 24-10:50 AM