

Pre-Calculus 12 Composite Functions

Composite functions are functions that are formed from two functions, $f(x)$ and $g(x)$, in which the output of one of the functions is used as the input for the other function.

Ex: $f(g(x)) \rightarrow$ same as $(f \circ g)(x)$

When combining functions, **order is important:**

outside fcn $f(g(x))$ is not always the same as $g(f(x))$
inside fcn

Examples

- Given the following,

x	<i>y</i> f(x)
-2	8
-1	3
0	0
1	-1
2	0

x	<i>y</i> g(x)
-2	3
-1	2
0	1
1	0
2	-1

Determine:

a) $f(g(2))$

Determine $g(2)$
find y when $x=2$
 $g(2) = -1$
sub in
 $f(-1)$

b) $g(f(2))$

$f(2) = 0$
 $g(0)$
 $g(0) = 1$
 $\therefore g(f(2)) = 1$

or
 $g(f(2))$
 $g(0)$
 1

c) $g(g(2))$

$g(-1)$
 2

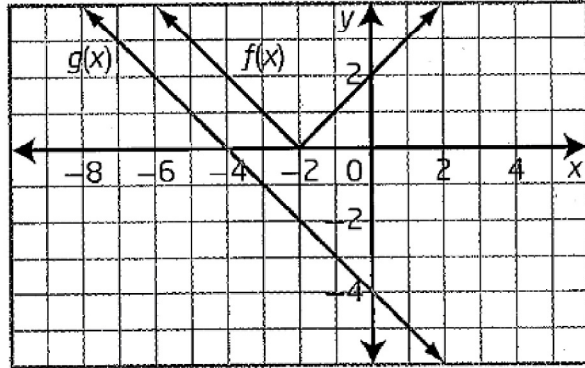
find y when $x=-1$
 $\therefore f(-1) = 3$
 $\text{and } f(g(2)) = 3$

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2. Given the graphs of $f(x)$ and $g(x)$, determine:

Work inside out

a) $f(g(-4))$
 \uparrow
 x , find y
 $f(0)$
 2



b) $f(f(-2))$
 $f(0)$
 2

3. Given the functions $f(x) = x^2 + 3$ and $g(x) = -2x + 1$, determine:

a) $f(g(2))$

① Evaluate $g(2)$
 replace x with 2
 $g(x) = -2x + 1$
 $g(2) = -2(2) + 1$
 $= -3$

② Replace $g(2)$ with -3 and evaluate $f(-3)$
 $f(x) = x^2 + 3$
 $f(-3) = (-3)^2 + 3$
 $= 12$
 $\therefore f(g(2)) = 12$

b) $g(f(-3))$

$f(-3) = 12$
 $g(x) = -2x + 1$
 $g(12) = -2(12) + 1$
 $= -23$
 $\therefore g(f(-3)) = -23$

c) $g(g(0))$

$g(x) = -2x + 1$
 $g(0) = -2(0) + 1$
 $= 1$

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

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4. Given $f(x) = 2x^2 + 1$ and $g(x) = 2x + 7$, determine an explicit equation for each of the following:

a) $f(g(x))$ determine $f(2x+7)$

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

$$f(2x+7) = 2(2x+7)^2 + 1 \quad \leftarrow \text{if worth 1 mark, stop}$$

$$= 2(4x^2 + 28x + 49) + 1$$

$$= 8x^2 + 56x + 98 + 1$$

$$= 8x^2 + 56x + 99$$

$$\therefore f(g(x)) = 8x^2 + 56x + 99$$

b) $g(f(x))$

$$g(x) = 2x + 7$$

$$g(2x^2 + 1) = 2(2x^2 + 1) + 7$$

$$= 4x^2 + 2 + 7$$

$$= 4x^2 + 9$$

$$\therefore g(f(x)) = 4x^2 + 9$$

c) $g(g(x))$

$$g(2x+7) = 2(2x+7) + 7$$

$$= 4x + 14 + 7$$

$$= 4x + 21$$

$$\therefore g(g(x)) = 4x + 21$$

ps. 507 # 1 a, c 2 b, d, 3 c, d
4 c, d, f, 6, 8