Composite Functions

$$f \circ g(x) \ or \ g \circ f(x)$$

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Goals and Objectives

Students will be able to recognize function notation and correctly compose two or more functions together to create a new function.

Why do we need this?

On many occasions, multiple situations happen to something before it obtains a final result. For example, you take extra food off of your plates before you put them in the dishwasher. Or, to wrap a present you must first put it in the box, then apply the wrapping paper, and finally tie the bow. These are multiple functions that go together to obtain a desired result.

Composite Functions

Composite functions exist when one function is "nested" in the other function.

There are 2 ways of writing a composite function:

$$f(g(x)) \ or \ f \circ g(x)$$

Each form is read "f of g of x" and both mean the same thing.

Composite Functions

To simplify composite functions, substitute one function into the other in place of "x" and simplify. Work from the inside out.

Given: $f(x) = 3x^2 + 2x \;\; \& \;\; g(x) = 4x$

Find: $f(g(x))$

Answer

Composite Functions

To simplify composite functions, substitute one function into the other in place of "x" and simplify. Work from the inside out.

Given: $f(x) = 3x^2 + 2x$ & $g(x) = 4x$

Find: $g(f(x))$

Answer

Composite Functions

Given: $f(x)=\sqrt{x-3}$ & $g(x)=2x^2+x-2$

Find: $f(g(x))$

Answer

Composite Functions

Given: $f(x)=\sqrt{x-3}$ & $g(x)=2x^2+x-2$

Find: $g\circ f(x)$

Answer

55 Find $f \circ g(x)$ if $f(x) = \dfrac{1}{|x| + 3}$ & $g(x) = -x^3$

A $\dfrac{|x^3|}{3}$

B $\dfrac{1}{|x^3| + 3}$

C $\dfrac{1}{x^3 + 3}$

D $x^3 + 3$

Answer

56 Find $g \circ f(x)$ if $f(x) = x^2$ & $g(x) = \sqrt{x^2 + 4}$

A $x^2 + 4$

B $x^2 + 2$

C $\sqrt{x^4 + 4}$

D $\sqrt{6x}$

Answer

57 Find $f \circ g(x)$ if $f(x) = x^2 + x + 4$ & $g(x) = \sqrt{x}$

A $x + \sqrt{x+4}$

B $\sqrt{x^2 + x} + 2$

C $x + \sqrt{x} + 2$

D $x + \sqrt{x} + 4$

Answer

58 Find $f \circ g(x)$ if $f(x) = x^2$ & $g(x) = \sqrt{x^2 + 4}$

A $x^2 + 4$

B $x^2 + 2$

C $\sqrt{x^4 + 4}$

D $\sqrt{6x}$

Answer

59 Find $g \circ f(x)$ if $f(x) = (x+7)^2$ & $g(x) = \sqrt{x} - 7$

A $x + 14$

B x

C $x - 14$

D $x - 14\sqrt{x} + 49$

Answer

Composite Functions

To simplify composite functions with numerical values, there are two different options:
1) substitute the number into the "inner" function, simplify, and then substitute that value in for the variable in the "outer" function.
2) find your composite function & then substitute the numerical value into the composite function.

If $f(x) = x^2 - 4x$ & $g(x) = 3x + 2$, then find $f(g(1))$.

Option 1)

$$g(1) = 3(1) + 2 = 5$$

$$f(g(1)) = f(5)$$

$$= 5^2 - 4(5)$$

$$= 25 - 20 = 5$$

Option 2)

$$f(g(x)) = (3x + 2)^2 - 4(3x + 2)$$

$$= 9x^2 + 12x + 4 - 12x - 8$$

$$= 9x^2 - 4$$

$$f(g(1)) = 9(1)^2 - 4 = 5$$

Composite Functions

Evaluate the composite functions. Use both methods and compare your results.

Given: $f(x) = 3x^2 + 2x$ & $g(x) = 4x$

Find: $f \circ g(3)$

Answer

Composite Functions

Evaluate the composite functions. Use both methods and compare your results.

Given: $f(x) = 3x^2 + 2x$ & $g(x) = 4x$

Find: $g(f(-2))$

Answer

60 If $f(x) = x^2 + 1$ & $g(x) = 3x - 1$, find the value of $f(g(2))$

A 0

B 5

C 26

D -4

Answer

61 If $f(x) = x + 2$ & $g(x) = \frac{1}{x}$, find the value of $g(f(-2))$

A undefined

B 0

C $\frac{5}{2}$

D $\frac{1}{2}$

Answer

62 If $f(x)=3x^2+2x-3$ & $g(x)=x-2$, find the value of $f(g(-3))$

A 62

B -88

C 82

D 19

Answer

63 If $f(x) = x + 1,\ g(x) = 3x - 1$ & $h(x) = |x|$, find the value of $f \circ h \circ g(0)$

A 0

B 1

C 2

D -1

Answer