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Keeper #4

Composition of Functions

Do now: Evaluate $f(x) = x^2 - 1$ at $x = 8$; at $x = -2$; at $x = 5.2$.

$f(8) = (8)^2 - 1$
$f(8) = 64 - 1$
$f(8) = 63$

$f(-2) = (-2)^2 - 1$
$f(-2) = 4 - 1$
$f(-2) = 3$

$f(5.2) = (5.2)^2 - 1$
$f(5.2) = 27.04 - 1$
$f(5.2) = 26.04$

- A **composition** of functions is a new function created by plugging one function into another (aka, evaluating one function at another function).
  - Ex: $f(g(x))$ is a composition in which the function _f__ is evaluated at the function __g__.

- $f(g(x))$ is read "f evaluated at g,"
  or "f of g of x"

- Instead of plugging in a value for x (like in the do now), we plug in an entire function.

Remember order of operations!

Operation	**Example: $f(x) = 3x^2 - 4$, $g(x) = 2x$**	**Example: $f(x) = 4x^5$, $g(x) = x^3$**
Composition of *f* with *g*	$f(x) = 3x^2 - 4$ $f(g(x)) = 3(2x)^2 - 4$ $f(g(x)) = 3(4x^2) - 4$ $f(g(x)) = 12x^2 - 4$	
Composition of *g* with *f*	$g(x) = 2x$ $g(f(x)) = 2(3x^2 - 4)$ $g(f(x)) = 6x^2 - 8$	

Note that in general, $f(g(x))$ does not equal $g(f(x))$!

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More examples

Let $f(x) = 3x + 2$, $g(x) = x - 4$, and $h(x) = -2x - 1$. Perform the indicated operation.

1. $f(g(x))$ **3.** $f(h(x))$ **5.** $g(h(x))$ **7.** $f(f(x))$

2. $g(f(x))$ **4.** $h(f(x))$ **6.** $h(g(x))$ **8.** $g(g(x))$

Let $f(x) = x^2$, $g(x) = 4x^3$, and $h(x) = -2x+1$. Perform the indicated operation.

9. $f(g(x))$ **11.** $f(h(x))$ **13.** $g(h(x))$ **15.** $f(f(x))$

10. $g(f(x))$ **12.** $h(f(x))$ **14.** $h(g(x))$ **16.** $g(g(x))$