Name:______________________________ Date:___________
PC: Composition of Functions Ms. Loughran

Two functions can be combined to form a new function.

Given: $f(x) = x^2 + 4$ and $g(x) = 2x$, then the composite function $f \circ g$, read " f following g," can be defined by $[f \circ g](x) = f(g(x))$.

If we want to find $f(g(4))$, we can go about it two ways:

First way:

Since $g(4) =$ then $f(g(4)) = f(\quad) =$

Therefore $f(g(4)) =$

Second way:

Since $g(x) = 2x$, then $f(g(x)) = f(\quad) =$

Now we can plug 4 into that rule so $f(g(4)) =$

Example 1: Using the functions given above find: (a) $g(f(x))$
(b) $g(f(4))$

Notice that $[f \circ g](x) \neq [g \circ f](x)$. Therefore, the operation of composition is not commutative.

Example 2:

Let $f(x) = 3x - 5$ and $g(x) = 2 - x^2$. Find:

(a) $[f \circ g](0)$

(b) $g(f(0))$

(c) $[f \circ f](4)$

(d) $[g \circ g](3)$

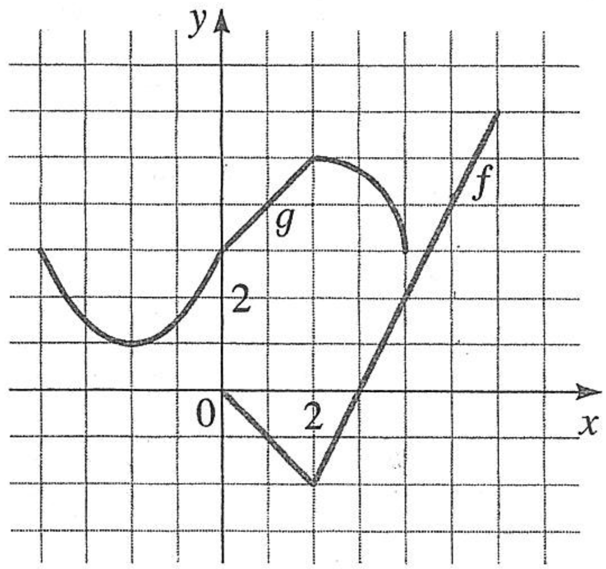
(e) $f(g(-2))$

(f) $g(f(x))$

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

Practice:

For 1-6, use the given graphs of *f* and *g* to evaluate the expression.



1. $f(g(2))$ 2. $g(f(0))$ 3. $(g \circ f)(4)$

4. $(f \circ g)(4)$ 5. $(g \circ g)(-2)$ 6. $(f \circ f)(4)$

7. For each of the following, find the functions $(f \circ g)(x)$ and $(g \circ f)(x)$.

(a) $f(x) = 2x + 3,\ g(x) = 4x - 1$

(b) $f(x) = 6x - 5,\ g(x) = \frac{x}{2}$

(c) $f(x) = x^3 + 2,\ g(x) = \sqrt[3]{x}$

(d) $f(x) = x^2,\ g(x) = \sqrt{x - 3}$

(e) $f(x) = x^2,\ g(x) = x - 1$

8. Find $f(g(h(x)))$

(a) $f(x) = x - 1,\ \ g(x) = \sqrt{x},\ \ h(x) = x + 1$

(b) $f(x) = \dfrac{1}{x},\ \ g(x) = x^3,\ \ h(x) = x^2 + 2$

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

(d) $f(x) = \sqrt{x},\ \ g(x) = \dfrac{x}{x-1},\ \ h(x) = \sqrt[3]{x}$