MATH 171 Activity #6: Composition of Functions/Inverse Functions	Homework: 2.6: 17, 19, 29, 33, 37, 55, 57, 59 5.1: 3, 53, 54, 55, 59, 65, 67, 69

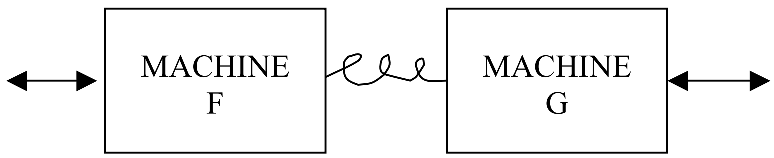
1. On your way to math class, you stumble across a magic lamp. After rubbing it, a genie appears and grants you 3 wishes. Since you're a typical college student, you wish for an "automatic money machine."

   The genie grants your wish and an ATM-like machine appears. The genie tells you the machine will automatically add $50 to whatever amount of money you insert into it. We'll call this Machine F.

   You realize it will take too long to get rich from this machine, so you wish for a second machine that will automatically double any amount of money you insert. We'll call this Machine G.

   While trying the machines out, you say, "Boy, I wish I had an adapter to hook these machines together." A few seconds later, the machines are magically connected.

   These machines can be visualized as:



   You can put money into either side of the machines.

2. Write out formulas for Machine F & G, showing what happens when you insert $X into each machine separately.

3. If you put money in on the right side, you are first finding f(x) and then evaluating g(x). This is written as $g(f(x))$.

   Find the value of $g(f(5))$, $g(f(10))$, and $g(f(x))$.

4. If you put money in on the left side, you are first finding g(x) and then evaluating f(x). This is written as $f(g(x))$.

   Find the value of $f(g(5))$, $f(g(10))$, and $f(g(x))$.

5. Let $f(x) = x^2 - 1$ and $g(x) = \sqrt{x}$. Perform the following operations

$f(g(x))$ ______________________________

$g(f(x))$ ______________________________

6. Complete the following table:

x	0	1	2
m(x)	1	9	____
h(x)	2	0	1
$m(h(x))$	5	____	____

7. How can we tell is a graph represents a function? Why does this work?

8. Suppose we conduct a *horizontal line test*. If a graph that passes this test, it means that each value of y (output) corresponds with exactly one value of x (input). Functions that pass the horizontal line test are said to be invertible (or one-to-one).

   Determine which of the following functions are one-to-one.

   $y = x^5 + 7$ $\qquad$ $y = |x|$ $\qquad$ $y = 4(2^x)$ $\qquad$ $y = x^6 + 2x^2 - 10$

9. The range of a function becomes the domain of an inverse function. In this way, inverse functions "undo" each other. In other words, if f(x) and g(x) are inverse functions, then f(g(x)) = g(f(x)) = x.

   Determine if the following pairs of functions are inverses by finding their compositions.

   $f(x) = 8x + 5$

   $g(x) = \dfrac{x-5}{8}$

   $j(x) = x^3 + 4$

   $k(x) = \sqrt[3]{x+4}$

10. Once we're sure a function is invertible, finding an inverse functions is a simple 2-step process:

    (1) Interchange y and x. (Turn the range into the domain)
    (2) Solve for y to find the inverse function.

    We symbolize the inverse function as $f^{-1}(x)$.

11. Find inverse functions for the following functions. Then graph both the original function and its inverse. What do you notice about the graph of a function and its inverse?

$f(x) = 7x - 2$

$g(x) = \sqrt{x + 5}$

$h(x) = \frac{1}{x}$

$h(x) = x^2 + 3$