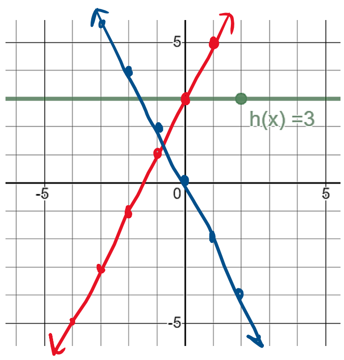
Name:____ Per: _______

1.5 - Combinations and Composition of Functions Investigation

1. $h(x) = (f+g)(x)$ and $h(x)$ is graphed below. Come up with equations for $f(x)$ and $g(x)$ that would produce $h(x)$, then sketch, and label, the graphs in. Note, neither can be equations with a slope of 0.

$f(x) =$ 2x + 3

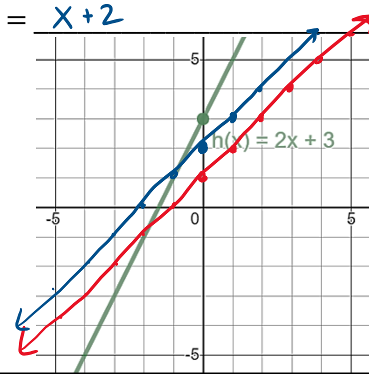
$g(x) =$ -2x



2. $h(x) = (f+g)(x)$ and $h(x)$ is graphed below. Come up with equations for $f(x)$ and $g(x)$ that would produce $h(x)$, then sketch, and label, the graphs in. Note, neither can be equations with a slope of 0.

$f(x) =$ x + 1

$g(x) =$ x + 2



3. Verify your work to problem 1 above by filling in the tables below.

x	-2	-1	0	1	2
f(x)	-1	1	3	5	7

x	-2	-1	0	1	2
g(x)	4	2	0	-2	-4

x	-2	-1	0	1	2
h(x)	3	3	3	3	3

h(x) = 3

4. Verify your work to problem 2 above by filling in the tables below.

x	-2	-1	0	1	2
f(x)	-1	0	1	2	3

x	-2	-1	0	1	2
g(x)	0	1	2	3	4

x	-2	-1	0	1	2
h(x)	-1	1	3	5	7

This is the table for 2x+3

5. $h(x) = (fg)(x)$ and $h(x) = x^2 + 4x - 12$. Come up with equations for $f(x)$ and $g(x)$ that would produce $h(x)$. Note, each equation must contain a variable.

$f(x) =$ $(x+6)$

$g(x) =$ $(x-2)$

6. $h(x) = (f/g)(x)$ and $h(x) = \frac{1}{x-7}$. Come up with equations for $f(x)$ and $g(x)$ that would produce $h(x)$. Note, each equation must contain a variable.

$f(x) =$ $x+3$

$g(x) =$ $x^2 - 4x - 21 = (x+3)(x-7)$

7. $h(x) = (f-g)(x)$ and $h(2) = 20$. Come up with equations for $f(x)$ and $g(x)$ that would produce $h(x)$. Note, one equation must be of degree 3 and the other degree 2.

$f(x) =$ $4x^3 + x^2$ $\quad f(2) = 36$

$g(x) =$ $4x^2$ $\quad g(2) = 16$

$h(2) = f(2) - g(2) = 20$

8. $h(x) = (fg)(x)$ and $h(4) = 100$. Come up with equations for $f(x)$ and $g(x)$ that would produce $h(x)$. Note, one equation must be of degree 2 and the other degree 1.

$f(x) =$ $x^2 + x$ $\quad f(4) = 20$

$g(x) =$ $x + 1$ $\quad g(4) = 5$

$h(4) = f(4)g(4) = 100$

9. $k(x) = f(g(x))$ and $k(x) = (x-3)^2$. Come up with equations for $f(x)$ *and* $g(x)$ that would produce $k(x)$.

$f(x) =$ x^2

$g(x) =$ $x-3$

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

10. $k(x) = f(g(x))$ and $k(x) = \sqrt{x+4} + 5$. Come up with equations for $f(x)$ *and* $g(x)$ that would produce $k(x)$.

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

$g(x) =$ $x+4$

$f(g(x)) = f(x+4) = \sqrt{x+4} + 5$

11. $k(x) = f(g(x))$ and $k(6) = 10$. Come up with equations for $f(x)$ *and* $g(x)$ that would produce $k(x)$. Note, one of the equations must have degree 2.

$f(x) =$ $x+7$

$g(x) =$ $x^2 - 33$

$K(6) = f(g(6)) = f(3) = 10$

12. $k(x) = f(g(x))$ and $k(-4) = 10$. Come up with equations for $f(x)$ *and* $g(x)$ that would produce $k(x)$. Note, one of the equations must have degree 2.

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

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

$K(-4) = f(g(-4)) = f(3) = 10$

13. In chemistry, one regular conducts mole conversions to convert grams of a substance to number of atoms. It turns out this process is just a composition of functions.
For chlorine, to convert from moles to atoms, you use the following function: $a(m) = m(6.02 \cdot 10^{23})$
For chlorine, to convert from grams to moles, you use the following function: $m(g) = \frac{g}{35.5}$

i) Simplify the following to get a function that takes you directly from grams to atoms:

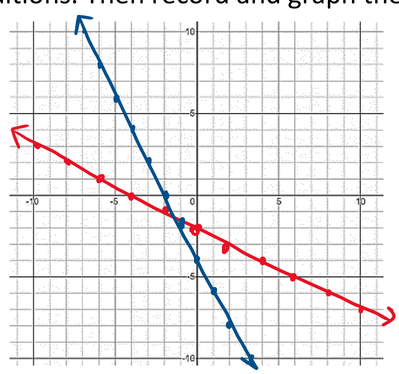
$a(m(g)) =$ $a\left(\frac{g}{35.5}\right) = \frac{g(6.02 \cdot 10^{23})}{35.5}$

ii) Use your finding from part (i) to determine how many atoms are in 83 grams of chlorine.

$a(m(83)) = 83(6.02 \times 10^{23})/35.5 = \boxed{1.41 \times 10^{24}}$

14. Find equations for $f(x)$ and $g(x)$ that satisfy the following conditions. Then record and graph them.

- $f(g(x)) = x$
- $g(f(x)) = x$
- Both equations are linear
- $f(x)$ has a negative slope
- $g(x)$ has a negative y-intercept



$f(x) =$ $-\frac{1}{2}x - 2$

$g(x) =$ $-2x - 4$

15. Fill in a table of points for each function and record what you notice.

x	-4	-2	0	2	4
f(x)	0	-1	-2	-3	-4

x	0	-1	-2	-3	-4
g(x)	-4	-2	0	2	4

Noticing: ***The inputs and outputs (x and y-coordinates) for the functions are flipped.***