Pre-AP Algebra 2
Lesson 1-2 – Composite Functions

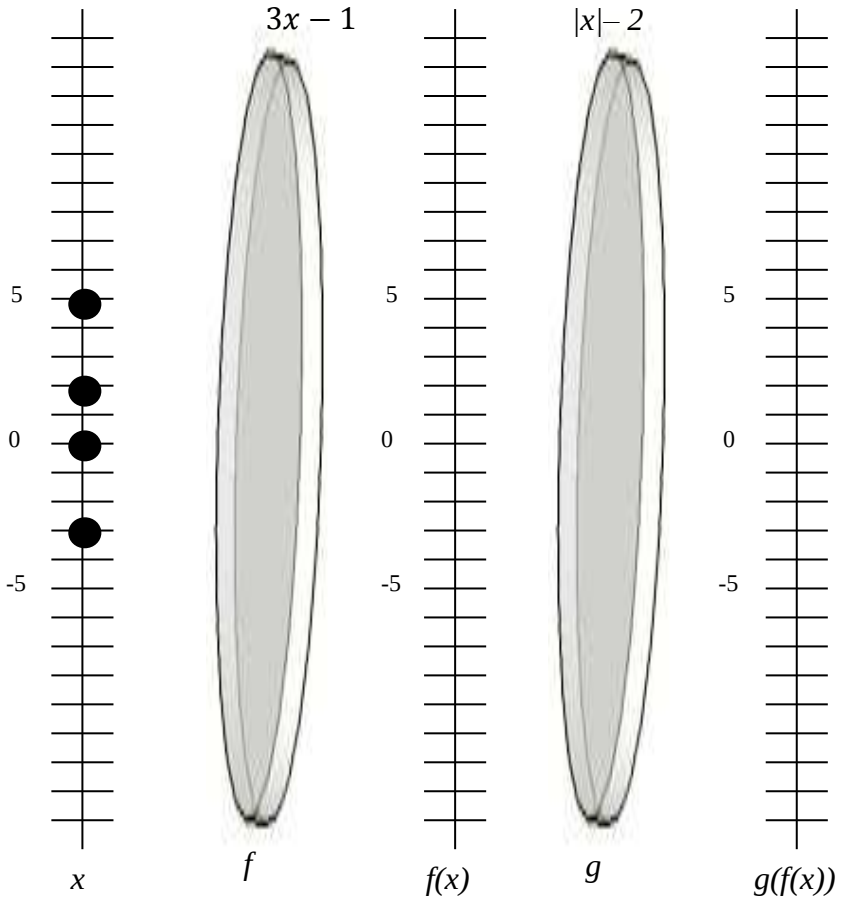
Objectives: The students will be able to answer questions relating to a function given the graph. The students will be able to add, subtract, and multiply. The students will be able to compose functions and evaluate them, given their equations. The students will also be able to decompose a composite function.

Materials: Hw #1-1 answers overhead; Do Now worksheet; pairwork; hw #1-2

Time	Activity
10 min	**Homework Review** Put up the answers to hw #1-1 on the overhead. Give students time to discuss in groups any problems.
15 min	**Homework Presentation** Show students how to do selected problems from the tally sheet. Use the spiral problems (5, 6, 7) to introduce the different ways to write a solution set (set notation and interval notation)
10 min	**Do Now** Students work on **Functions through a Double Lens** handout. **Work through this illustration together.** **Questions to ask: What is f(-3)? What is g(-10)? What does g(f(-3)) mean? What would the picture need to look like to find f(g(-3))?**
15 min	**Direct Instruction:** **A composite function** • **is a function of a function.** • **uses the output of the inner function as the input of the outer function.** • **has two notations that mean the same thing: f(g(x)) or f ° g (x) both mean f of g of x.** **(I prefer the first, because it more clearly indicates which function is being substituted into which.)** **Examples:** **For examples 1 – 8, let** $f(x) = \sqrt{(x+2)}$, $g(x) = x^2 - 1$, $h(x) = \lvert x - 10 \rvert$ **Find: 1) f(g(1)) 2) g(f(1)) 3) h ° g(5) 4) g ° h(5)** **Concepts:** • **Is f(g(x)) = g(f(x))? Not usually! See examples 1 – 4.** **Examples:** **Find: 5) f(g(h(1))) 6) g(g(-2))** **Concepts:** • **We can compose as many functions as we want! Just add another lens or rule. You can also compose a function with itself. See examples 5 and 6.** • **If the input to a composite function is a variable, then the result will be a function (not a number). See examples 7 and 8.** **Examples:** **7) Let c(x) = f(g(x)). What is c(x)?** **8) Let d(x) = g(f(x)). What is d(x)? Is function composition commutative?**
20 min	**Pairwork** ➢ Arrange the students in pairs and distribute the worksheet. After each section, stop them to check for understanding. This pairwork gives them practice with function composition using all representations
	Exit Ticket: 3-2-1 (3 things you have learned so far, 2 things you still don't understand, 1 thing you could teach someone else)

Pre-AP Algebra 2 Name: _____
Lesson 1-2 – Do Now

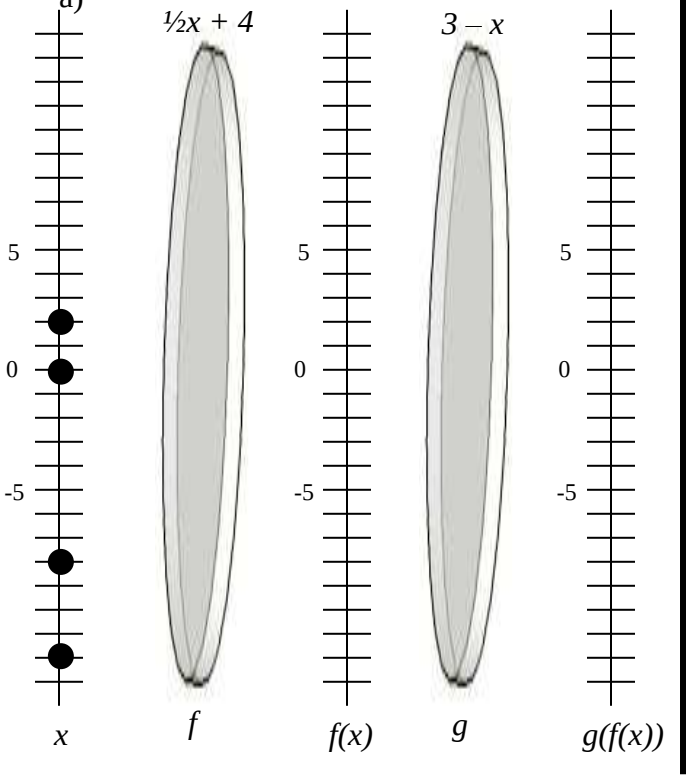
Last time we explored a lens model as a way to think of functions. What if the input was passed through one lens and then the resulting output was passed through another lens?



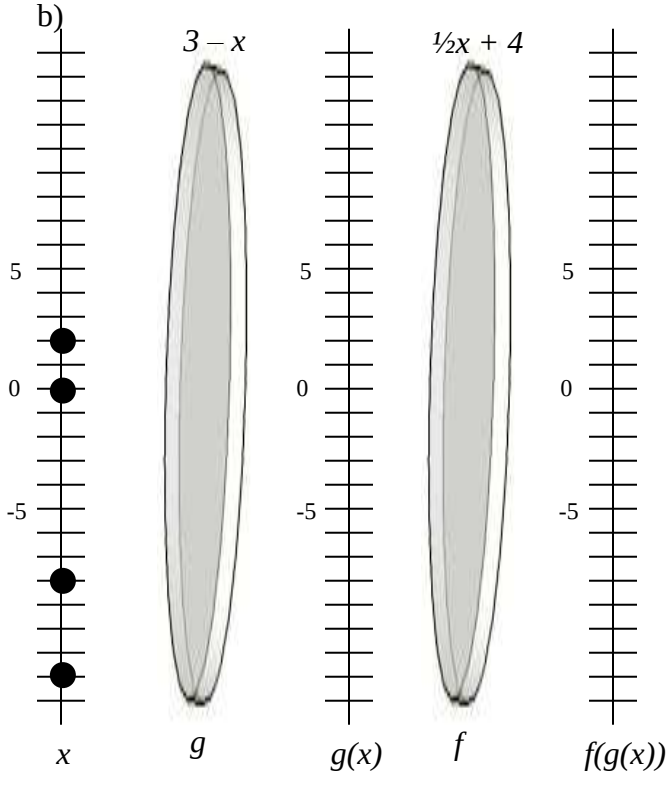
Pre-AP Algebra 2 Name: _____
Lesson 1-2 – Pairwork

1) Use arrows to show how each input (x) value gets mapped onto the final output.

a)



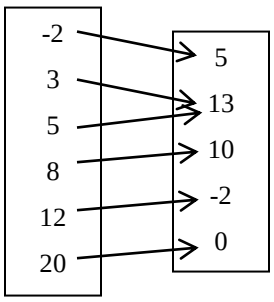
b)



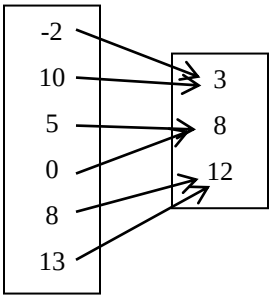
2) Based on problem #1, is function composition **commutative**? In other words, does the order in which you compose the functions matter? Is f(g(x)) always the same as g(f(x))?

3) Use the arrow mappings to find the following

f



g



a. f(g(10))

b. g ° f(-2)

c. g ° f(6)

d. f(g(f(20)))

e. f(g(g(0)))

Pre-AP Algebra 2 Name: _____
Lesson 1-2 – Pairwork

4) Let $f(x) = 3x - 7$, $g(x) = \sqrt{2x + 10}$, $h(x) = 4x^2 - 3x$ Find:

a. f(-2)

b. g(-5)

c. h(2)

d. h(-2)

e. f(a + 1)

f. f(a + h)

g. f(a) + h

h. g(x – 5)

i. h(a + b)

j. f(g(3))

k. g(f(3))

l. h ° g(-2)

m. g ° h(-2)

n. f(g(h(1)))

o. h(f(g(-3)))

p. f ° f ° f(1)

q. Let c(x) = f(g(x)). Then, c(x) =

r. Let d(x) = h(f(x)). Then, d(x) =

s. Let e(x) = f ° h(x). Then, e(x) =

5) Use the tables below to find each of the following (or write CND):

f:

x	-9	-5	-1	0	3	4	6	8
y	10	-2	3	7	-½	4	16	-20

g:

x	-5	-3	0	1	4	8	12
y	8	4	3	-5	12	0	-9

a. f(g(-3)) =

b. f(g(12)) =

c. g(g(4)) =

d. g ° f(4) =

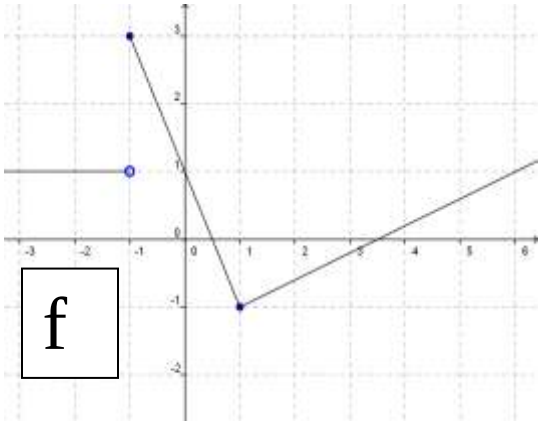
e. g(f(-5)) =

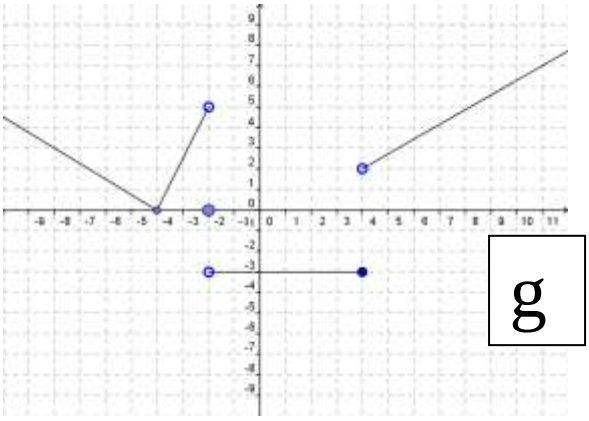
f. f ° g(-5) =

g. f(g(0)) + f(g(8)) =

Pre-AP Algebra 2 Name: _____
Lesson 1-2 – Pairwork

6) Use the graphs below to find each of the following (or write CND):





a. f(g(5)) =

b. f(g(-2)) =

c. g(f(6)) =

d. g(f(-4)) =

e. f(f(3)) =

7) Most functions are compositions of basic functions. Work backwards to determine the basic functions that created the composition.

	f(g(x))	***f(x)***	***g(x)***
a	$(x + 4)^2 + 5$		
b	$\sqrt{x-4}$		
c	$(4x - 1)^2$		
d	$\lvert x + 2 \rvert$		
e	$\sqrt{x} - 4$		

Composition of Functions

Check for Understanding

Can you complete these problems correctly by yourself

1) Match each of the composite functions with the appropriate component functions.

	Composite Function		**Component Functions**
	$f(g(x)) = (2x-5)^2 + 1$	**A**	$f(x) = 2x^2 - 3x \quad g(x) = 3 - 5x$
	$f(g(x)) = 3\sqrt{2x^2 - 5}$	**B**	$f(x) = x^2 + 1 \quad g(x) = 2x - 5$
	$f(g(x)) = 2(3-5x)^2 - 3(3-5x)$	**C**	$f(x) = 2x - 5 \quad g(x) = x^2 + 1$
	$f(g(x)) = 2(3\sqrt{x})^2 - 5$	**D**	$f(x) = 3 - 5x \quad g(x) = 2x^2 - 3x$
	$f(g(x)) = 2(x^2+1) - 5$	**E**	$f(x) = 3\sqrt{x} \quad g(x) = 2x^2 - 5$
	$f(g(x)) = 3 - 5(2x^2 - 3x)$	**F**	$f(x) = 2x^2 - 5 \quad g(x) = 3\sqrt{x}$

2) Explain the difference in the way you compute $f(a+h)$ and *f(a)* + h and verbally work through the steps to compute both for the function *f(x)* = $4x^2 - 1$.

3) Given that $f(x) = -2x - 5$, $g(x) = -2|x+3| - 4$, and $h(x) = \frac{2}{x-1}$, find:

1) f(g(-5))

2) g ° f(-5)

3) h(f(0))

4) h(h(½))

5) f(h(x))

6) h ° f(x)

Pre-AP Algebra 2 **Name:_____**

Homework 1-2 – Composition of Functions

Spiral

What do you remember from Algebra 1? (these are skills we will need in Algebra 2)

1) Solve the following for x

   a. $3.1 - 0.5x = .01x + 0.45$

   b. $\frac{4}{5}(6x - 3) = 2x - 1$

2) Write an equation of the line that passes through the given points.

   a. (-1, 3), (2, 9)

   b. (3, 7), (3, 5)

3) Write an equation of the line that passes through the given point and satisfies the given condition.

   a. (-3, -5); parallel to $y = -4x + 1$

   b. (4, 1); perpendicular to $y = \frac{1}{3}x + 3$

4) Solve and graph on a number line.

   a. $\frac{3}{4}x + 2 < 7$

   b. $5 - 2x < 9$

   c. $-3x + 12 > 6$

   d. $4x - 8 > \frac{1}{2}x + 6$

   e. $5 < 3x + 7 < 12$

   f. $4x - 1 < -9$ or $4x - 1 > 9$

   g. $-4 < 8 - 3x < 23$

   h. $|x| < 3$