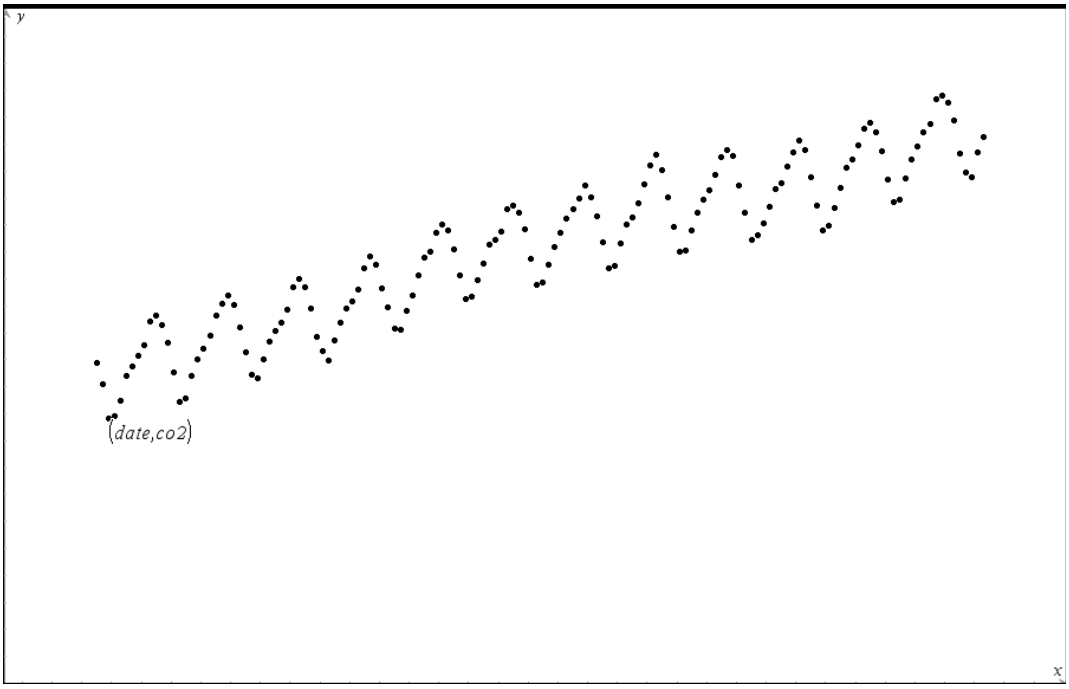
MHF4U – Unit 1: Characteristics and Properties of Functions
Lesson 7: Operations with Functions

The graph below shows the level of CO_2 (parts per million) in the air at the Mauna Loa Observatory in Hawaii over about 12 years, ending in 1995.

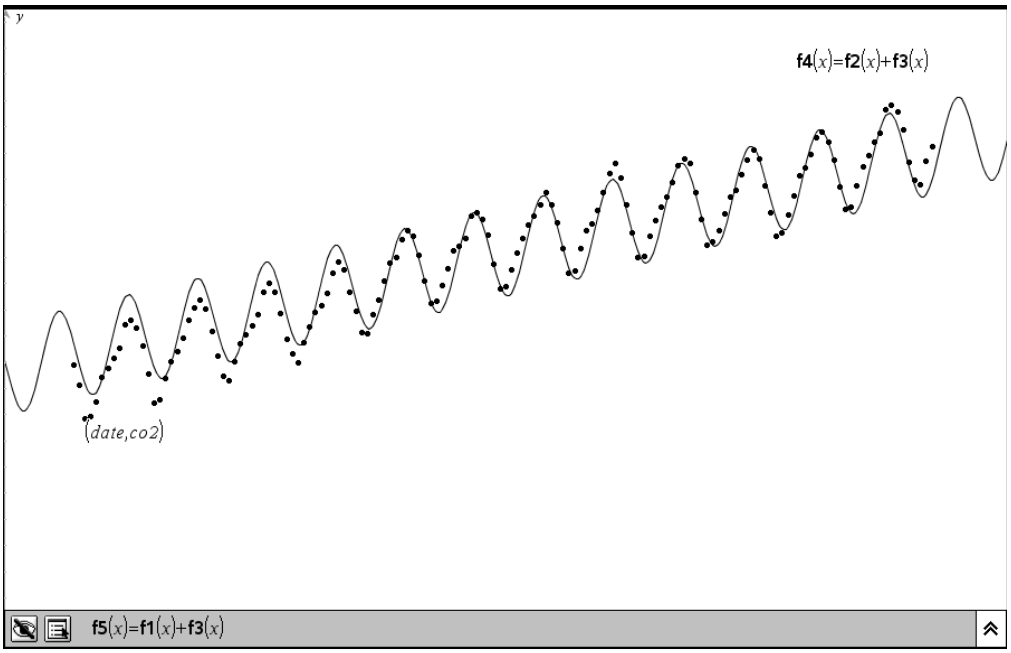
Date	CO_2
Jan 1995	359.82
Feb 1995	360.86
Mar 1995	361.49
Apr 1995	363.30
May 1995	363.63
Jun 1995	363.10
Jul 1995	361.73
Aug 1995	359.28
Sep 1995	357.87
Oct 1995	357.56
Nov 1995	359.36
Dec 1995	360.49



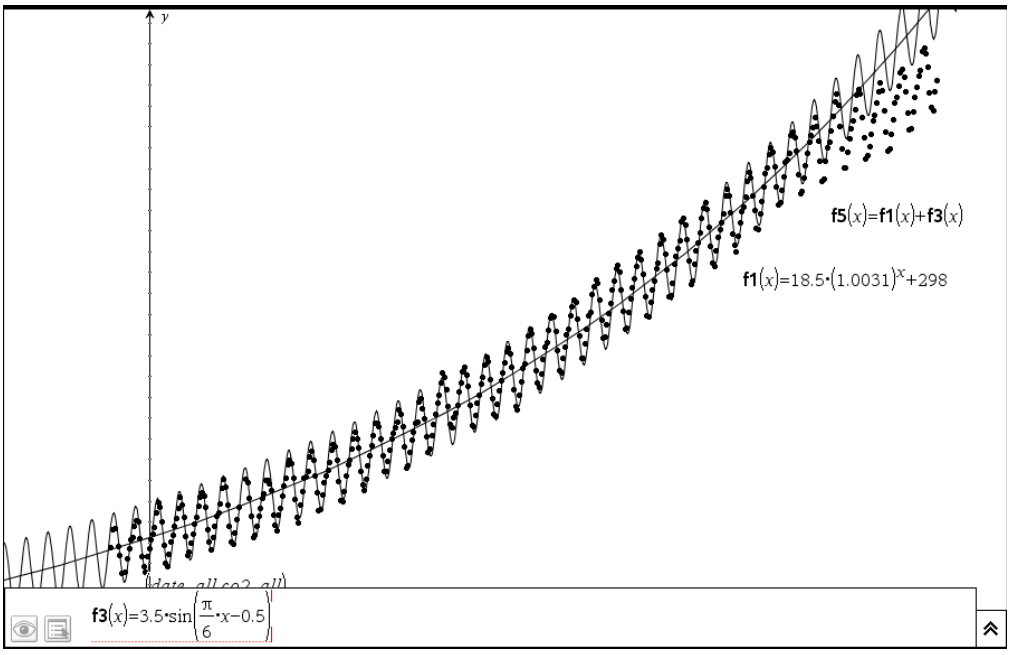
The scatter plot shows that from year to year, the concentration of CO_2 in the air has increased. However, within each individual year the concentration of CO_2 oscillates.

If a function $f(t)$ is used to model the average CO_2 level from year to year, the graph of f would run through the middle of the scatter plot between the individual peaks and valleys.

If we used *g(t)* to model the sinusoidal function representing each year we can then add the two functions together to model the data:



Over this relatively short period of time, a linear function models the rise in the annual average CO_2 levels. However, over a longer period of time we see that an exponential function models this better.



This is one example where we need to **combine** functions. In this case, for each x-value, the combined function's y-value is equal to the sum of the individual function's y-values, i.e. $h(x) = f(x) + g(x)$.

Ex. If $f(2) = 3$ and $g(2) = 8$ then $h(2) = 11$.

Note that the domain of the combined function is the intersection of the domains of the individual functions.

Functions can also be subtracted and multiplied.

Ex. Let $f = \{(1,2), (3,4), (5,6), (7,8)\}$ and $g = \{(1,5), (3,7), (4,0), (7,7)\}$, determine

a) $f + g$

b) $f - g$

c) fg

Ex. Given $f(x) = x + 6$ and $g(x) = (x - 1)^2$

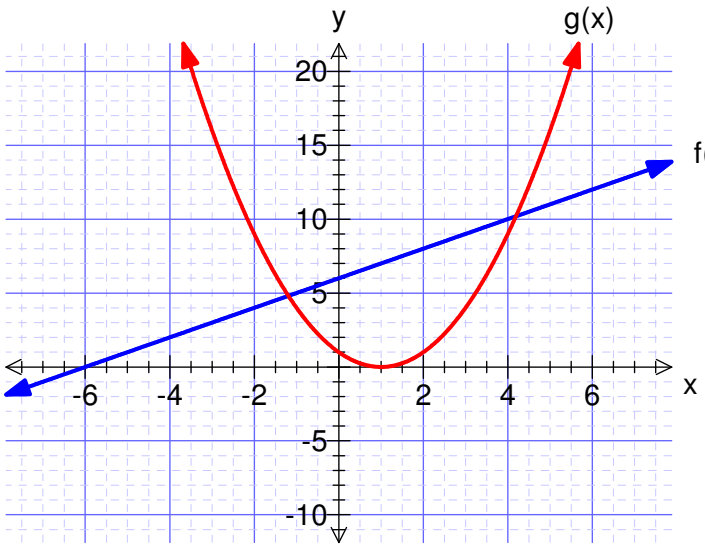
a) What type of function will $k(x) = f(x)\,g(x)$ be?

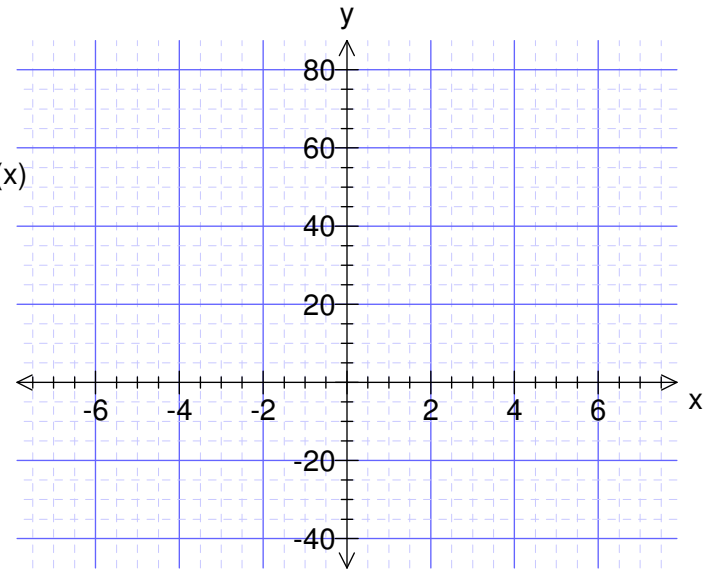
b) Determine an equation for $k(x)$.

c) Complete the table of values.

x	$f(x)$	$g(x)$	$k(x)$
-6			
-5			
-4			
-3			
-2			
-1			
0			
1			
2			
3			
4			

d) Graph *k(x)* on the grid provided.





e) Where are the x-intercepts for each function?

f) Where are the y-values of each function positive/negative?

HW: Pg. 56 #1cd, 2b, 3b, 4b, 7