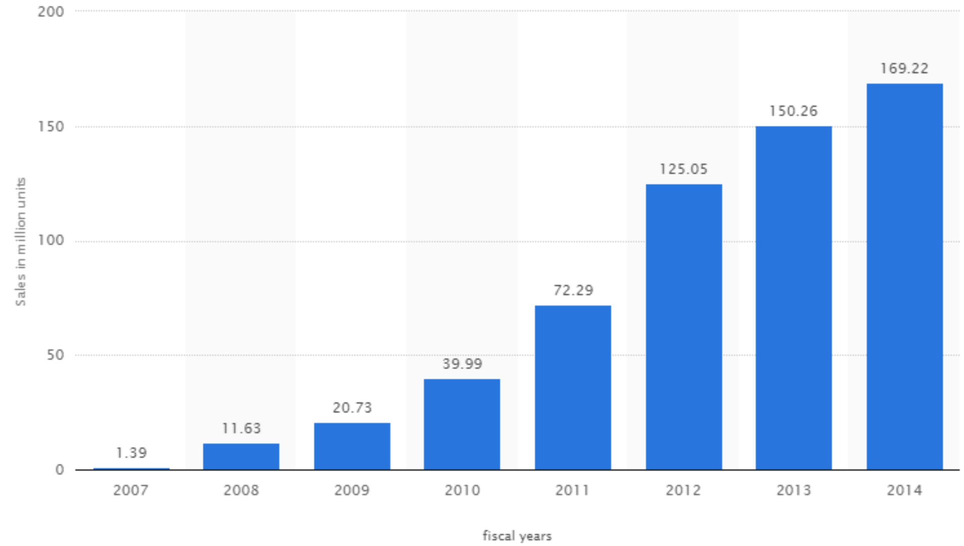
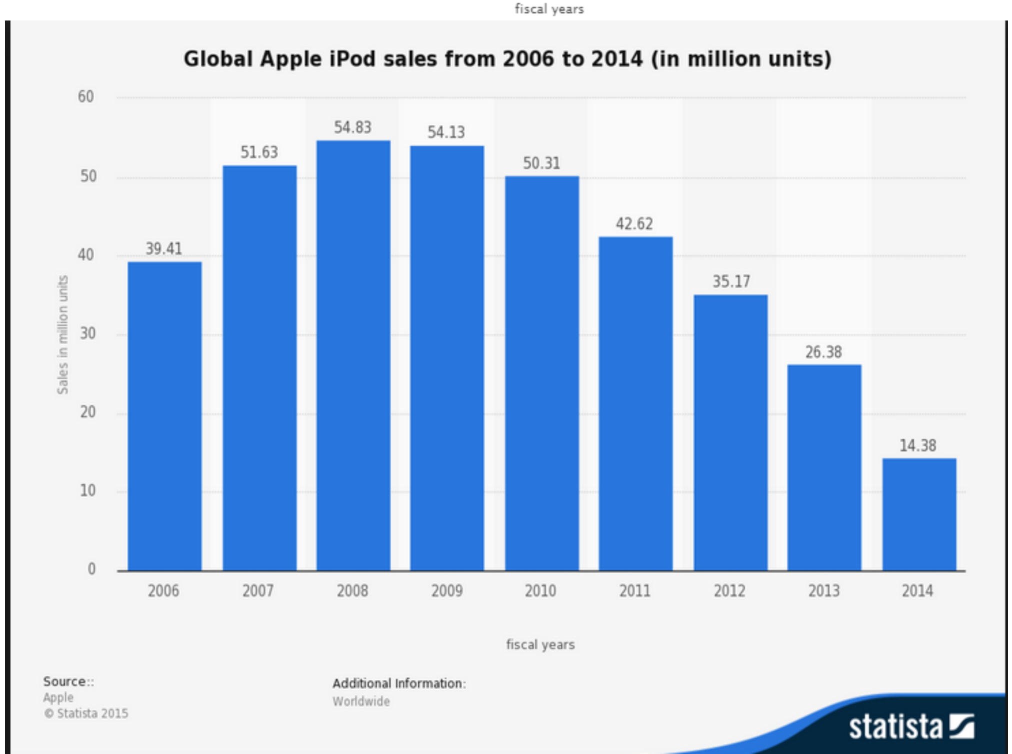
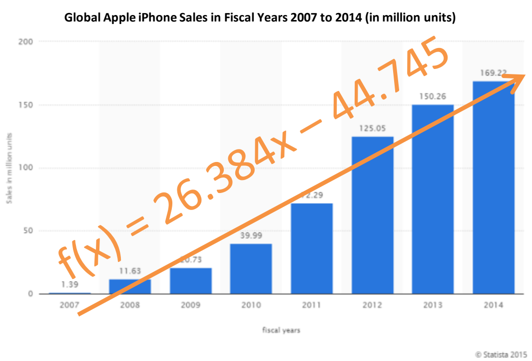
Combinations of Functions: Composite Functions

Section 1.8

Global Apple iPhone Sales in Fiscal Years 2007 to 2014 (in million units)






Global Apple iPhone Sales in Fiscal Years 2007 to 2014 (in million units)
f(x) = 26.384x – 44.745
1.39
11.63
39.99
125.05
150.26
169.22
2007
2008
2009
2010
2011
2012
2013
2014
fiscal years
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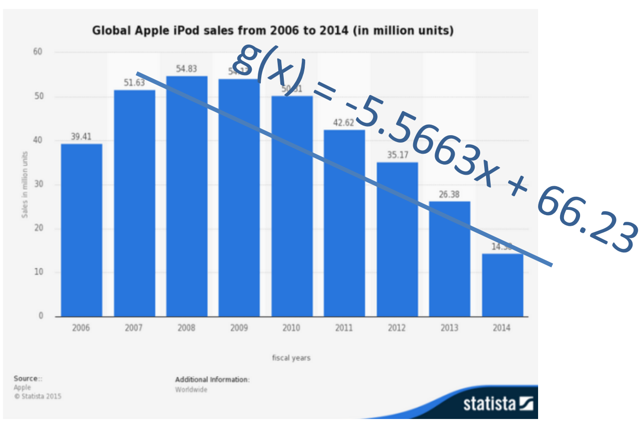
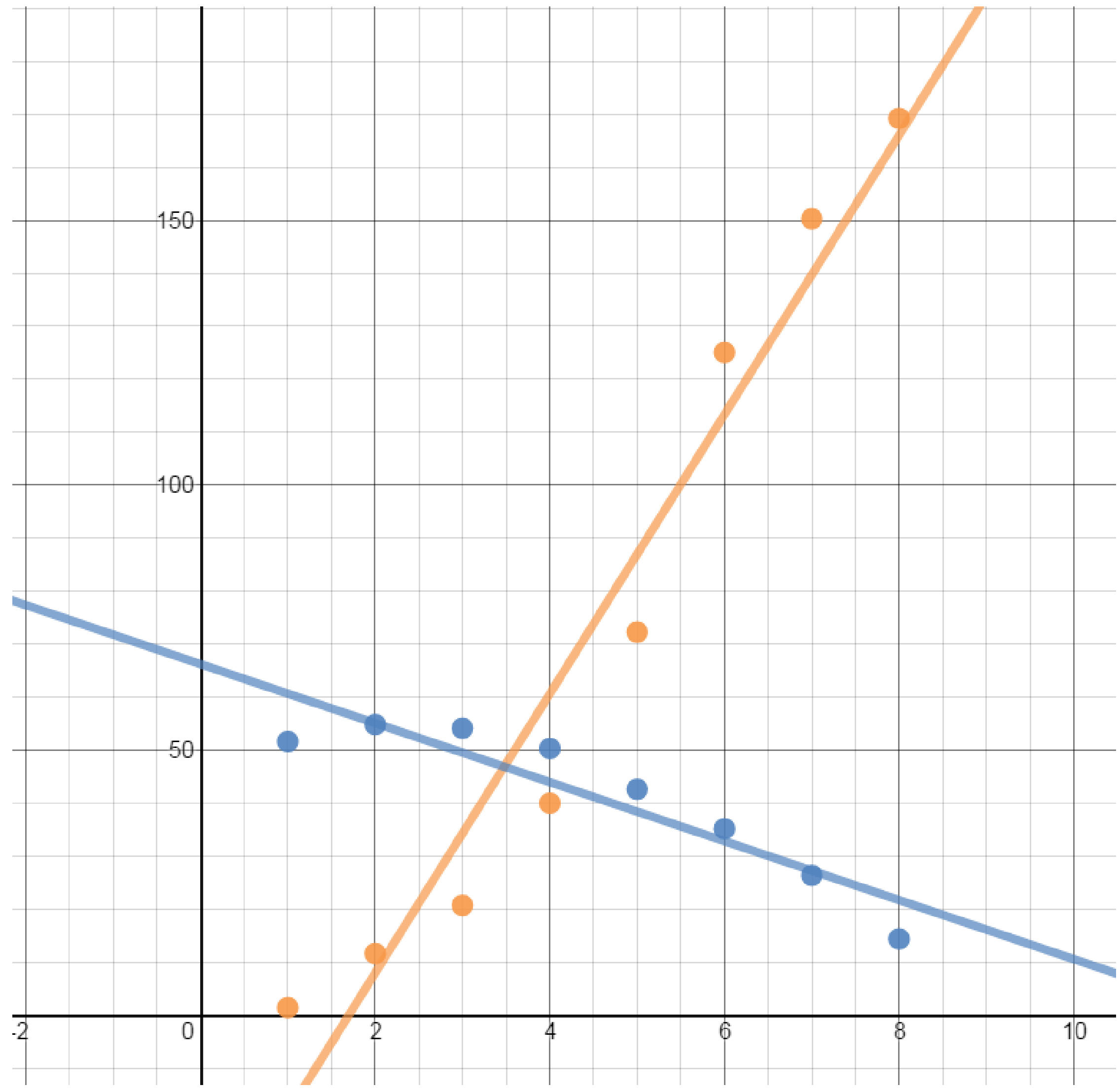
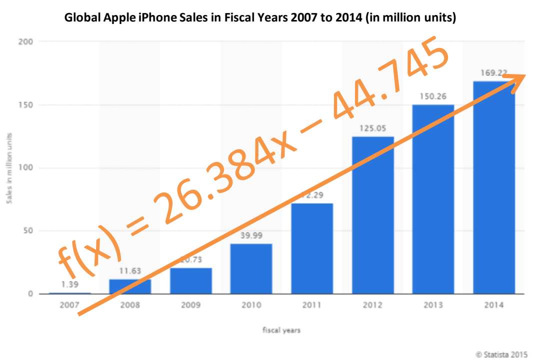
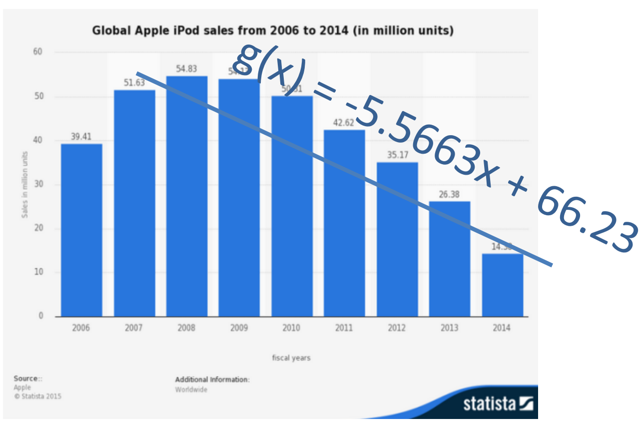
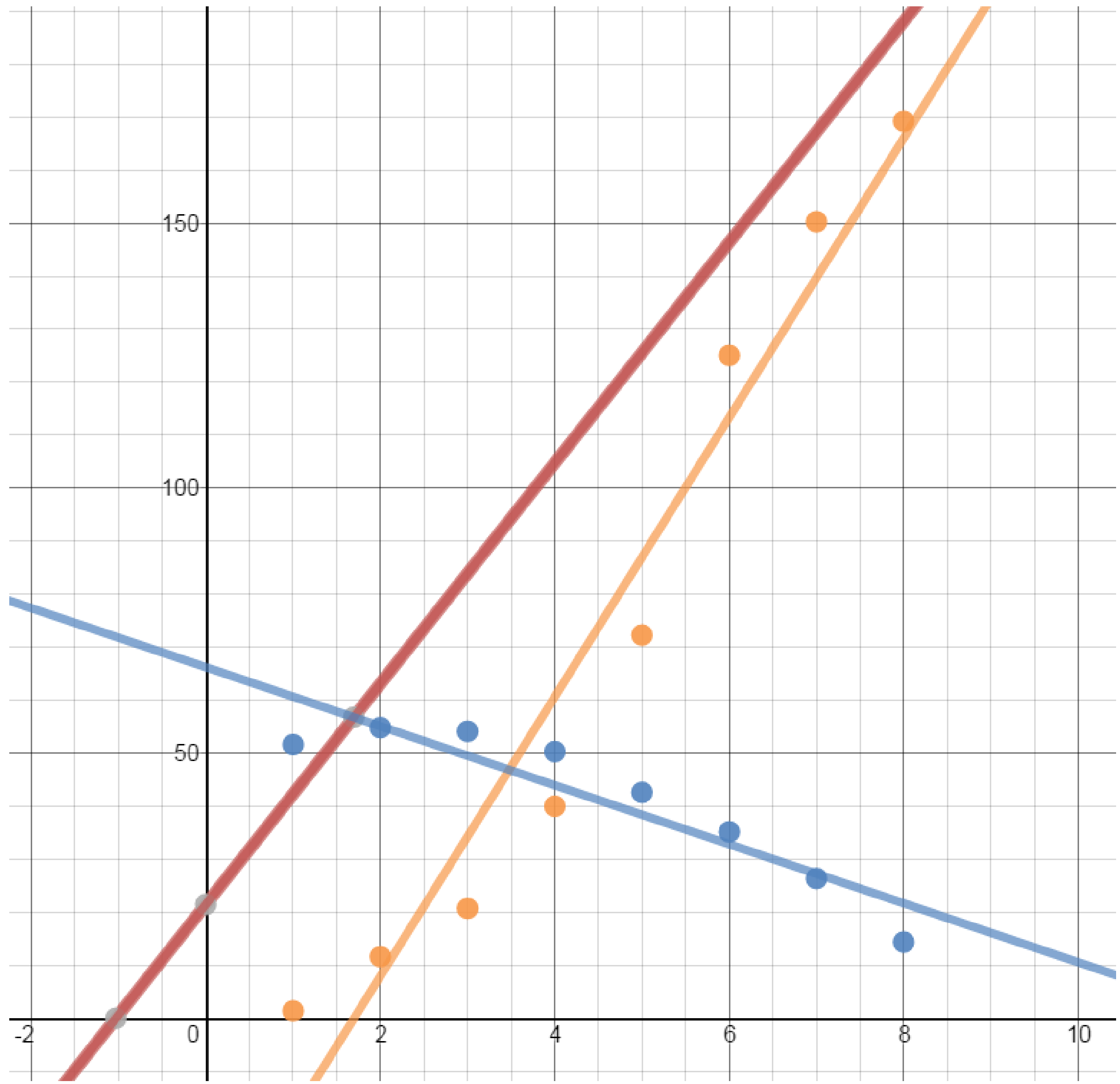

Global Apple iPod sales from 2006 to 2014 (in million units)
g(x) = -5.5663x + 66.23
39.41
51.63
54.83
42.62
35.17
26.38
2006
2007
2008
2009
2010
2011
2012
2013
2014
fiscal years
Source:
Apple
© Statista 2015
Additional Information:
Worldwide
statista


150
100
50
-2
0
2
4
6
8
10

Find (f + g)(x)







(f + g)(x) = 20.8177x + 21.485

desmos

Arithmetic Combination of Functions

- Let f and g be functions with overlapping domains. Then for all x common to both domains:
- $(f + g)(x) = f(x) + g(x)$
- $(f – g)(x) = f(x) – g(x)$
- $(fg)(x) = f(x) \cdot g(x)$
- $(f/g)(x) = f(x) / g(x)$, if $g(x)$ is not equal to zero.

Given f(x) = 2x – 5 and g(x) = 2 - x, find

- $(f \pm g)(x)$

  $2x-5+2-x$

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

- $(f - g)(x)$

  $(f-g)(x) = 2x-5-(2-x)$

  $2x-5-2+x$

  $3x-7$

- $(fg)(x)$

  $(2x-5)(2-x)$

  $4x-2x^2-10+5x = -2x^2+9x-10$

- $\left(\frac{f}{g}\right)(x)$

  $\frac{2x-5}{2-x}$

  $(-\infty,2)\cup(2,\infty)$ ℝ s.t. $x \neq 2$

- (f + g)(5)

  $(f+g)(5) = 5-3 = 2$

The composition of the function *f* with the function *g* is $(f \circ g)(x) = f(g(x))$.

Think of it as putting a function into a function.

If $f(x) = x^2 - 9$, and $g(x) = \sqrt{9 - x^2}$

$-3 \le x \le 3$

$[-3, 3]$

First find the domains and ensure they are overlapping.

*The domain of $(f \circ g)(x)$ is restricted by the original functions.

$f \circ g(x) = (\sqrt{9 - x^2})^2 - 9$

$9 - x^2 - 9$

$= -x^2$

$[-3, 3]$

Given $f(x) = x^2 + 2x$ and $g(x) = 2x + 1$

Find $(f \circ g)(x) =$ $(2x+1)^2 + 2(2x+1)$

$(2x+1)(2x+1)$

$4x^2 + 4x + 1 + 4x + 2$

$4x^2 + 8x + 3$

Find $(g \circ f)(x) =$ $2(x^2+2x)+1$

$2x^2 + 4x + 1$

Decomposing a Function

Find two functions f and g such that $(f \circ g)(x)=$ h(x) where h(x) = $\frac{\sqrt{2-x^2}}{3}$

$f(x) = \frac{\sqrt{x}}{3}$

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

$h(x) = (x-2)^2+5$

$g(x) = x-2$ $f(x) = x^2+5$

p. 81: 5-11 odd, 13-23 odd, 31, 33, 35, 37, 40, 42, 47-51 odd