1. Chapter 3 Section 4: The Chain Rule - Compositions

In this section we will learn how to find the derivative of a composition. Before we get to the derivative formulas, though, we briefly review compositions. You must be able to look at a function that is a composition and recognize an "inside" function and an "outside" function that may be used to create the given function.

Example 1.1. *Let* $y = \left(\frac{x^2+2}{3}\right)^2$. *Find two functions,* $f(z)$ *amd* $g(x)$ *such that* $y = f(g(x))$ *and where neither* f *nor* g *are the identity function (the identity function is* $h(x) = x$*).*

Example 1.2. *Let* $y = e^{(3w/2)}$. *Find two functions,* $f(z)$ *amd* $g(x)$ *such that* $y = f(g(x))$ *and where neither* f *nor* g *are the identity function (the identity function is* $h(x) = x$*).*

2. The Chain Rule

Theorem 2.1 (Version 1)**.** *If* w *is a function of* z *and* z *is a function of* x*, then we can find the derivative of* w *with respect to* x *by...*

$\frac{dw}{dx} =$

Theorem 2.2 (Version 2)**.** *The derivative of a composite function,* $h \circ g$*, is*

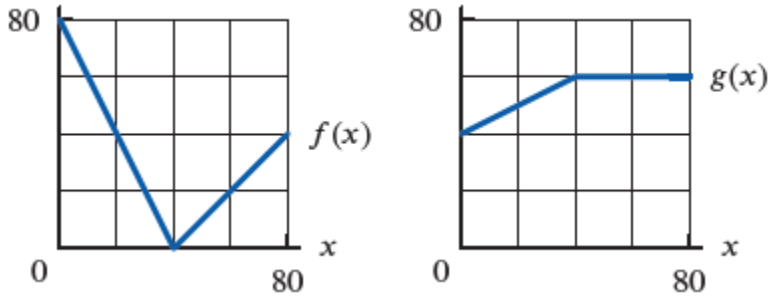
$(h \circ g)'(x) =$

3. Examples

Example 3.1 (3.4 Text Problem 34)**.** *Find the derivative of* $y = \left(\frac{x^2+2}{3}\right)^2$.

Example 3.2 (3.4 Text Problem 12)**.** *Find the derivative of* $y = e^{(3w/2)}$.

Example 3.3 (3.4 Text Problem 64)**.** *Use the figure below to evaluate* $\frac{d}{dx}g(f(x))|_{x=30}$.



Example 3.4 (3.4 WileyPlus Problem 9, Text Problem 66)**.**

(1) Differentiate $f(x) = (kx^3 + 4)e^{5x-1}$.

(2) What is the slope of the $f(x)$ *at* $x = 1$*?*