Calculus Section 2.3 Product Rule and Higher Order Derivatives

Homework: Page 126 #’s 1-6, 31, 32, find tangent lines of 63 and 64, write equations and fill out table for 117

-Find the derivative of a function using the product rule.  
-Find higher order derivatives of functions.  
-Find an equation for acceleration from a position function.

**Product Rule**  
The product of two differentiable functions is differentiable itself. If *f* and *g* are differentiable, then their product *fg* is also differentiable. To find the derivative of a product:



The derivative of a product is: the derivative of the first function times the second plus the first times the derivative of the second function.

**Proof**  


**Examples)**  
1)  2)  3) 

The product rule can be generalized for any number of products. For example,  


**Higher Order Derivatives**Oftentimes, more than one derivative can be taken for a differentiable function. These derivatives imply continued continuity (like the first derivative), and can be used to find helpful information about a function. Higher order derivatives can be denoted as follows:



First derivative:   
  
 Second derivative:  
  
 Third derivative:  
  
 Fourth derivative:  
  
 nth derivative:

**Examples)**1) , find  2) , find  3) , find 

**Acceleration**Acceleration can be defined as the second derivative of the position function or the first derivative of the velocity function: .

**Example)**The position of an object is defined by the equation . What is the acceleration of the object at t=2?