Key Concepts Review

In this chapter, we introduced a new base for exponential functions, namely the number e, where $e \doteq 2.718\ 281$. We examined the derivatives of the exponential functions along with the primary trigonometric functions. You should now be able to apply all the rules of differentiation that you learned in Chapter 2 to expressions that involve the exponential, sine, cosine, and tangent functions combined with polynomial and rational functions.

We also examined some applications of exponential and trigonometric functions. The calculus techniques that are used to determine instantaneous rates of change, equations of tangent lines, and absolute extrema for polynomial and rational functions, can also be used for exponential and trigonometric functions.

Derivative Rules for Exponential Functions

- $\frac{d}{dx}(e^x) = e^x$ and $\frac{d}{dx}(e^{g(x)}) = e^{g(x)} \times g'(x)$
- $\frac{d}{dx}(b^x) = b^x \ln b$ and $\frac{d}{dx}(b^{g(x)}) = b^{g(x)}(\ln b)g'(x)$

Derivative Rules for Primary Trigonometric Functions

- $\frac{d}{dx}(\sin x) = \cos x$ and $\frac{d}{dx}(\sin f(x)) = \cos f(x) \times f'(x)$
- $\frac{d}{dx}(\cos x) = -\sin x$ and $\frac{d}{dx}(\cos f(x)) = -\sin f(x) \times f'(x)$
- $\frac{d}{dx}(\tan x) = \sec^2 x$ and $\frac{d}{dx}(\tan f(x)) = \sec^2 f(x) \times f'(x)$