Section 3.7: Derivatives of Logarithmic Functions

These notes reflect material from our text, *Calculus, Concepts and Contexts, Third Edition*, by James Stewart, published by Brooks/Cole, Pacific Grove, CA, 2005.

Key points from Stewart, Section 3.7: Derivatives of $x^p, x^{1/p}, a^x, log_a(x)$.

The Derivatives of Certain Inverse Functions

Let p be a positive integer and a a positive constant.

Power Functions

$$\frac{d}{dx}\left(x^{1/p}\right) = (1/p)x^{1/p-1}$$

Exponential Functions

$$\frac{d}{dx}\left(a^x\right) = \ln(a)a^x$$

Logarithmic Functions

$$\frac{d}{dx}\left(\log_a(x)\right) = \frac{1}{x\log(a)}$$

Exercise

Show that $\lim_{x\to 0}(1+x)^{1/x} = e$. Conclude that $\lim_{n\to\infty}(1+\frac{1}{n})^n = e$.

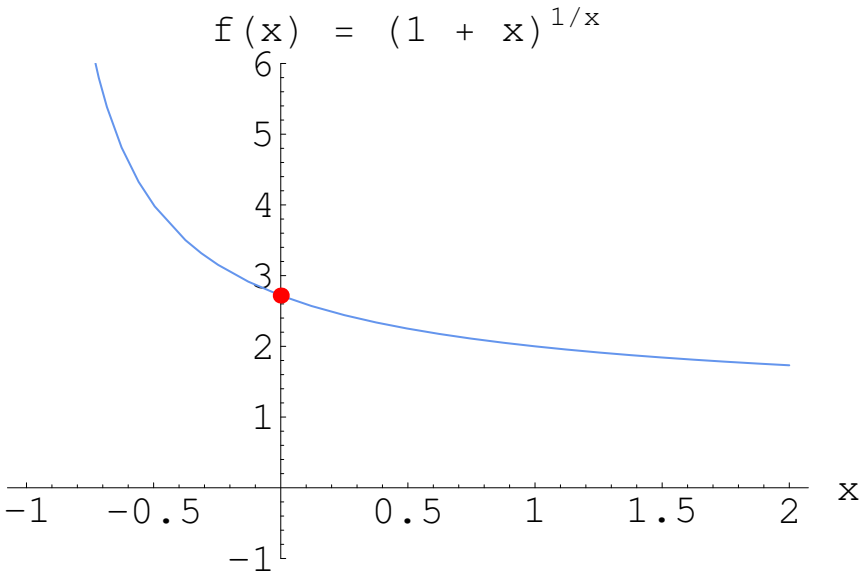

Fig. $\lim_{x\to 0}(1+x)^{1/x} = e$, *hence* $\lim_{n\to\infty}(1+\frac{1}{n})^n = e$.

Exercises

Exercises for Section 3.7, pp 245–246: 1 (why the natural log?), 3, 7, 17, 21, 24, 26, 31 (logarithmic differentiation)