3.5 – L'Hôpital's Rule, Part II

Indeterminate Forms

Some common indeterminate forms that often result from direct substitution applied to a limit are:

$$\frac{0}{0}, \frac{\infty}{\infty}, 0\cdot\infty, \infty-\infty, 0^0, 1^\infty, \infty^0$$

L'Hôpital's Rule

Suppose *f* and *g* are differentiable on an open interval containing *a*. If direct substitution into $\lim_{x\to a}\frac{f(x)}{g(x)}$ yields either $\frac{0}{0}$ or $\frac{\infty}{\infty}$, then

$$\lim_{x\to a}\frac{f(x)}{g(x)}=\lim_{x\to a}\frac{f'(x)}{g'(x)}$$

Use L'Hôpital's Rule to evaluate the following limits.

1. $\lim_{x\to 0}\left(\frac{1}{x}-\csc x\right)$

2. $\lim_{x \to 1} \left(\frac{1}{\ln x} - \frac{1}{x-1} \right)$

3. $\lim_{x \to 0^+} x^x$

4. $\lim_{x \to 0^+} (1 + \sin 4x)^{\cot x}$

5. $\lim_{n \to \infty} P\left(1 + \frac{r}{n}\right)^{nt}$ (Hint: Apply the constant multiple rule first.)