

NAME _____

1. Compute the limit

$$\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$$

Probably the easiest way is to take logarithms and use L'Hôpital's rule.

2. In L'Hôpital's 1696 textbook, he illustrated his rule by finding the limit

$$\lim_{x \rightarrow a} \frac{\sqrt{2a^3x - x^4} - a\sqrt[3]{a^2x}}{a - \sqrt[4]{ax^3}}$$

where $a > 0$. Find this limit as well.

3. Find the fourth order Taylor approximation to $\ln x$ about $x = 1$. Use this to estimate $\ln 1.1$
4. Find the fourth order Taylor approximation to both $-\ln(1 - x)$ and $1/(1 - x)$ about $x = 0$, and show that you can find the series for $1/(1 - x)$ by differentiating the series for $-\ln(1 - x)$.
5. Evaluate the following sums

$$\sum_{i=1}^5 \frac{1}{i} \quad \sum_{i=0}^5 2^i \quad \sum_{n=3}^6 n!$$

6. Show that the sum of the binomial coefficients satisfy

$$\sum_{k=0}^n \binom{n}{k} = 2^n.$$

Hint: use the binomial theorem.