

More on Limits, graph sketching, and L'Hopital's Rule

1. What is the limit $\lim_{x \rightarrow 0^+} x^x = ?$ Let's first answer some easier questions.

(a) $0^1 =$ $0^{0.1} =$ $0^{0.01} =$ $0^{0.001} =$

(b) $1^0 =$ $0.1^0 =$ $0.01^0 =$ $0.001^0 =$

(c) $0^0 =$

So what can we conclude about $\lim_{x \rightarrow 0^+} x^x$?

(d) $1^1 =$ $0.1^{0.1} =$ $0.01^{0.01} =$ $0.001^{0.001} =$

So what can we conclude about $\lim_{x \rightarrow 0^+} x^x$?

—Here's a trick for finding the answer without using the calculator:

(e) Warm-up: $e^{\ln(182)} =$ So $e^{\ln(x^x)} =$

Step 1. Write x^x as $e^{\text{something}}$:

Simplify: $\ln(x^x) =$ So $x^x = e^{\ln(x^x)} =$

So finding $\lim_{x \rightarrow 0^+} x^x$ is the same as finding _____.

Step 2. $\lim_{x \rightarrow 0^+} x \ln(x) =$

Step 3. $\lim_{x \rightarrow 0^+} e^{x \ln(x)} =$

2. Use the above trick to find $\lim_{x \rightarrow 0} (1+x)^{1/x}$.

Step 1. Write $(1+x)^{1/x}$ as $e^{\text{something}}$.

Step 2.

Step 3.

3. (a) Find all horizontal and vertical asymptotes of the function $f(x) = \frac{x^{1000}}{e^x}$.
- (b) Find the domain and all critical points of $f(x)$.
- (c) Find all local and global extrema of $f(x)$.
- (d) Use the above information to sketch a graph of $f(x)$. Be careful, your graphing calculator will very easily mislead you in this problem!

ANNOUNCEMENTS

3rd midterm: Monday 11/23.

No Homework due Friday. Instead do the practice midterm, start reviewing, and make a long list of questions to ask on Friday.