

Math 131 - April 1, 2016
Solutions

Warm-up Problems

1. Identify which of these are indeterminate and why:

$\frac{0}{0}$	$\frac{1}{0}$
$\frac{\infty}{\infty}$	$\frac{0}{1}$
$0 \cdot \infty$	$\frac{0}{\infty}$
$\infty - \infty$	$\infty + \infty$
0^0	2^∞
1^∞	$3 \cdot \infty$
∞^0	∞^2

2. Identify the “form” of the limits.

(a) $\lim_{x \rightarrow \infty} \sqrt{x^2 + 1} - \sqrt{x + 1} = \infty$

Solution: $\infty - \infty$

(b) $\lim_{x \rightarrow \infty} x - \ln x = \lim_{x \rightarrow \infty} x(1 - (\ln x)/x) = \infty$

Solution: $\infty - \infty$

(c) $\lim_{x \rightarrow \infty} x^{1/x} = 1$

Solution: ∞^0

(d) $\lim_{x \rightarrow 0} \frac{1}{x} - \frac{1}{e^x - 1} = 1/2$

Solution: $\infty - \infty$

(e) $\lim_{x \rightarrow 0^+} (e^x - 1)(\ln x) = 0$

Solution: $0 \cdot \infty$

(f) $\lim_{x \rightarrow 0^+} x^x = 1$

Solution: 0^0

(g) $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^{2x} = e^2$

Solution: 1^∞

(h) $\lim_{x \rightarrow \infty} x^x = \infty$

Solution: ∞^∞

(i) $\lim_{x \rightarrow 0^+} x^{x^x} = 0$

3. Find the error

$$\begin{aligned}\lim_{x \rightarrow 2} \frac{x^3 - x^2 - x - 2}{x^3 - 3x^2 + 3x - 2} &\stackrel{LH}{=} \lim_{x \rightarrow 2} \frac{3x^2 - 2x - 1}{3x^2 - 6x + 3} \\ &\stackrel{LH}{=} \lim_{x \rightarrow 2} \frac{6x - 2}{6x - 6} = \frac{6}{6} = 1\end{aligned}$$

Solution: Limit should be $7/3$. LH should have only been applied once.

Lecture Problems

4. Compute the limits in Problem 2.

5. Determine if there is a slant asymptote and find it:

$$y = \frac{4x^3 + 3x^2 - 2x + 1}{x^2}$$

Solution: Slant asymptote of $y = 4x + 3$