

Mth 31, Homework 9 on sections 4.4, 4.5

Due by Wed, Nov 13.

Try these questions. Write all your working out and answers by hand on your own notepaper and hand them to me next week. Please use lots of space and as many pages as you want, so I can include corrections or comments. You do not need to write the questions, but it is very important that you show clearly any work you had to do to get your answers. Each question is worth 3 points.

Section 4.4 Indeterminate forms and l'Hospital's rule

(1) Suppose $f(0) = 0$ and $g(0) = 0$. Also, at the point $(0, 0)$, $f(x)$ has tangent line $y = 2x$ and $g(x)$ has tangent line $y = 3x$. Use this to find: $\lim_{x \rightarrow 0} \frac{f(x)}{g(x)}$

(2) Use l'Hospital's rule to calculate: (a) $\lim_{x \rightarrow 9} \frac{\sqrt{x} - 3}{x - 9}$ (b) $\lim_{x \rightarrow \infty} \frac{\sqrt{x} - 3}{x - 9}$

(3) Use l'Hospital's rule if it applies, or another method, to calculate:

(a) $\lim_{x \rightarrow 0} \frac{\sin(4x)}{\sin(3x)}$ (b) $\lim_{x \rightarrow 0} \frac{\cos(4x)}{\cos(3x)}$

(4) Compute: $\lim_{x \rightarrow 0} \frac{\cos(x) - 1}{x^2}$

(5) Calculate: $\lim_{\theta \rightarrow 0} \frac{\tanh(\theta^2)}{\tan(\theta^2)}$

(6) Calculate: (a) $\lim_{t \rightarrow 0} \frac{6^t - e^t}{6t}$ (b) $\lim_{x \rightarrow \infty} x^2 \cdot 3^{-x}$

(Those ts are both powers on the top of part (a).)

(7) Find: $\lim_{x \rightarrow 0^+} \left(\frac{1}{x} - \frac{1}{e^x - 1} \right)$

(Hint: combine these using a common denominator first. Then apply l'Hospital.)

(8) Find: (a) $\lim_{x \rightarrow \infty} \frac{\ln(x)}{x}$ (b) $\lim_{x \rightarrow \infty} x^{1/x}$

more on next page →

Section 4.5 Summary of curve sketching

To sketch the graph of $f(x)$ we first work out the following:

- (a) Find the domain of f .
- (b) Find all x and y intercepts.
- (c) Is f odd, even or periodic? (Odd means $f(-x) = -f(x)$, even means $f(-x) = f(x)$ and periodic means $f(x + P) = f(x)$.)
- (d) Find all vertical and horizontal asymptotes.
- (e) Give the intervals where f is increasing and decreasing.
- (f) Find all the local maximums and minimums: identify which is which and give their coordinates.
- (g) Find where f is concave up or down and locate any inflection points.

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- (9) Let $f(x) = x^4 - 8x^2 + 8$. Work out its properties (a) – (g).
 - (10) Graph $f(x)$ from the previous question using the properties you found and plotting any extra points you need.
 - (11) Let $g(x) = \frac{x}{x^2 - 4}$. Work out its properties (a) – (g).
 - (12) Graph $g(x)$ from the previous question using the properties you found and plotting any extra points you need.
 - (13) Let $h(x) = x + \sin(x)$. Work out its properties (a) – (g).
 - (14) Graph $h(x)$ from the previous question using the properties you found and plotting any extra points you need.

If you get stuck on a question or aren't sure if you understand it:

- Go over the relevant class notes and section in the textbook.
- Check if you get the right answer for a similar odd-numbered question in the textbook (answers at the back of the book).
- Ask me about it after class.
- Come to my office hours: Mon 12:00 - 1:00, Wed 12:00 - 1:00 in CP 317.
- Go to the Math Tutorial Lab in-person in CP 303 or online.