



UNIVERSITY OF GHANA

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DEPARTMENT OF MATHEMATICS

MATH 223: CALCULUS II (3 credits)

CHAPTER 4: Indeterminate Forms and l'Hopitals Rule

At the end of the chapter, learners are expected to be able to identify indeterminate forms and appropriately apply l'Hopitals rule in finding limits.

LESSON HIGHLIGHTS

Consider a rational function $r(x) = \frac{p(x)}{q(x)}$, where p and q are polynomial functions of x . When a direct substitution for $\lim_{x \rightarrow a} \frac{p(x)}{q(x)}$ yields $\frac{0}{0}$ or $\frac{\infty}{\infty}$, we have an indeterminate form.

Theorem

Suppose f and g are differentiable on an open interval I that contains a , with the possible exception of a itself, and if $g'(x) \neq 0$, $\forall x \in I$. If $\lim_{x \rightarrow a} \frac{f(x)}{g(x)}$ is an indeterminate form of the type $\frac{0}{0}$ or $\frac{\infty}{\infty}$ then

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

provided that the limit on the right-hand side exists or is infinite.

Other indeterminate forms

- $0 \times \infty$
- 1^∞
- 0^0
- ∞^0
- $\infty - \infty$

Procedure for dealing with the other indeterminate forms

- Put the function in the form $\frac{0}{0}$ or $\frac{\infty}{\infty}$.
- Apply L'Hopitals rule appropriately.

IMPORTANT THINGS TO NOTE

- Spend time trying the exercises on your own. This would give you an idea of what you truly understand and what you need to work on.
- Revise your notes before class and make an effort to read ahead of each class.
- Seek help before it is too late.