

CALCULUS
GLOBAL GOVERNANCE
A.Y. 2025/26

Recitation II

Exercise 1 (Limits)

Compute, if they exist, the following limits:

$$\text{(a)} \quad \lim_{x \rightarrow +\infty} \frac{\ln x^2 - 4e^x + x^{100}}{2e^x + \sin x - 100\sqrt{x}} \quad \text{(b)} \quad \lim_{x \rightarrow -\infty} \sin\left(\frac{\pi x^4 - e^x}{2x^4 + x^3}\right) \quad \text{(c)} \quad \lim_{x \rightarrow 0} \frac{1 + e^x}{e^{\frac{1}{x}} + x^2 + 1}.$$

In the cases in which the limit does not exist, discuss the existence of the one-sided limit (from the left and from the right).

Exercise 2 (Derivatives)

Compute the derivatives of the following functions:

$$\text{(a)} \quad f(x) = x^4 - 9x^2 + \frac{3}{\sqrt{x}} \quad \text{(b)} \quad g(x) = \frac{x^4 + x}{x^3 - 2} \quad \text{(c)} \quad \ell(x) = x^3 e^x \quad \text{(d)} \quad h(x) = x \ln x.$$

Exercise 3 (Graph of a function)

Study the following function and sketch its graph:

$$f(x) = \frac{x^4}{2 - x^3}.$$

In particular, determine: domain, intersection with axes, continuity, sign, asymptotes (vertical, horizontal), derivative, intervals of increase.