

**Corso di Analisi Matematica T-1**  
Corso di Laurea in Ingegneria dell'Automazione  
Anno Accademico 2023/24

## Esercizi

A) Calcolare i seguenti limiti:

1.  $\lim_{x \rightarrow 0} \frac{\sin(2x) - \tan(2x + x^3)}{x(1 - \cos^2 x)}$

2.  $\lim_{x \rightarrow 0} \frac{\log(1 + x^2) - \sin^2 x}{(1 - \cos x + x^4)^2}$

3.  $\lim_{x \rightarrow 0} \frac{(1 + x)^{11} - (1 + x + x^2)^{11}}{e^{x^8} - 1}$

4.  $\lim_{x \rightarrow 0} (e^x + x)^{1/x}$

5.  $\lim_{x \rightarrow +\infty} x \left( \sqrt{4 + \frac{5}{x}} - 2 \cos \frac{1}{x} \right)$

6.  $\lim_{x \rightarrow 0} \frac{(\cos(2x) + \cosh(2x) - 2) \tan(x + 3)}{\sin^2(3x) - 9x^2}$

7.  $\lim_{x \rightarrow +\infty} \frac{\sqrt[3]{x^3 + 3x^2} - \sqrt{x^2 + 3x}}{\sqrt{x^4 + x^2} - \sqrt{x^4 + 1}}$

8.  $\lim_{x \rightarrow 0} \frac{\sqrt{4 + x^2} - \sqrt[3]{8 + 3x^2}}{x \sin(2x) + \cos(2x + 2x^2) - e^{3x^4}}$

9.  $\lim_{x \rightarrow +\infty} \frac{2(x + 3)^{3/2} - 2x^{3/2} - 9(x + 3)^{1/2}}{\sin((x + 2)^{-1/2})}$

10.  $\lim_{x \rightarrow +\infty} \frac{\sqrt{x^3 + 2x} - \sqrt{x^3 + 5}}{e^x (\exp(x + 3e^{-x}) - \exp(x) - 3)}$

11.  $\lim_{x \rightarrow 0^+} \frac{\sqrt{e^x + x} - \cosh(\sqrt{2x})}{\exp(\sqrt{1 + 2x}) - e\sqrt{1 + 2x}}$

12.  $\lim_{x \rightarrow 0} \frac{x^2(e^{-2x^2} - (1 + 4x^2)^{-1/2})}{\sin x \sinh x - x^2}$

13.  $\lim_{x \rightarrow 0^k} \frac{(\sinh^2(2x) - \sin^2(2x)) \cos(2x)}{\sqrt{x^2 + 7x^5} - \sqrt{x^2 + 8x^5}}$

14.  $\lim_{x \rightarrow +\infty} (\sqrt{x^2 + 6x - 4} - xe^{3/x}) \log(1 + e^{2x})$

15.  $\lim_{x \rightarrow 0} \frac{\sin(x - \sin x)}{\sinh(x - \sinh x)}$

16.  $\lim_{x \rightarrow 0} \frac{2 \exp(\cos x) + e \log(1 + x^2) - 2e}{(\exp(\cos^2 x) - e)^2}$

17.  $\lim_{x \rightarrow +\infty} \left( x^2 \exp\left(\frac{x + 3}{x^2 - 4}\right) - x^2 - x \right)$

18.  $\lim_{x \rightarrow +\infty} \left( 2x(x - 2) - x^3 \log\left(1 + \sin \frac{2}{x}\right) \right)$

19.  $\lim_{x \rightarrow +\infty} x^4 \left( \exp\left(\frac{2x^2}{2x^2 + 1}\right) - \exp\left(\cos \frac{1}{x}\right) \right)$

20.  $\lim_{x \rightarrow 0} \left( \frac{\sin(4x)}{1 - \cos(4x)} - \frac{\cos(3x)}{\sin(2x)} \right)$

21.  $\lim_{x \rightarrow +\infty} x^4 \left( \log\left(\cos \frac{3}{x}\right) - \cos \frac{3}{x} + 1 \right)$

22.  $\lim_{x \rightarrow +\infty} \frac{x^2 \log\left(\frac{5 + x^2}{3 + x^2}\right) - 2}{\exp\left(\sin \frac{5}{x}\right) - 1 - \frac{5}{x}}$

23.  $\lim_{x \rightarrow 0} \frac{\exp(3 \cos x) + \exp(3 \cosh x) - 2e^3}{(\cos(3x) \cosh(3x) - 1)(\cos(e^x) - 1)}$

24.  $\lim_{x \rightarrow +\infty} x^4 \left( \exp\left(\frac{3x^2}{x^2 + 4}\right) - e^3 + \frac{12e^3}{x^2} \right)$

25.  $\lim_{x \rightarrow +\infty} \frac{\exp\left(5x \cos \frac{4}{x}\right) - 2 \sinh(5x)}{\left(\sqrt{x^6 + 6x^4} - x^3 \exp\left(\frac{3}{x^2}\right)\right) e^{5x}}$

26.  $\lim_{x \rightarrow 0^+} \frac{(\exp(\sqrt{x^2 + 5x^3}) - e^x) \sin(2x^2)}{(\cos(\sqrt{4x}) - e^{-2x})^2}$

## Soluzioni

A)

1.  $-5$

2.  $-\frac{2}{3}$

3.  $-\infty$

4.  $e^2$

5.  $\frac{5}{4}$

6.  $-\frac{4}{81} \tan 3$

7.  $-1$

8.  $0$

9.  $-\frac{27}{4}$

10.  $0$

11.  $-\frac{5}{6e}$

12.  $360$

13.  $-\frac{64}{3}$

14.  $-22$

15.  $-1$

16.  $-\frac{1}{6e}$

17.  $\frac{7}{2}$

18.  $-\infty$

19.  $\frac{5e}{24}$

20.  $0$

21.  $-\frac{81}{8}$

22.  $-\frac{16}{25}$

23.  $-\frac{5e^3}{27(\cos 1 - 1)}$

24.  $120e^3$

25.  $\frac{40}{9}$

26.  $\frac{45}{16}$