Corso di Analisi Matematica T-1
Corso di Laurea in Ingegneria dell'Automazione
Anno Accademico 2022/23

Esercizi

A) Dimostrare, verificando la definizione di limite, che:

1. $\lim\limits_{n \to +\infty} \sqrt{n^2 + n + 1} = +\infty$

3. $\lim\limits_{n \to +\infty} \sqrt{\dfrac{4n+1}{n+1}} = 2$

2. $\lim\limits_{n \to +\infty} \dfrac{n^2 + 4}{n^2 + n - 1} = 1$

4. $\lim\limits_{n \to +\infty} \left(\sqrt{n^2 - 1} - 2n \right) = -\infty$

B) Calcolare (se esistono) i seguenti limiti:

1. $\lim\limits_{n \to +\infty} \dfrac{\sqrt{n^3 + 5} + n^2 + 5n}{\sqrt{n^4 + n} + n}$

13. $\lim\limits_{n \to +\infty} \dfrac{-n!\, 2^n + \sqrt{n^3 + 4n}}{(n+2)! + n^4 - 2^n}$

2. $\lim\limits_{n \to +\infty} \dfrac{4^n + \sqrt{n}}{n^3 + 3}$

14. $\lim\limits_{n \to +\infty} \dfrac{n}{\sqrt[3]{n^3 + 1}}$

3. $\lim\limits_{n \to +\infty} \dfrac{2^n + (n+1)^2}{n^3 + e^n + 3}$

15. $\lim\limits_{n \to +\infty} \dfrac{n^n - n^{n+1}}{3^n + n! + \sqrt{n^4 - 2n}}$

4. $\lim\limits_{n \to +\infty} \left(\sqrt{n^2 + n} - \sqrt{n^2 + 4} \right)$

16. $\lim\limits_{n \to +\infty} \dfrac{5^{n+1} + 4^{n+1}}{3^n + 2^n}$

5. $\lim\limits_{n \to +\infty} \left(2^{3n+1} - 3^{2n} \right)$

17. $\lim\limits_{n \to +\infty} \dfrac{(-5)^{n+1} + (-4)^{n+1}}{(-3)^n + (-2)^n}$

6. $\lim\limits_{n \to +\infty} \dfrac{e^{-n} + \sqrt{n} + 1}{n^2 + n}$

18. $\lim\limits_{n \to +\infty} \dfrac{n^{-3} + 3n^{-2}}{2^{-n}}$

7. $\lim\limits_{n \to +\infty} (-1)^n \dfrac{\sqrt{n} + 1}{n^3 + e^n + 1}$

19. $\lim\limits_{n \to +\infty} \dfrac{n^{-2} + 3n^{-1}}{n^{-4} + n^{-1}}$

8. $\lim\limits_{n \to +\infty} (-1)^n \dfrac{\sqrt{n^6 + 2}}{n^3 + 1}$

20. $\lim\limits_{n \to +\infty} \dfrac{5^{-n} + 2^{-n}}{3^{-n} + 4^{-n}}$

9. $\lim\limits_{n \to +\infty} (n^2 3^n - n^3 2^n)$

21. $\lim\limits_{n \to +\infty} \left(n^2 - \sqrt{3n^3 + 2} \right)$

10. $\lim\limits_{n \to +\infty} \dfrac{(n+1)!}{n!(n+3) + n^2}$

22. $\lim\limits_{n \to +\infty} \dfrac{n^2}{e^{n/2} \left(\sqrt{e^n + n} - \sqrt{e^n - n^2} \right)}$

11. $\lim\limits_{n \to +\infty} \dfrac{(n+1)! + n}{n! + 2^n}$

23. $\lim\limits_{n \to +\infty} \dfrac{\sqrt{3n^2 - n} - n}{n + 1}$

12. $\lim\limits_{n \to +\infty} \dfrac{(-1)^n (n^2 + 1)}{2^n + 1}$

24. $\lim\limits_{n \to +\infty} \dfrac{n^2 - \sqrt{n^4 + 1}}{n^2 - \sqrt{n^4 + 2}}$

25. $\displaystyle\lim_{n\to+\infty}\frac{\sqrt{n^2+4n+1}-n}{\sqrt{n^2+1}-n}$

26. $\displaystyle\lim_{n\to+\infty}\left(n^2-\sqrt{2n^4+5n^3+2}\,\right)$

27. $\displaystyle\lim_{n\to+\infty}\frac{n^n+\log n+2\,n!-e^{n+3}}{-e^n+3n^n+3\,n!+n^8}$

28. $\displaystyle\lim_{n\to+\infty}\sqrt{n}\left(\sqrt{n+1}-\sqrt{n-1}\,\right)$

29. $\displaystyle\lim_{n\to+\infty}\frac{\sqrt{n^2+4n+1}-n}{\sqrt{n^2+n+1}-n}$

30. $\displaystyle\lim_{n\to+\infty}\frac{\sqrt{n^2-1}-n}{\sqrt{n^4+1}-n^2}$

31. $\displaystyle\lim_{n\to+\infty}\frac{(7^n-8^{n-2})n!}{(n!)^2+8^{2n}}$

32. $\displaystyle\lim_{n\to+\infty}n\left(\sqrt{n^2+4n+2}-n-2\right)$

33. $\displaystyle\lim_{n\to+\infty}\frac{n^n-4^n n!}{n^n-2^n n!}$

34. $\displaystyle\lim_{n\to+\infty}\frac{(2n)!+n^{3n}}{3(2n)!+5n^{3n}}$

35. $\displaystyle\lim_{n\to+\infty}\frac{(3n)!+n^{3n}}{\left((n+4)!+n^n\right)^3}$

36. $\displaystyle\lim_{n\to\infty}\frac{(2n)!-n^n}{n!-2^n n^{2n}}$

Soluzioni

B)

1. 1

2. $+\infty$

3. 0

4. $\dfrac{1}{2}$

5. $-\infty$

6. 0

7. 0

8. Non esiste

9. $+\infty$

10. 1

11. $+\infty$

12. 0

13. $-\infty$

14. 1

15. $-\infty$

16. $+\infty$

17. $-\infty$

18. $+\infty$

19. 3

20. $+\infty$

21. $+\infty$

22. 2

23. $\sqrt{3}-1$

24. $\dfrac{1}{2}$

25. $+\infty$

26. $-\infty$

27. $\dfrac{1}{3}$

28. 1

29. 4

30. $-\infty$

31. 0

32. -1

33. $-\infty$

34. $\dfrac{1}{5}$

35. $+\infty$

36. 0