④- Examine whether the following sequences converges diverge or oscillate.

(i) $\langle 1+\frac{1}{n} \rangle$ (ii) $\langle \frac{n^2+1}{2n+3} \rangle$

(iii) $\langle (-1)^n n + \frac{1}{n} \rangle$ (iv) $\langle \log \frac{1}{n} \rangle$

(v) $\langle 1 + \frac{(-1)^n}{n} \rangle$ (vi) $\langle -\frac{n^2}{n+1} \rangle$

(vii) $\langle (-1)^n n \rangle$ (viii) $\langle 3 + (-1)^n \rangle$

(ix) $\langle a_n \rangle$, where $a_n = 1 + \frac{1}{3} + \frac{1}{3^2} + \cdots + \frac{1}{3^{n-1}}$.

⑤- Prove that

$$\lim_{n\to\infty} \frac{1}{n}\left(1 + 2^{1/2} + 3^{1/3} + \cdots + n^{1/n}\right) = 1$$

⑤- Evaluate

$$\lim_{n\to\infty} \left[\frac{(n+1)(n+2)\cdots(n+n)}{n^n}\right]^{1/n}$$

⑤- Evaluate

$$\lim_{n\to\infty} \left[\left(\frac{2}{1}\right)\left(\frac{3}{2}\right)^2\left(\frac{4}{3}\right)^3 \cdots \left(\frac{n+1}{n}\right)^n\right]^{1/n}.$$