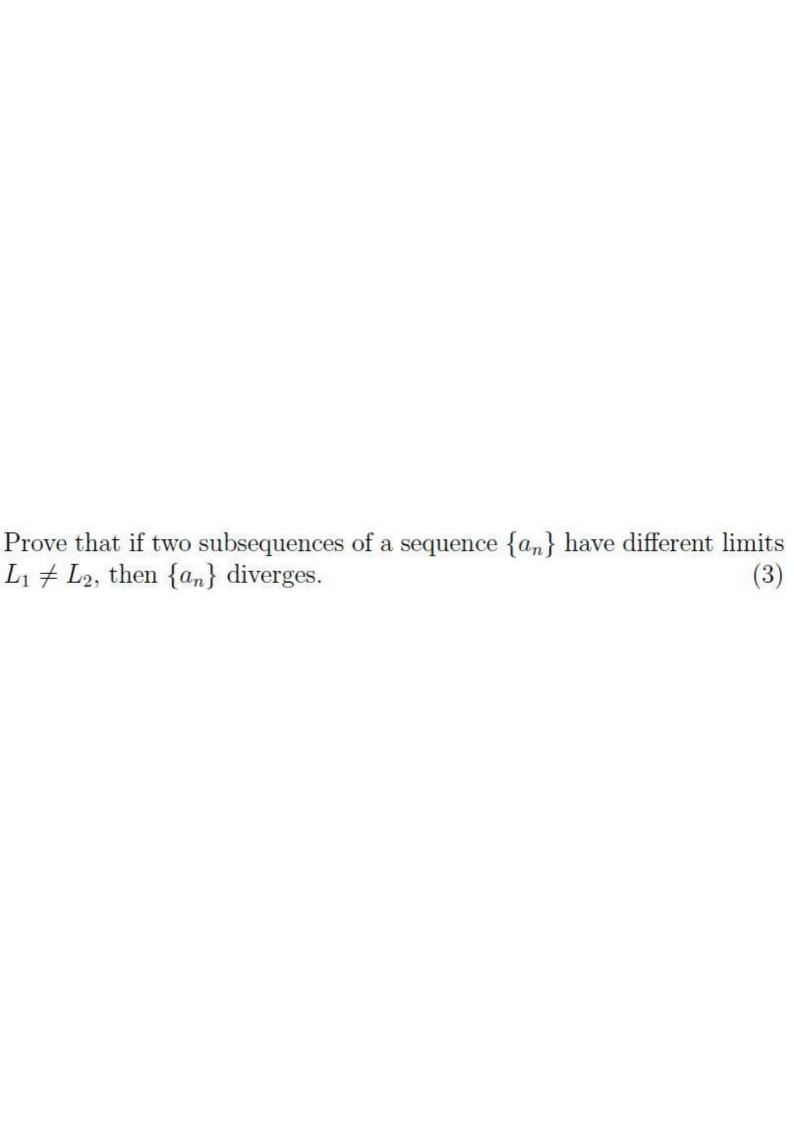
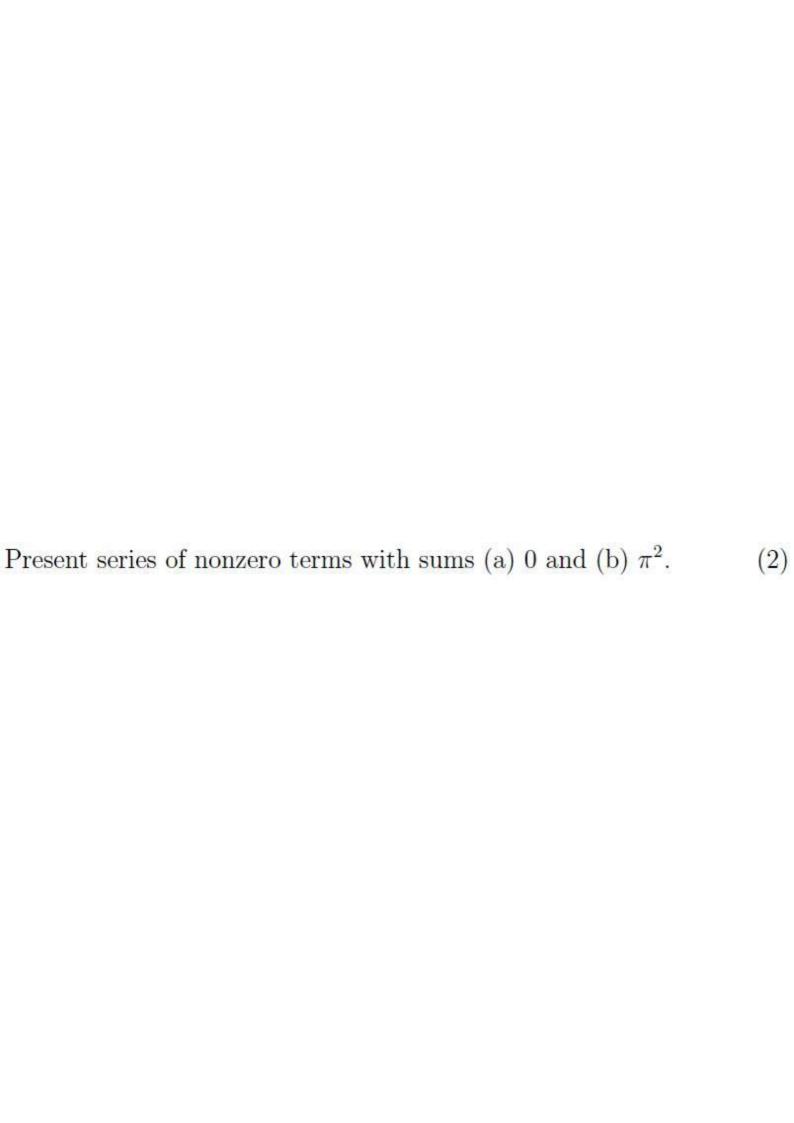


Find  $\lim_{n \to \infty} (n!)^{1/n^2}$ . (2)





Prove or disprove:

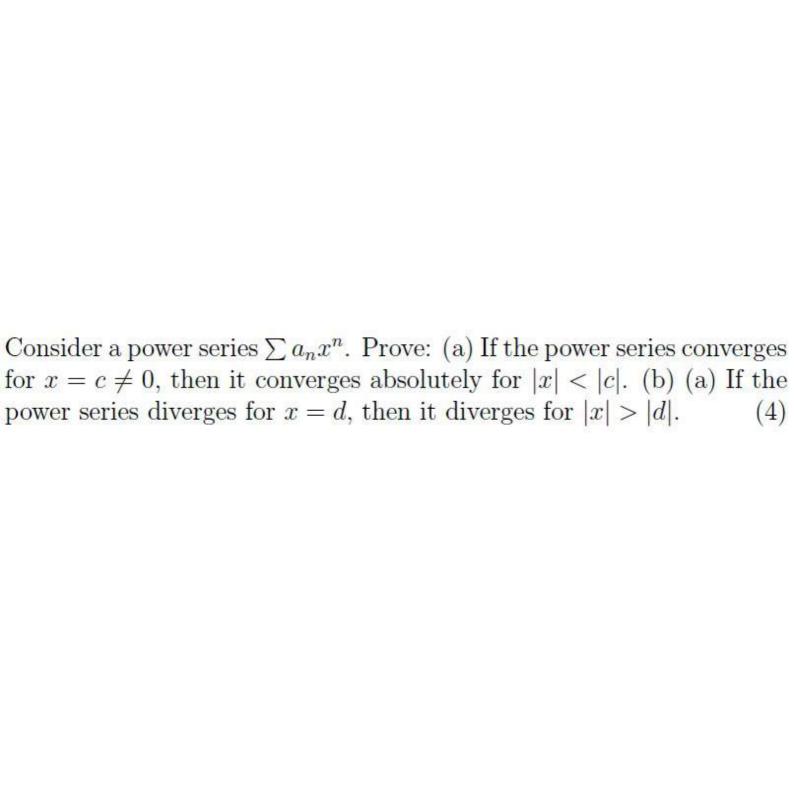
(a) 
$$\sum_{n=1}^{\infty} \sin\left(\frac{1}{n}\right)$$
 converges; (b)  $\sum_{n=1}^{\infty} \cos\left(\frac{1}{n}\right)$  converges. (3)

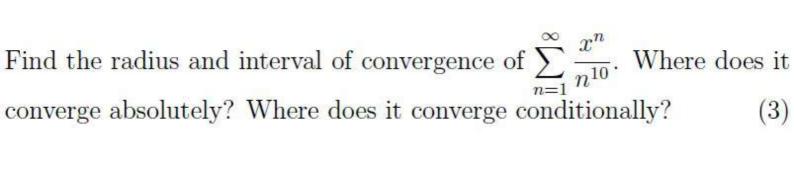
Consider the series  $\sum a_n$ , where  $a_n = \begin{cases} n/2^n & \text{if } n \text{ is prime;} \\ 1/2^n & \text{otherwise.} \end{cases}$ 

Does it converge? Give reasons.

(2)

Prove that the alternating *p*-series  $\sum_{n=1}^{\infty} \frac{(-1)^n}{n^p}$  converges if p > 0 and diverges if  $p \leq 0$ .





Find the Maclaurin series of  $f(x) = \sqrt{1+x}$ . In particular, find its general term. (3)