

Consider the power series

$$\begin{aligned} P(x) &= 1 - \frac{x}{2} + \frac{x^2}{3} - \frac{x^3}{4} + \cdots \\ &= \sum_{k=0}^{\infty} \frac{(-x)^k}{k+1} \end{aligned}$$

1. Does the series converge when $x = 1$?
2. Does the series converge when $x = -1$?
3. Does the series converge when $x = -2$?
4. Does the series converge when $x = \frac{1}{2}$?
5. For what values of x does $P(x)$ converge absolutely?
(Hint: Try the Ratio Test)