

Let $P(x)$ be the power series

$$1 + 2x + 3x^2 + 4x^3 + \cdots = \sum_{k=0}^{\infty} (k+1)x^k$$

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