

Consider the power series

$$P(x) = \sum_{k=1}^{\infty} \frac{x^k}{k2^k} = \frac{x}{2} + \frac{x^2}{2 \cdot 2^2} + \frac{x^3}{3 \cdot 2^3} + \dots$$

1. Does $P(x)$ converge or diverge at $x = 1$?
2. Does $P(x)$ converge or diverge at $x = -1$?
3. Does $P(x)$ converge or diverge at $x = 2$?
4. Does $P(x)$ converge or diverge at $x = -2$?
5. What is the interval of convergence of $P(x)$?