Definition: A **power series centered at 0** is a series of the form

$$a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \cdots = \sum_{k=0}^{\infty} a_k x^k$$

where each a_k is a constant. You can think of a power series as an "infinite" polynomial.

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- The presence of the variable x in a power series is critical.
- Instead of there being a simple result – it converges or it doesn't – we now are in a situation where our series may converge for some values of x and diverge for others.
- The interval of convergence is the set of all values of x for which a power series does converge.

Let $P(x)$ be the power series

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

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? (Remember: Try the Ratio Test)

Find the interval of convergence for $\sum_{k=1}^{\infty} \frac{(x-1)^k}{k2^k}$