# Power Series (Section 10.1)

* Infinite Series: expressed in the form $\sum_{k=1}^{\infty} a_k = a_1 + a_2 + a_3 + \ldots + a_n + \ldots$

  $a_n$ is the "$n^{th}$ term" in the series.

* Partial Sums: $\sum_{k=1}^{n} a_k$ would sum the series from 1 to n.

* Converge / Diverge: a series converges if a limit as $n \to \infty$ exists.
  a series diverges if there is no limit.

* Geometric Series: $\sum_{n=1}^{\infty} a \cdot r^{n-1}$ if $|r| < 1 \to$ the $S = \frac{a}{1-r}$
  if $|r| \geq 1 \to$ the series diverges

  * The interval of convergence is $-1 < r < 1$

ex: $\sum_{n=1}^{\infty} 3\left(\frac{1}{2}\right)^{n-1}$ conv or div?

ex: $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \ldots + \left(-\frac{1}{2}\right)^{n-1}$ conv or div?

ex: $\frac{\pi}{2} + \frac{\pi^2}{4} + \frac{\pi^3}{8} + \ldots$ conv or div?

* Power Series: $\sum_{n=0}^{\infty} c_n x^n = c_0 + c_1 x + c_2 x^2 + c_3 x^3 + \ldots + c_n x^n + \ldots$

  This is centered @ $x=0$

  general form

* Power Series centered @ $x=a$:

$$\sum_{n=0}^{\infty} c_n(x-a)^n = c_0 + c_1(x-a)^1 + c_2(x-a)^2 + c_3(x-a)^3 + \dots c_n(x-a)^n + \dots$$

↑ general form

* Using: $\frac{1}{1-x} = 1 + x + x^2 + x^3 + \dots + x^n + \dots = \sum_{n=0}^{\infty} x^n$

ex: What would the series $\frac{x}{1-x}$ look like?

ex: What would the series $\frac{1}{1-2x}$ look like?

ex: Find a power series for $\frac{1}{(1-x)^2}$.

ex: Find a power series for $\ln(1+x)$.

* Repeating Decimals: Steps ① Set the decimal equal to x

② Multiply both sides by a factor of 10 that moves the repeating part to the left side of the decimal.

③ Subtract these two equations. (the repeating part will cancel out!)

④ Solve for x & reduce the fraction.

ex: $0.\overline{53}$

ex: #45 $1.\overline{414}$

Redo #45 Using Series:

$1.\overline{414}$