

Does this converge or diverge

$$\sum_{n=1}^{\infty} \frac{n^n}{n!}$$

$$\lim_{n \rightarrow \infty} \left| \frac{(n+1)^{n+1}}{(n+1)!} \cdot \frac{n^n}{n!} \right|$$

$$\lim_{n \rightarrow \infty} \left| \frac{(n+1)^{n+1}}{(n+1)!} \cdot \frac{n!}{n^n} \right|$$

$$\lim_{n \rightarrow \infty} \left| \frac{(n+1)^n (n+1)^1}{n^n} \cdot \frac{n!}{(n+1)!} \right|$$

$$\lim_{n \rightarrow \infty} \left| \frac{(n+1)^n}{n^n} \right|$$

$$\lim_{n \rightarrow \infty} \left| \left(\frac{n+1}{n} \right)^n \right|$$

$$\lim_{n \rightarrow \infty} \left| \left(1 + \frac{1}{n} \right)^n \right|$$

e

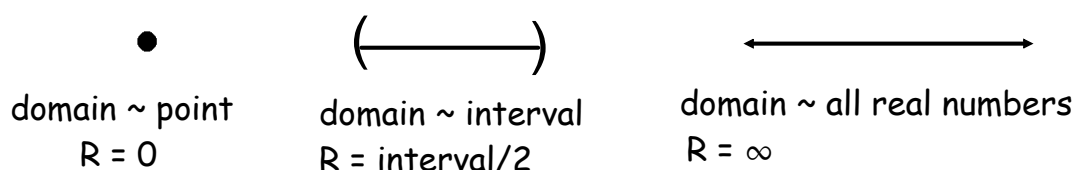
e > 1 diverges by Ratio Test

9.8 Power Series

Read pages 659 - 660

- What is a power series?
- How do you know where the series is centered?
- What are the 3 types of domains for a power series?
- What is the difference between the radius of convergence and the domain for convergence?

Draw a picture.



Summary

Power Series Intervals of Convergence

1) Use Ratio Test to find one of three possibilities...

a) converge only at a point, otherwise diverge

b) always converges

c) if inconclusive set expression $-1 < x < 1$

Check endpoints separately

	<u>Domain</u> of Convergence	<u>Radius</u> of Convergence
ratio test <u>lim</u> <1 doesn't matter what x is	all real numbers $(-\infty, \infty)$	$R = \infty$
ratio test <u>lim</u> >1 doesn't matter what x is	(its center) only one point {2} {0} $\{-\pi\}$ etc.	$R = 0$
ratio test <u>lim</u> =1	<u>interval</u> such as $(-1, 7]$ $[-1, 7)$ $[-1, 7]$ $(-1, 7)$	$(\text{right-left})/2$ $(7+1)/2 = 4$



Power Series Radius of Convergence

- Find the interval of convergence
- Compute its length
- Divide by 2

next slide for examples

Ex. 1

$$\sum_{n=0}^{\infty} \frac{(2n)! x^{2n}}{n!}$$

$$\lim_{n \rightarrow \infty} \left| \frac{(2(n+1))! x^{2(n+1)}}{(n+1)!} \cdot \frac{n!}{(2n)! x^{2n}} \right|$$

$$\lim_{n \rightarrow \infty} \left| \frac{(2n+2)! x^{2n+2}}{(n+1)!} \cdot \frac{n!}{(2n)! x^{2n}} \right|$$

$$\lim_{n \rightarrow \infty} \left| \frac{(2n+2)(2n+1)(2n)!}{(2n)!} \cdot \frac{n!}{(n!)n!} \cdot \frac{x^{2n} \cdot x^2}{x^{2n}} \right|$$

$$\lim_{n \rightarrow \infty} \left| \frac{(2n+2)(2n+1) x^2}{n+1} \right|$$

$\infty > 1$ only way to make converge

Domain
 $x=0$ Radius
 0

ex. $\sum_{n=1}^{\infty} \frac{(2n)!}{n!} (x-4)^{2n}$

Domain
 $x=4$ Radius
 $\neq 0$