1. Test the series for convergence or divergence. Name the test utilized. Support your conclusion. If convergent, find the sum whenever possible.

\[ \sum_{n=0}^{\infty} \frac{2n}{n^2 + 1} \]

Test:

Apply test / reasoning:

Converge / diverge:

Sum, if possible:

2. Find the center, radius, and the (open) interval of convergence for the power series. You need NOT test endpoints.

\[ f(x) = \sum_{n=1}^{\infty} \frac{(-1)^n x^n}{(n-1)!} \]

Center: \( C = \)

Radius: \( R = \)

(open) Interval of Convergence ( , )
3. Find the center, radius, and the (open) interval of convergence for the power series,

\[ f(x) = \sum_{n=1}^{\infty} \frac{(-1)^n (x - 2)^n}{5^n \cdot n^2} \]. You need NOT test endpoints.

Center: \( C = \)

Radius: \( R = \)

(open) Interval of Convergence \( ( , ) \)
4. Given the power series, \( f(x) = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}(x-1)^n}{n} \), and the fact that the radius of convergence is \( R = 1 \), to find the interval of convergence, \textit{including} testing endpoints, if necessary.

TEST LEFT ENDPOINT: | TEST RIGHT ENDPOINT:

FINAL interval of Convergence Radius:
(after testing endpoints)
5. For the power series, \( f(x) = \sum_{n=0}^{\infty} \frac{(-1)^n(x-2)^n}{n!} \) find \textbf{AND} simplify or rewrite \( n^{th} \) term for each of the following. You need \textbf{NOT} find interval of convergence, nor test endpoints.

\[
f(x) = \sum_{n=0}^{\infty} \frac{(-1)^n(x-2)^n}{n!} = 1 - \frac{1}{1!}(x-2) + \frac{1}{2!}(x-2)^2 - \frac{1}{3!}(x-2)^3 + \frac{1}{4!}(x-2)^4 - \frac{1}{5!}(x-2)^5 + \ldots
\]  

a. \( f'(x) = \sum_{n=1}^{\infty} \) 

\[
f(x) = \sum_{n=0}^{\infty} \frac{(-1)^n(x-2)^n}{n!} = 1 - \frac{1}{1!}(x-2) + \frac{1}{2!}(x-2)^2 - \frac{1}{3!}(x-2)^3 + \frac{1}{4!}(x-2)^4 - \frac{1}{5!}(x-2)^5 + \ldots
\]

b. \( \int f(x) \, dx = C + \sum_{n=}^{\infty} \)
6. Use the definition of the Taylor/Maclaurin Polynomial and Taylor/Maclaurin Series to find the 4th Maclaurin Polynomial for \( f(x) = e^{-2x} \) centered at \( c = 0 \). Then use your polynomial to write the Maclaurin Series for \( f(x) = e^{-2x} \) centered at \( c = 0 \).

<table>
<thead>
<tr>
<th>( n = 0 )</th>
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<tbody>
<tr>
<td>( n = 1 )</td>
<td></td>
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<tr>
<td>( n = 2 )</td>
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<tr>
<td>( n = 3 )</td>
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<tr>
<td>( n = 4 )</td>
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4th Maclaurin polynomial: \( P_4(x) = \)

Maclaurin Series: \( P(x) = \sum_{n=0}^{\infty} \)

7. (4 points): In your opinion the greatest song (or recording) of all time (in any musical genre).

There is no wrong answer.