9.1 Power Series

Recall the Power Series, centered at \( x = a \):

\[
f(x) = c_0 + c_1(x-a) + c_2(x-a)^2 + c_3(x-a)^3 + \ldots + c_n(x-a)^n + \ldots
\]

Power Series Theorems

If

\[
f(x) = \sum_{n=0}^{\infty} c_n(x-a)^n
\]

is differentiable and converges on \((a - R, a + R)\),

then

① \( f'(x) = \)

and

② \( \int f(x) \, dx = \)

also,

\[
\int_{a}^{x} f(t) \, dt =
\]

• If the series for \( f \) converges for all \( x \), then so does the series for \( f' \) and the series for \( \int f(x) \, dx \).
Examples:
Express each function as a power series.

1. \( \frac{1}{(1-x)^2} \)

2. \( \ln(1-x) \)

3. \( \tan^{-1}x \)