$x=-1/3$

$\sum \frac{(-3)^{n-1}\left(-\frac{1}{3}\right)^n}{n}$

$\sum \frac{(-3)^n\cdot(-3)^{-1}\left(-\frac{1}{3}\right)^n}{n}$

$\sum -\frac{1}{3n}$

multiple harmonic diverges

$x=+\frac{1}{3}$

$\sum (-1)^n\left(\frac{1}{3n}\right)$

conditional convergence

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$n=1 \quad n=2 \quad n=3 \quad n=4$

$x-\frac{3}{2}x^2+3x^3+(-3)^3x^4/4$

1. The Maclaurin series for a function f is given by

$f(x)=\sum_{n=1}^{\infty}\frac{(-3)^{n-1}}{n}x^n=\boxed{x-\frac{3}{2}x^2+3x^3-\cdots}+\frac{(-3)^{n-1}}{n}x^n\cdots$ and converges to f(x) for $|x|<R$, where R is the radius of convergence of the Maclaurin series.

$R=\frac{1}{3}$

a) Use the Ratio Test to find R

$\lim_{n\to\infty}\left|\frac{(-3)^n x^{n+1}}{n+1}\cdot\frac{n}{(-3)^{n-1}x^n}\right|=\left|\frac{x}{(-3)^{-1}}\right|=|3x|<1$

$-1<3x<1$

$-\frac{1}{3}<x<\frac{1}{3}$

b) Write the first four non-zero terms of the Maclaurin series for f', the derivative of f. Express f' as a rational function for $|x|<R$.

$f'(x)=1-3x+9x^2-27x^3$

Sum of geo

$f'(x)=\frac{1}{1-(-3x)}=\frac{1}{1+3x}$

c) Write the first four nonzero terms of the Maclaurin series for e^x. Use the Maclaurin series for e^x to write the third-degree polynomial for $g(x)=e^xf(x)$ about $x=0$.

$f(x)=x-\frac{3}{2}x^2+3x^3-\frac{27x^4}{4}$

$e^x=1+x+\frac{x^2}{2}+\frac{x^3}{3!}$

$e^xf(x)=x-\frac{3}{2}x^2+3x^3+1x^2-\frac{3}{2}x^3+\frac{1x^3}{2}$

$=x-\frac{1}{2}x^2+2x^3$