Each problem is worth 5 points. Clear and complete justification is required for full credit.

1. Find the sum of the series $\sum_{n=1}^{\infty}\left(\frac{-1}{3}\right)^n$.

$\left(-\frac{1}{3}\right)^1 + \left(-\frac{1}{3}\right)^2$

$-\frac{1}{3} + \frac{1}{9}$

$\frac{\frac{1}{9}}{-\frac{1}{3}} = -\frac{1}{3}$

$a = \left(\frac{-1}{3}\right)^1 = \left(\frac{-1}{3}\right)$

$r = -\frac{1}{3}$

$S = \frac{a}{1-r}$

$S = \frac{-\frac{1}{3}}{1-(-\frac{1}{3})}$

$S = \boxed{-\frac{1}{4}}$

Excellent

2. Determine whether the series $\sum_{n=2}^{\infty}\frac{1}{n(\ln n)^2}$ converges or diverges.

Integral Test

$\lim_{x\to\infty}\int_2^x \frac{1}{x(\ln x)^2}\,dx =$

let $u = \ln x$

$\frac{du}{dx} = \frac{1}{x}$

$du \cdot x = dx$

$\lim_{x\to\infty}\int_2^x \frac{1}{\cancel{x}(u)^2}\,du\cdot\cancel{x}$

$\lim_{x\to\infty} -u^{-1}\Big|_{x=2}^{x=x} =$

$\lim_{x\to\infty} \frac{-1}{\ln x}\Big|_2^x \quad 0 - \ -1/\ln 2$

converges

Well done

$\ln x$ gets bigger so $1/\ln x$ goes to zero

or $\ln\infty$ or $1/\ln\infty$

Yes.