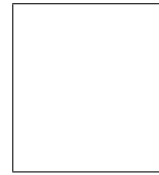




Quiz # 1  
 Math 102-001 Calculus  
 2 June 2016, Thursday  
 Instructor: Ali Sinan Sertöz



Bilkent University

Your Name: .....

Student ID: .....

Your Department: .....

**Q-1)** Use the integral test to check if the series  $\sum_{n=3}^{\infty} \frac{\ln n}{n^2}$  converges or diverges.

*Show your work in detail. Correct answers without justification are never graded.*

**Answer:**

Let  $f(x) = \frac{\ln x}{x^2}$  be defined for  $x \geq 3$ . Then  $f'(x) = \frac{1 - 2 \ln x}{x^3}$  and thus  $f'(x) < 0$  for  $x \geq 3$ . Since we also have  $f(x) > 0$  on this interval, we can apply the integral test.

$$\int_3^{\infty} \frac{\ln x}{x^2} dx = - \left( \frac{\ln x}{x} \Big|_3^{\infty} \right) + \int_3^{\infty} \frac{dx}{x^2} = \frac{\ln 3}{3} - \left( \frac{1}{x} \Big|_3^{\infty} \right) = \frac{\ln 3}{3} + \frac{1}{3} < \infty,$$

where we used integration by parts with  $u = \ln x$  and  $dv = \frac{dx}{x^2}$  for the first integral. Since the value of this integral is finite, the given series converges by the integral test.