

Books, watches, notes or cell phones are **not** allowed. The **only** calculators allowed are the Sharp EL-531\*\*\*. You **must** show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

**Question 1.** (5 marks) Determine whether the series is convergent or divergent.

$$\sum_{n=2}^{\infty} \cos\left(\frac{1}{n^2}\right)$$

**Question 2.** (5 marks) Determine whether the series is convergent or divergent.

$$\sum_{n=1}^{\infty} \frac{n - \arcsin\left(\frac{1}{n}\right)}{n2^n}$$

**Question 3.** (5 marks) Determine whether the series is convergent or divergent.

$$\sum_{n=10}^{\infty} \frac{1}{n \ln n \sqrt{(\ln n)^2 - 1}}$$

**Bonus Question** (2 marks)

A Calculus II student is hired as a manager at David Hilbert's Hotel which is a very large hotel, in fact, it has infinitely many rooms numbered 1, 2, 3, ... The hotel is very popular and every room is occupied one night.

That night a new guest arrives.

-Is there any free room?

-No, the former Calculus II student said.

-Oh, what a pity, the guest said and started to walk away.

-But wait, you can still get a room.

How can the former Calculus II student find a room for the guest?