Question 1

b)

To determine if

$$\sum_{n=2}^{\infty} \frac{(-1)^n}{lnn}$$

converges, I will use the alternating series test.

The conditions for that test is if the series is of the form

$$\sum_{n=k}^{\infty} (-1)^n a_n$$

, where k is an integer greater than or equal to 0, then, if $a_n > 0$, a_n is decreasing as n gets bigger, and $\lim_{n \to \infty}$ of $a_n = 0$, then the series converges.

In this example, $2 \geq 0$, $a_n = \frac{1}{lnn} > 0$, when $n \geq 2$, and a_n is

decreasing as n gets bigger, and $\lim_{n \to \infty}$ of $a_n = 0$.

Therefore this series converges.

To determine absolute convergence, we need to take the absolute value of the series, and determine if that new series converges or not.

When taking the absolute value, $(-1)^n$ simply becomes 1, and thus the sum of the new series becomes

$$\sum_{n=2}^{\infty} \frac{1}{lnn}$$

Now consider the sum of another series,

$$\sum_{n=2}^{\infty} \frac{1}{n}$$

The sum of this series diverges, since it was proved in class, and each term, is less than each term in the $\frac{1}{lnn}$ series, since $n > ln\ n$, and therefore $\frac{1}{n} < \frac{1}{lnn}$

Therefore by the comparison test, the $\frac{1}{lnn}$ series diverges.

Therefore the original series $\frac{(-1)^n}{lnn}$ only converges conditionally.