**Mat104 Geometric Series, Sequences and L'Hôpital's Rule from Old Exams**

(1) For which values of $x$ does $\sum_{n=0}^{\infty} e^{nx}$ converge? What is the value when it converges?

(2) Evaluate $\sum_{n=4}^{\infty} \left(-\frac{2}{3}\right)^n$.

(3) Evaluate $\sum_{n=0}^{\infty} \frac{2^n + 3^{n+1} + 4^{n+2}}{5^n}$.

(4) Find $2 + \sum_{n=1}^{\infty} \frac{2 + (-3)^n}{5^n}$.

(5) Evaluate $\sum_{n=0}^{\infty} \frac{2 + 2^n}{4^n}$.

(6) Find $\lim_{n\to\infty} \frac{\ln(n^2+n)}{\ln(n^2-n)}$ or show that it does not exist.

(7) Evaluate or show that $\lim_{n\to\infty} \frac{3n^3+1}{n^4+n^2+n+8}$ does not exist:

(8) Find each $\lim_{n\to\infty} \frac{n + 17\arctan(n) + 2}{1-n}$ or show that it does not exist.

(9) Find $\lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^{2n}$ or show that it does not exist.

(10) Find the following limits:

(a) $\lim_{n\to\infty} \frac{\left(1+\frac{1}{n}\right)^n}{3\sqrt{n}}$

(b) $\lim_{n\to\infty} \frac{\ln(n+1000)}{\ln(n^2)}$