5. Does $\sum_{n=1}^{\infty} \frac{4^n + n}{n!}$ converge? Justify your answer.

$n < 4^n$ for all integers n with $1 \le n$

$\therefore \frac{4^n+n}{n!} < \frac{4^n+4^n}{n!} = 2\frac{4^n}{n!}$

I will show that $\sum_{n=1}^{\infty} 2\frac{4^n}{n!}$ converges.

The (straight) comparison test then shows that $\sum_{n=1}^{\infty} \frac{4^n+n}{n!}$ also converges.

Use the ratio Test on $\sum_{n=1}^{\infty} 2\frac{4^n}{n!}$

Let $\rho = \lim_{n\to\infty} \left|\frac{a_{n+1}}{a_n}\right| = \lim_{n\to\infty} \frac{\cancel{2}\frac{4^{n+1}}{(n+1)!}}{\cancel{2}\frac{4^n}{n!}}$

$= \lim_{n\to\infty} \frac{4}{n+1} = 0 < 1.$ $\therefore \sum 2\frac{4^n}{n!}$ converges

6. Express $9.12323232\overline{323}$ as a fraction

Let $N = 9.123\overline{23}$

So $100N = 912.3232\overline{32}$

$- \quad N = 9.12323\overline{2}$

$99N = 903.2$

$\frac{903.2}{99} = \frac{9032}{990}$