Do the following series converge or diverge?

1. $\displaystyle\sum_{k=98}^{\infty} \frac{3^k + \sin(k)}{\cos(k) + 5}$

2. $\displaystyle\sum_{k=1}^{\infty} \frac{2k^2 - 3}{5k^2 + 6k}$

3. $\displaystyle\sum_{k=1}^{\infty} \frac{1}{3^k + 2}$

4. $\displaystyle\sum_{k=2}^{\infty} \frac{1}{k^2}$ Hint: Draw a picture comparing with $\displaystyle\int_1^{\infty} \frac{1}{x^2}\, dx$.

5. $\displaystyle\sum_{k=1}^{\infty} \frac{1}{k}$ Hint: Draw a picture comparing with $\displaystyle\int_1^{\infty} \frac{1}{x}\, dx$.

1. Consider the series $\sum_{k=0}^{\infty} \dfrac{1}{k!}$. Use Maple to calculate $S_0, S_{10}, S_{20}, S_{100}$.

   Does this series look like it converges? If so, what do you think the limit is?

2. Without using Maple, evaluate

$$1 + \frac{1}{4} + \frac{1}{4^2} + \frac{1}{4^3} + \frac{1}{4^4} + \cdots + \frac{1}{4^{89}}$$

   (Hint: This is a partial sum of a geometric series)