1. We're interested in the convergence of the series $\sum_{n=1}^{\infty} \frac{n^2+3n^5+8n!}{n^n}$.

   Define $a(n) = \frac{n^2+3n^5+8n!}{n^n}$. Find the **numerical** values of $\frac{a(n+1)}{a(n)}$ for large values of n (say $1000, 10000$, and 100000). Using Mathematica, calculate the actual limit. What does the ratio test say about the series?

2. The MaClaurin series for $\sin(x)$ is

   $$\sin(x) = \sum_{n=0}^{\infty}(-1)^k \frac{x^{2n+1}}{(2n+1)!} = x - \frac{x^3}{6} + \frac{x^5}{120} + \ldots$$

   By truncating the series at some point, we get a Taylor polynomial. Plot the degree 4 Taylor polynomial of $sin(x)$ and the sine function on the same graph, in the interval $[-8, 8]$. Do the same for degrees $8, 12$, and 16. For roughly what values of x is the Taylor polynomial a good approximation to the sine function for each of these degrees?