1. Let $f(x) = 1 + 2x + 3x^2 + 4x^3$. Find the Taylor series for $f(x)$ at $x = 0$ (the Maclaurin series).

2. Find the Taylor series expansion about $x = 1$ of $\sin(\pi x)$.

3. Use known Maclaurin series to find the Maclaurin expansions of

   (a) $f(x) = xe^{2x}$

   (b) $g(y) = 2\cosh(y) = e^y + e^{-y}$.

(c) $h(t) = t^5 \sin(3t^2)$.

4. Approximate the following integral using a 6th order Taylor polynomial for $\cos(x)$:

$$\int_0^1 x \cos(x^3) \, dx.$$