1. Let \( f(x) = \int_0^x \cos(t^2) \, dt \). Write the Maclaurin series (Taylor series centered at 0) for each of the following functions of \( x \).

   (i) \( \cos(x) \) 
   (ii) \( \cos(x^2) \) 
   (iii) \( f(x) \) 
   (iv) \( g(x) = f(x^2) \)

2. Find the equations of all lines which are tangent to the curve \( y = x^3 - x \) and are perpendicular to the line \( y = 4x + 5 \).

3. Let a curve be given by the parametric equations

   \[
   x = e^t \sin t - e^t \cos t \\
   y = e^t \sin t + e^t \cos t
   \]

   Find the arclength of the curve from \( t = 0 \) to \( t = \ln(2) \).

4. Suppose that \( x \) and \( y \) are given as functions of \( s \) and \( t \) by the equations

   \[
   x = e^{st} \\
   y = s^2 t^3
   \]

   Suppose also that \( s \) is a function of \( t \) such that \( ds/dt = (1 + t^3)^{-1} \). Then \( y \) can be regarded as a function of \( x \). Compute \( dy/dx \) in terms of \( s \) and \( t \).

5. Let \( f(x) = \begin{cases} 
   x^2 \sin(1/x) & \text{if } x \neq 0 \\
   0 & \text{if } x = 0
\end{cases} \)

   (i) Show that \( \lim_{x \to 0} f'(x) \) does not exist.

   (ii) Using the definition of the derivative, show that \( f'(0) = 0 \).