1. Compute the derivatives of the following functions \( f(x) \).
   a) \( f(x) = \log(\cos x) \)
   b) \( f(x) = e^{-x^2} \)
   c) \( f(x) = x \log x \)
   d) \( f(x) = e^x \sin x \)
   e) \( f(x) = 2^{\arctan x} \)

2. Consider the function \( f(x) = x^x \), defined for \( x > 0 \).
   a) Compute \( f'(x) \) and find the point(s) \( x \) where \( f'(x) \) is positive, negative and zero.
   b) Compute \( f''(x) \) and find the point(s) \( x \) where \( f'(x) \) is positive, negative and zero.
   c) Use your information from a) and b) to sketch the graph of \( x^x \)

3. Find the \( n^{th} \) Taylor polynomial of the function \( f(x) = 2^x \).

4. Find the point of maximum curvature on the graph of \( y = e^x \).

5. The **Hyperbolic trigonometric functions** \( \cosh(x) \) and \( \sinh(x) \) \(^1\) are defined by
   \[
   \cosh x = \frac{e^x + e^{-x}}{2}, \quad \sinh x = \frac{e^x - e^{-x}}{2}.
   \]
   a) Show that \( \cosh^2 x - \sinh^2 x = 1 \). Explain why these functions are called “hyperbolic”.
   b) Show that \( (\cosh x)' = \sinh x \) and \( (\sinh x)' = \cosh x \).
   c) Compute the Taylor polynomials for \( \cosh x \) and \( \sinh x \) and compare with the Taylor polynomials for \( \cos x \) and \( \sin x \).

6. The inverse function of \( \sinh x \) is called \( \text{arcsinh} x \). Express \( \text{arcsinh} x \) in terms of the logarithm function.
   [Hint: solve for \( y \) in the equation \( x = \sinh y \).]

\(^1\) pronounced “kosh” and “cinch”