1. Differentiate the following functions:

(i) \( y = \sec x \),

(ii) \( y = \frac{x^2}{\cos x} \),

(iii) \( y = \sec x(x - \cot x) \),

(iv) \( y = \sin(\sin(\sin x)) \),

(v) \( y = \frac{(\csc x)^4}{2x^2} \).

2. Let \( y = \sin 2x - 2\sin x \). For what values of \( x \) is the tangent line parallel to the \( x \)-axis?

3. Suppose that \( f \) is differentiable on \( \mathbb{R} \). Given \( F \) as follows, find an expression for \( F' \).

(i) \( F(x) = f(e^x) \),

(ii) \( F(x) = e^{f(x)} \),

(iii) \( F(x) = f(x^\alpha) \),

(iv) \( F(x) = f(x)^\alpha \).

4. Let \( y = e^{-rx} \), where \( r \) is a constant.

(i) Find expressions for \( y' \) and \( y'' \) in terms of \( y \) and \( r \).

(ii) Show that the following equation is satisfied:

\[ y'' + 2ry' + r^2y = 0. \]

(iii) Write down a function which satisfies:

\[ y'' - 6y' + 9y = 18. \]