Derivatives of Trigonometric Functions

Solutions should show all of your work, not just a single final answer.

1. Compute the derivative of each function below using differentiation rules.

   (a) $f(x) = x^3 \cos x$

   (b) $f(x) = \dfrac{1 + \sin x}{1 + \cos x}$

   (c) $f(x) = e^x \tan x$

   (d) $f(x) = \dfrac{\sec x}{\sqrt{x}}$ (Compute (d) in **two ways**, using (i) the quotient rule and (ii) the product rule.)

2. Find the equation of the tangent line to the curve $y = \sin x \cos x$ at $x = \dfrac{\pi}{4}$. (Your coefficients must be exact, not approximations.)

3. Find the higher derivative $\dfrac{d^{2017}}{dx^{2017}}(2 \cos x)$ by finding the first eight derivatives and observing the pattern that occurs.

4. Determine the following limits by making a change of variables to allow you to use the relation $\lim\limits_{t \to 0} \dfrac{\sin t}{t} = 1$.

   (a) $\lim\limits_{x \to 0} \dfrac{\sin 4x}{x}$

   (b) $\lim\limits_{x \to 0} \dfrac{\sin 7x}{5x}$