M408C: Problem Set 5

Problem 1

Differentiate the following functions:

$$f(x) = x^2 \sin(x), \quad f(x) = e^x \cos(x), \quad f(x) = \frac{x \sin(x)}{1+x}.$$

Problem 2

Find an equation of the tangent line to the curve $y = 2x \sin(x)$ at the point $\left(\frac{\pi}{2}, \pi\right)$. Illustrate by graphing the curve and the tangent line.

Problem 3

Differentiate the following functions:

$$f(x) = (5x^6 + 2x^3)^4, \quad f(x) = \sqrt{5x+1}, \quad f(x) = \cos(x^2).$$

Problem 4

Differentiate the following functions:

$$f(x) = x^2 e^{\frac{-1}{x}}, \quad f(x) = \sin^2(e^{\sin^2(x)}).$$

Problem 5

Given the following equations, find $y'(x)$ by implicit differentiation:

$$x^2 - 4xy + y^2 = 4, \quad xe^y = x - y.$$