# Assignment 1

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**Problems:**

1. Consider that the defined function is

$$f(x) = \begin{cases} x^3 cos(\frac{2}{x}) & x \neq 0 \\ 0 & x = 0 \end{cases}.$$

Show that $f(x)$ is continuous at $x = 0$.

2. Find the differential coefficient of the following function with respect to $\sin^{-1} x$ :

$$y = x^{sin^{-1}x}.$$

Ans: Hints: Using the chain rule.

3. Find the differential coefficient of the following functions with respect to $x$ :

$$y = (sin(x))^{cos(x)} + (cos(x))^{sin(x)}.$$

4. If $y = e^{ax} sin(bx)$, then show that

$$y_2 - 2ay_1 + (a^2 + b^2)y = 0.$$

5. If $x = sin(t), y = sin(at)$, show that

$$(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + a^2 y = 0.$$

6. Find all $n^{th}$ derivative of $\frac{1}{1-5x+6x^2}$.

7. Determine all the numbers $c$ which satisfy the conclusions of the Mean Value Theorem for the following function.

$$f(x) = x^3 + 2x^2 - x, \quad on \quad [-1, 2].$$

8. Find the Maclaurin polynomial $P_0, P_1, P_2, P_3$ for $e^x cos(x)$.