口　述　試　験（午 前　1）　　19　大修
工　学　基　礎　　時間　９：００～１０：００

注　意　事　項

１．　問題は全部で 3 題ある。この全てについて解答せよ。

２．　答案用紙は全部で 3 枚ある。

３．　各答案用紙には、必ず受験番号を記入せよ。

４．　計算機能のみの電卓を使用してもよい。

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Answers to questions can be given in Japanese or English.

1. Solve the ordinary differential equation,

$$2xy\frac{dy}{dx} = y^2 - x^2 \qquad (1)$$

Hint: Introduce the new unknown function $u = y/x$.

2. Solve the ordinary differential equation,

$$\frac{dy}{dx} = 2xy, \qquad (2)$$

by assuming a solution in the form of a *power series* with unknown coefficients,

$$y = \sum_{m=0}^{\infty} a_m x^m . \qquad (3)$$

Determine the first five non-zero terms of the power series.

3. The Laplace transform of a function $f(t)$ defined for all $t \geq 0$, is the function $F(s)$ given by

$$F(s) = \int_0^{\infty} f(t)e^{-st}dt . \qquad (4)$$

Find the Laplace transforms of (a) $f(t) = 2t + 6$, and (b) $f(t) = \sin \pi t$.

4. Find the sample mean, standard deviation and sample variance of the following data set. Indicate clearly any formulas used.

51.5, 49.8, 51.1, 48.9, 50.3, 49.2, 51.2, 50.4, 52.8.