

口述試験(午前1)
工学基礎

22 大修

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. (a) The Bernoulli equation is a *nonlinear* ordinary differential equation,

$$\frac{dy}{dx} + p(x)y = g(x)y^a, \quad (a \text{ is a real number, } y \text{ is a function of } x). \quad (1)$$

Use the substitution $u(x) = [y(x)]^{1-a}$, to reduce the Bernoulli equation to a *linear* differential equation.

(b) Obtain the general solution of the ordinary differential equation,

$$\frac{dy}{dx} + 2y = y^2. \quad (2)$$

2. Obtain the general solution of the ordinary differential equation,

$$\frac{d^2y}{dx^2} - xy = 0, \quad (3)$$

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

$$y = \sum_{m=0}^{\infty} a_m x^m, \quad (4)$$

and give the first six non-zero terms of the power series.

3. Find the eigenvalues (固有値) and normalized eigenvectors (正規化された固有ベクトル) of the matrix,

$$\mathbf{A} = \begin{bmatrix} 3 & -10 & 0 \\ -10 & 0 & 30 \\ 0 & 30 & -27 \end{bmatrix}. \quad (5)$$