

國立臺灣師範大學 103 學年度碩士班招生考試試題

科目：工程數學（精密機械組）

適用系所：機電工程學系

注意：1.本試題共 2 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

【試題 1】(15 分)

$$2 \sin(y^2) dx + xy \cos(y^2) dy = 0, \quad y(2) = \sqrt{\pi/2}$$

【試題 2】(20 分)

(a) Please prove the initial value theorem: if $\mathcal{L}[f(t)] = F(s)$, then

$$\lim_{t \rightarrow 0} f(t) = \lim_{s \rightarrow \infty} sF(s)$$

(b) Use the Laplace transform to solve

$$ty'' + (4t + 2)y' - 4y = 0, \quad y(0) = 2$$

【試題 3】(15 分)

Solve the systems

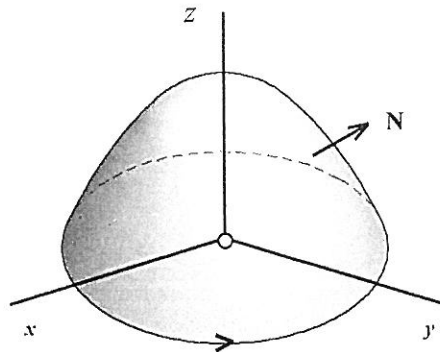
$$\begin{cases} x_1 + 2x_2 + 3x_3 = 4 \\ 2x_1 + 5x_2 + 3x_3 = 5 \\ x_1 + 8x_3 = 9 \end{cases}$$

- (a) via the Gauss-Jordan elimination method.
- (b) via the elementary matrix method by using inversed matrix.
- (c) via the Cramer's rule.

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【試題 4】(20 分)

Please prove the Stokes's theorem for $\vec{F} = y\vec{i} + z\vec{j} + x\vec{k}$ and S the paraboloid $z = f(x, y) = 1 - (x^2 + y^2)$, $z \geq 0$ (as shown in the following figure).



【試題 5】(15 分)

(a) Find the Fourier series of the following periodic function

$$f(x) = \begin{cases} -1 & \text{if } -\pi < x < 0 \\ 1 & \text{if } 0 < x < \pi \end{cases} \quad \text{and} \quad f(x+2\pi) = f(x)$$

(b) $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots = ?$

【試題 6】(15 分)

(a) Solve $z^2 - (5+i)z + (8+i) = 0$

(b) Find all z , such that $\sin z = \sqrt{2}$