臺灣綜合大學系統108學年度學士班轉學生聯合招生考試試題

科目名稱	工程數學	類組代碼	D36
		科目碼	D3691

※本項考試依簡章規定各考科均「不可以」使用計算機　　本科試題共計 1 頁

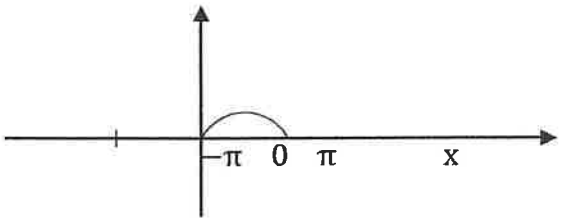
1. Find the angle between the surfaces $xy^2z = 3x + z^2$ and $3x^2 - y^2 + 2z = 1$ at the point$(1, -2, 1)$. (10%)

2. Use Laplace Transformation (with respect to t) to solve the partial differential equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ $u(x, 0) = 0$ $0 < x < \infty, 0 < t < \infty$ and $u(0, t) = -\int_0^t u(0, s)ds + e^{-2t} - 1$. (10%)

3. Prove $\nabla \times (\nabla \emptyset) = 0$. (10%)

4. To solve a PDE, we need to have boundary and initial conditions. There are also three types of boundary conditions: Dirichlet, Neumann, and Robin (mixed) conditions. Please clearly describe each type of boundary conditions. (10%)

5. Find the Fourier series of the periodic function $f(x)$,
$f(x) = \begin{cases} 0, -\pi < x \leq 0 \\ \sin x, 0 < x \leq \pi \end{cases}$ (10%)



6. Use Cramer's rule to solve the system of linear equation,
$\begin{cases} -x + 2y - 3z = 1 \\ 2x + z = 0 \\ 3x - 4y + 4z = 2 \end{cases}$ (10%)

7. Find the eigenvalues and corresponding eigenvectors for matrix /A. What is the dimension of the eigenspace of each eigenvalue?
$/A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ (10%)

8. Solve $\begin{cases} y_1''(t) = -y_1(t) - y_2(t) + 1 \\ y_2'(t) = y_1(t) + y_2(t) \end{cases}$; $y_1(0) = y_1'(0) = y_2(0) = 0$ (10%)

9. Find $yy''(x) + (y + 1)\{y'(x)\}^2 = 0$ (10%)

10. Prove that, the Fourier sine series $\frac{\pi - x}{2} = \sum_{n=1}^{\infty} \frac{\sin nx}{n}$; $(0 \leq x \leq \pi)$ (10%)