

國立成功大學  
110學年度碩士班招生考試試題

編 號：187

系 所：電腦與通信工程研究所

科 目：工程數學

日 期：0203

節 次：第 3 節

備 註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Solve the following initial value problem. (20%)

$$tx'(t) = x(t) + \sqrt{t^2 - x^2(t)}, \quad x(t_0) = 0 \quad \text{for some } t_0 > 0$$

2. Find the eigenvalues and eigenvectors of the matrix. (20%)

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

3. Solve the following differential equation (10%)

$$(3x^2y + y^2 + 1) dx + (x^3 + 2xy - 1) dy = 0$$

4. Find the value of  $y'(0.5) - 1$  by solving the initial value problem for the following nonhomogeneous second-order differential equation. Show the details. (20%)

$$x^2y'' - 3xy' + 4y = x + 3 \quad \text{for } x > 0$$

$$y(1) = \frac{11}{4}, \quad y'(1) = 3$$

5. Find the value of  $\frac{1}{4\pi} \ln \left[ \frac{y(\pi) - 2\pi - 5}{2} \right]$  by solving the initial value problem. Show the details. (20%)

$$y'' + 4y' = 8 + 34 \cos(x)$$

$$y(0) = 3, \quad y'(0) = 2$$

6. Find the value of  $2 \cdot y\left(\frac{9\pi}{4}\right)$  by solving the initial value problem, where  $\delta(t-a)$  is the Dirac delta function. Show the details. (10%)

$$y'' + 4y = \delta(t - \pi) - \delta(t - 2\pi);$$

$$y(0) = 0, \quad y'(0) = 1$$