

國立中央大學 108 學年度碩士班考試入學試題

所別：地球科學系地球物理 碩士班 不分組(一般生)
地球科學系地球物理 碩士班 不分組(在職生)

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科目：微積分

本科考試禁用計算器

作答時須列出完整計算過程

1. (a) $\frac{d^2}{d\theta^2} \cos^{-1}\theta = ?$ (5%)

(b) $\lim_{x \rightarrow 0} \frac{\sin 2x - 2x}{x^3} = ?$ (5%)

2. (a) $\int x^3 \cos 3x dx$ (5%)

(b) $y = x^x, \frac{dy}{dx} = ?$ (5%)

3. (10%) Solve the initial value problem

$$y'' + y' - 2y = 0, \quad y(0) = 4, \quad y'(0) = -5.$$

4. (10%) Find the eigenvalues and eigenvectors of the matrix

$$A = \begin{bmatrix} -4.0 & 4.0 \\ -1.6 & 1.2 \end{bmatrix}$$

5. (10%) Legendre functions are defined by

$$P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} [(x^2 - 1)^n]. \text{ Associated Legendre functions are}$$

$$\text{defined by } P_n^k(x) = (1 - x^2)^{\frac{k}{2}} \frac{d^k P_n(x)}{dx^k}.$$

Find $P_0(x), P_1(x), P_2(x), P_1^1(x), P_2^2(x)$.

參考用

注意：背面有試題

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6. (10%) Find the Laplace transform of $\cos\omega t$, $\sin\omega t$, and $e^{at}\cos\omega t$.

Find the Inverse Laplace transform of $\frac{-s+11}{s^2-2s-3}$.

7. (10%) Find the inverse of the matrix

$$A = \begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$$

8. (10%) Find the integral of $\int_{-\infty}^{\infty} e^{-x^2} dx$

9. (10%) Find the Fourier coefficients of the periodic function $f(x)$. The

formula is $f(x) = \begin{cases} -k & \text{if } -\pi < x < 0 \\ k & \text{if } 0 < x < \pi \end{cases}$, $f(x+2\pi) = f(x)$.

10. (10%) Use the method of separating variables to solve the

one-dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$, for the vibrations of an

elastic string of length L . The boundary conditions are $u(0, t) =$

$0, u(L, t) = 0$ for all t . The initial conditions are $u(x, 0) =$

$f(x), u_t(x, t)|_{t=0} = g(x)$.



注意:背面有試題