

淡江大學九十學年度日間部轉學生招生考試試題

系別：物理系三年級

科目：應用數學

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本試題共 1 頁

(20%) 1. Evaluate the integral

$$I = \int_0^{\infty} \frac{\cos x}{1+x^2} dx$$

(20%) 2. Find the general solutions $x(t)$ and $y(t)$ of the system of equations:

$$\begin{cases} \frac{dx}{dt} = x + \sqrt{3}y + \sqrt{3}e^t \\ \frac{dy}{dt} = \sqrt{3}x - y + e^t \end{cases}$$

(20%) 3. Calculate the Fourier transform of the function $f(x)$ in the integral equation

$$f(x) = e^{-|x|} + \frac{1}{4} \int_{-\infty}^{\infty} dx' e^{-|x-x'|} f(x')$$

where $|x|$ is the absolute value of x .

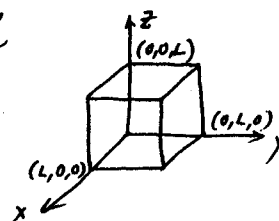
(20%) 4. Evaluate explicitly the surface integral

$$\int_S (\vec{\nabla} \times \vec{V}) \cdot d\vec{\sigma}$$

$$\text{where } \vec{V} = (xz^2)\hat{j} + (xy^2 + L^2y)\hat{k}$$

and S is the closed surface of the cube with length L as shown.

Explain the result using the Stokes' theorem



(20%) 5. Find $x(t)$ if

$$\frac{d^2x}{dt^2} = -e^{-x}/2 \quad \text{and} \quad x(0) = 0, \quad \dot{x}(0) = 1.$$