※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

(10%) 1. Find the solution of $y'' + 6y' + 73y = 80e^x \cos 4x$.

(10%) 2. Find the Laplace transform of $f(t) = \frac{t}{2\beta} \sin \beta t$.

(10%) 3. Reduce the quadratic form $x_1^2 + 24x_1x_2 - 6x_2^2 = 5$ to principal axes form (or canonical form).

(10%) 4. Find the component of $\mathbf{u} = [-1, 5, 0]$ in the direction of $\mathbf{v} = [3, 4, 0]$.

(15%) 5. Evaluate $\iint_S \mathbf{F} \cdot \mathbf{n}\, dA$ by the divergence theorem, where $\mathbf{F} = [x, y, z]$, S the sphere $x^2 + y^2 + z^2 = 9$.

(15%) 6. Find the Fourier series of the periodic function $f(x) = \begin{cases} -k & \text{if } -1 < x < 0 \\ k & \text{if } 0 < x < 1 \end{cases}$, where the period is 2.

(15%) 7. Find all values of $\ln 1$ in the complex plane.

(15%) 8. Evaluate the integral $\int_0^\infty \frac{1+2x^2}{1+4x^4}\, dx$.