所別：光電科學研究所碩士班 一般生 科目：應用數學
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1.Find Laplace transform of the function:

$$f(t) = \int_0^t e^{-4z} \sin(3z)dz \qquad (10\%)$$

2. Find the inverse Laplace transform of the function:

$$\frac{s}{(s^2 + a^2)(s^2 - b^2)} \qquad (10\%)$$

3. Compute the surface integral of the vector field $\mathbf{F} = 2z\mathbf{i} + (x-y-z)\mathbf{k}$ over the surface $\mathbf{S}$: $z = x^2+y^2$; $x^2+y^2 \leq 6$.   (10%)

4. Find the inverse of the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$ (10%)

5. Integrate the following function in the counterclockwise sense around the unit circle:
$(e^z-1)/z$ (10%)

注意：背面有試題

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5. Use contour integration to find the value of the following integral :

$$\int_0^\infty \frac{\sin^2 x}{x^2}\, dx \qquad (10\%)$$

6. If $U(x, y, z) = \left(x^2 + y^2 + z^2\right)^{-\frac{1}{2}}$, find

   (a) the magnitude of the gradient of U, (i.e. $\left|\vec{\nabla} U\right|$), at the point $(1, 2, 0)$; and

   (b) the direction cosines of $\vec{\nabla} U$ at the point $(1, 2, 0)$. $\qquad (10\%)$

7. Solve the equation $2xyy' + y^2 - x^2 = 0$ to obtain the solution for y as a function of x. $\qquad (10\%)$

8. Find the Fourier series of the periodic function $g(x)$ which is assumed to have a period L. Within the central period,

   $$g(x) = x \quad for \quad -0.4L < x < 0.4L \quad,$$

   $$g(x) = 0 \quad otherwise. \qquad (10\%)$$

9. Evaluate the following integral :

   $$I(\beta) = \int_0^\infty e^{i 2\pi \beta x}\, dx \qquad (10\%)$$