① Use Green's theorem in plane of the form $\int_S \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dx\,dy = \oint_C (M\,dx + N\,dy)$, derive the vector function form $\int_S (\nabla \times \vec{B}) \cdot \vec{N}\, dS = \oint_C \vec{B} \cdot d\vec{R}$

and the complex function form $\int_S \nabla B\, dS = \frac{1}{i} \oint_C B\, dz$

② The displacement $u(x,t)$ of a vibrating string with fixed ends satisfies $u_{tt} = a^2 u_{xx}$, $u(0,t) = u(l,t) = 0$

by setting $u(x,t) = X(x)T(t)$ and separating variables, express $u(x,t)$ as an infinite series if

$$u(x,0) \equiv f(x) \quad , \quad u_t(x,0) \equiv g(x)$$

③ given X_1, X_2, X_3 as linearly independent base vectors in $V_3(R)$ Space, determine a set of orthogonal base vectors Y_1, Y_2, Y_3 in the same space.

④ Forward difference operator Δ and shifting operator E are related by $\Delta = E - 1$. Try to establish Newton's forward interpolation formula symbolically.

⑤ For function with single variable $f(x)$, the Taylor's series expansion is like $f(x+a) = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} x^n$

try to express it into symbolic form, then extend it to functions with two variables like $f(x,y)$

⑥ Slove $y^2 \left(\frac{dy}{dx}\right)^2 - 2xy\left(\frac{dy}{dx}\right) + 2y^2 - x^2 = 0$