計算題（共 100 分）

1. Find the unit vector perpendicular to the surface, \( x^2 + 2y^2 + z^2 = 4 \), at the point \((1, 1, 1)\). (10%)

2. \( xydx + x^2dy = 0 \). Find general solution of \( y(x) \) (10%)

3. (a) \( \frac{d\sin(ax)}{dx} = ? \) (5%)

(b) \( \frac{d^{25x}}{dx} = ? \) (5%)

4. \( \int_{0}^{\infty} e^{-2t} \sin(3t)dt = ? \) (10%)

5. \( r = \sqrt{x^2 + y^2 + z^2} \), find expression for \( \nabla \left( \frac{1}{r} \right) \). (10%)

6. Find \( \int_{0}^{\frac{2\pi}{x}} \sin^2 xdx \). (10%)

7. Find \( \int x^2 \ln xdx \). (10%)

8. Solve \( 2xy \frac{dy}{dx} = 4x^2 + 3y^2 \). (10%)

9. Find a particular solution of \( y'' + 4y = 3x^3 \). (10%)

10. A body with mass \( m = \frac{1}{2} \) kilogram (kg) is attached to the end of a spring that is stretched 2 meters (m) by a force of 100 newtons (N). It is set in motion with initial position \( x_0 = 1 \) (m) and initial velocity \( v_0 = -5 \) (m/s). Find the position function of the body as well as the amplitude, frequency, period of oscillation, and time lag of its motion. (10%)