1. (14%)

Consider the surface given by

$$(x-3)^2 + y^2 + z^2 = 6$$

(a) Find a **unit vector** perpendicular to the surface at the point (1, 1, 2).

(b) Derive the equation of the plane tangent to the surface at (1, 1, 2).

2. (21%)

Evaluate the following integrals

(a) $\int_{-2}^{2} |x+1| dx$

(b) $\int_{a}^{b} 5^x dx$

(c) $\int \log^n x \, dx$

3. (10%)

Find the radius of convergence and domain of convergence for the following series:

(a) $\sum_{n=1}^{\infty} 2^n (x-1)^n$

(b) $\sum_{n=1}^{\infty} n^2 (x-2)^n$

4. (15%)

Let

$$f(x) = e^x + e^{-x} - 2\cos(x) + 2$$

(a) Compute the third order Taylor expansion around x = 0.

(b) Show that f(x) has a local minimum at x = 0.

（背面仍有題目，請繼續作答）

5. (20%)

Find the maximum of z:

$$z = 2x + y$$

Under the following conditions:

$$\begin{cases} x + y \leq 16 \\ x + 2y \geq 8 \\ x \geq 2 \\ y \leq 7 \\ x, y \geq 0 \end{cases}$$

6. (20%)

Find the least square approximation to the following table by a polynomial of degree two:

y=f(x)						
x	0.	0.25	0.5	0.64	0.8	1.0
y	0:	0.5	0.7	0.8	0.9	1.0