編號：F 577　系所：認知科學研究所　　科目：微積分

本試題是否可以使用計算機：☑可使用 ，□不可使用　（請命題老師勾選）

1. (10 points) Evaluate the definite integral

$$\int_{-\pi}^{\pi} (sinx + cosx)\, dx.$$

2. (15 points) Find the formula for the integral

$$\int xe^x dx.$$

Hint: Use the formula for *integration by parts*, $\int udv = uv - \int vdu$.

3. (20 points) Determine the derivative $f'(x)$. In each case it is understood that x is restricted to those values for which the formula for $f(x)$ is meaningful.

(a)

$$f(x) = x\sqrt{1+x^2}.$$

(b)

$$f(x) = \frac{1}{1+e^{-x}}.$$

4. (20 points) Ten students take a test. The scores are as follows:

116　91　130　120　114　99　118　102　119　113

Let $x_1 = 116, x_2 = 91, \ldots, x_{10} = 113$. Find the expression for the quantity, α, that minimizes the sum of squared deviations $\sum_i^{10}(x_i - \alpha)^2$.

（背面仍有題目，請繼續作答）

5. (20 points) A hungry rat is placed in a T-maze. On one end of the maze, food can be obtained by a pressing bar. The rat runs the maze 10 times and the data are shown below:

0 0 1 1 1 0 1 1 1 1

The number 1 indicates that the rat gets the food and the number 0, otherwise. Suppose that, on each trial, the probability that the rat finds the food is θ. The likelihood of the data is given by

$$(1-\theta)^3\theta^7$$

Find the value of θ such that the likelihood of the data is maximized. (Hint: The maximum of a function, if it exists, is the same as the maximum of the logarithm of the function.)

6. (15 points) Compute $\lim_{x\to 0}\frac{1-e^{2x}}{x}$.