

科目：微積分 適用：資管系三

編號：731

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本 試 題

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第 1 頁

1. Express the repeating decimal 3.142142142... as a rational number. (10 分)

2. Use the fourth Taylor polynomial of $f(x) = \ln(1+x)$ to approximate

$$\int_{0.1}^{0.2} \frac{\ln(x+1)}{x} dx. \text{ (10 分)}$$

3. Find the radius of convergence and the interval of convergence of each power series. (每題 5 分，共 10 分)

(a) $\sum_{n=0}^{\infty} \frac{x^n}{n^2 + 2}$

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

4. Let $f(x) = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 4x + 1$. (每題 5 分，共 10 分)

- (a) Find the points on the graph of f at which the slope of the tangent line is equal to -2 .
- (b) Find the equation(s) of the tangent line(s) of part (a).

5. Evaluate the following integral. (每題 5 分，共 20 分)

(a) $f(x, y) = ye^{x^2}$; R is bounded by $x = \frac{y}{2}$, $x = 1$, $y = 0$, and $y = 2$.

(b) $\int_{-\infty}^{\infty} \frac{xe^{-x^2}}{1+e^{-x^2}} dx$.

(c) $\int_1^4 \ln 2x \, dx$.

(d) $\int \frac{x}{\sqrt{2x+3}} dx$.

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6. Find $h'(1)$ if $h(x) = g(f(x))$, and $f(x) = \ln x$. (10 分)

7. The total weekly revenue (in dollars) of the Country Workshop realized in manufacturing and selling its roll top desks is given by

$$R(x, y) = -0.2x^2 - 0.25y^2 - 0.2xy + 200x + 160y$$

where x denotes the number of finished units and y denotes the number of unfinished units manufactured and sold each week. The total weekly cost attributable to the manufacture of these desks is given by

$$C(x, y) = 100x + 70y + 4000$$

dollars. Determine how many finished units and how many unfinished units the company should manufacture each week in order to maximize its profit. What is the maximum profit realizable? (10 分)

8. HAL Corporation invests P dollars/year (assume this is done on a frequent basis in small deposits over the year so that it is essentially continuous) into a fund earning interest at the rate of $r\%$ /year compounded continuously. Then the size of the fund A grows at a rate given by

$$\frac{dA}{dt} = rA + p$$

Suppose $A = 0$ when $t = 0$. Determine the size of the fund after t yr. What is the size of the fund after 5 yr if $P = \$50,000$ and $r = 12\%$ /year? (10 分)

9. The demand function for a certain make of inkjet cartridge is

$$p = -0.01x^2 - 0.1x + 6$$

Where p is the unit price in dollars and x is the quantity demanded each week, measured in units of a thousand. Compute the elasticity of demand and determine whether the demand is inelastic, unitary, or elastic when $x = 10$. (10 分)