

科目：微積分 適用：財金系

編號：354

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

一、選擇題(共 20 分，每空格 5 分)

1. () Evaluate $\int (x-3)\ln(2x) dx$.

a) $\frac{(x-3)^2}{2}\ln(2x) + C$ b) $3x - \frac{x^2}{4} + \frac{x(x-6)\ln(2x)}{2} + C$

c) $6x - \frac{x^2}{2} + x(x-6)\ln(2x) + C$ d) $\frac{x^2}{2} + x(x-6)\ln(2x) + C$

2. () Find the minimum value of $f(x, y) = x^2 + y^2 - 4y + 4$ on the hyperbola $x^2 - y^2 = 4$.

a) $12\sqrt{3}$ b) 43 c) 6 d) 34

3. () Find constants a , b , and c so that the graph of the function $f(x) = ax^2 + bx + c$ has a relative maximum at $(7, 36)$ and crosses the y -axis at $(0, 8)$.

a) $a = -\frac{4}{7}$, $b = -8$, $c = -8$ b) $a = -\frac{4}{7}$, $b = 8$, $c = 8$

c) $a = \frac{4}{7}$, $b = 8$, $c = 8$ d) $a = \frac{4}{7}$, $b = -8$, $c = 8$

4. () If $z = x^2 + y^2$, $x = 5\sqrt{t}$, and $y = t^2 - t$, find $\frac{dz}{dt}$ when $t = 9$.

a) -2,111 b) 10,618 c) -8,100 d) 2,473

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二、填充題(共 50 分，每空格 5 分，不需列出計算過程)

1. $f(x, y) = ye^{-5x^2y}$. Find $f_{xy}(x, y) =$ _____.

2. Find the particular solution of the differential equation

$$\frac{dy}{dx} = \frac{2x + y}{x}$$

that satisfies $y = -2$ when $x = 1$. Ans: _____.

3. Given the following points in the plane, find the corresponding least squares line: (1, 2), (2, 1), (4, 2), and (5, 1). Ans: _____.

4. Given that $\int_0^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$, evaluate

$$\int_0^{\infty} e^{-9x^2} dx =$$

5. Evaluate $\lim_{x \rightarrow -\infty} \frac{x}{\sqrt{x^2 + 1}} =$ _____.

6. Evaluate $\lim_{x \rightarrow \infty} (e^x + x)^{\frac{1}{x}} =$ _____.

7. Find $f'(1)$, if

(a) $f(x) = \frac{(x^2 - x)e^{(x-1)}}{x^2 + 3x + 2}$, $f'(1) =$ _____.

(b) $f(e^x) = (2x + 3)^3$, $f'(1) =$ _____.

8. a and b maximize the following integral

$$\int_a^b (x - x^2) dx. \quad a + b =$$

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9. Use double integration to find the average value of $f(x, y) = e^{x^2}$ over the triangle with vertices, $(0, 0)$, $(1, 0)$, and $(1, 1)$.

Ans: _____

三、計算題(共 30 分，沒有列出計算過程者不予計分)

1. (10%) Evaluate the double integral $\int_R \int f(x, y) dA$ for the function $f(x, y)$ and the region R . $f(x, y) = e^{y^2}$; R is bound by $x = 0, x = 1, y = 2x$, and $y = 2$.

2. (10%) A cylinder is inscribed (內接) in a sphere of radius r . Find the largest possible volume of such a cylinder.

3. (10%) Suppose that $f(x)$ is continuous and $f'(0) = f''(0) = 0$, but $f'''(0) > 0$. Does f have a point of inflection at 0? why?