

科目：微積分 適用：經濟系二、資管系二、財金系二

編號：322、331、342

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。

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1. Use a Taylor polynomial to estimate  $\int_0^{0.2} e^{-(1/2)x^2} dx$  with an error less than  $10^{-2}$ . (10 分)

2. Find the sum of the following geometric series if it converges. (每題 5 分，共 10 分)

(a)  $\sum_{n=1}^{\infty} 2^{-n} 3^{-n+1}$ .

(b)  $\sum_{n=1}^{\infty} \left(\frac{1}{e}\right)^n$ .

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

(a)  $f(x, y) = ye^{x^3}$ ;  $R$  is bounded by  $x = \frac{y}{2}$ ,  $x = 1$ ,  $y = 0$ , and  $y = 2$ .

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

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

(d)  $\int x\sqrt{x-5} \, dx$ .

4. Find  $h'(0)$  if  $h(x) = g(f(x))$ ,  $g(x) = x + \frac{1}{x}$ , and  $f(x) = e^x$ . (10 分)

5. Find the absolute maximum value and the absolute minimum value, if any, of the function. (10 分)

$$g(x) = \frac{x}{x^2 + 1} \text{ on } [0, 5].$$

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

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

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7. The total weekly revenue (in dollars) of the Country Workshop realized in manufacturing and selling its rolltop 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. The temperature (in °F) in Boston over a 12-hr period on a certain December day was given by

$$T = -0.05t^3 + 0.4t^2 + 3.8t + 5.6 \quad (0 \leq t \leq 12)$$

where  $t$  is measured in hours, with  $t=0$  corresponding to 6 a.m. Determine the average temperature on that day over the 12-hr period from 6 a.m. to 6 p.m. (10 分)

9. 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)