

# 中原大學 104 學年度碩士班考試入學

104/3/4 8:00 AM~9:30 AM

誠實是我們珍視的美德，  
我們喜愛「拒絕作弊，堅守正直」的你！

企業管理學系商管組；企業管理學系非商管組

科目：微積分

(共 1 頁，第 1 頁)

■可使用計算機(僅限於四則運算、三角函數及對數等基本功能，可程式之功能不可使用)

□不可使用計算機

1. (5%) Find the inverse function of  $f(x) = \sqrt{x^2 + 3}$

2. (10%) Let  $f(x) = x^2 + x + 18$ ;  $g(x) = x^2$ .

(1) Find the function  $\frac{f}{g}$ .

(2) Find the rules for the composite functions  $f \circ g$ .

3. (20%) Find the following limit

(1)  $\lim_{x \rightarrow \infty} \frac{6x^4 - 7x^2}{3x^4 + x^3 + 100x^2 + x}$  (2)  $\lim_{x \rightarrow 1} \frac{3x^2 - 3}{x - 1}$

(3)  $\lim_{x \rightarrow 1} \frac{\sqrt{x^2 + 3}}{3x + 3}$  (4)  $\lim_{x \rightarrow 0} \frac{\sqrt{2x^2 + 4} - 2}{2x^2}$

4. (10%) Find the derivative of the function

(1)  $f(x) = \frac{x^2}{5} + \frac{5}{x^3}$  (2)  $f(x) = \cos^5(x^2 + 1000)$

5. (20%) Evaluate the following integrals if possible

(1)  $\int_0^1 x\sqrt{5x^2 + 4} dx$  (2)  $\int_{-2}^2 e^{\frac{1}{2}x} dx$

(3)  $\int_1^3 \int_1^4 (x + 2y) dx dy$  (4)  $\int_0^{15} \int_0^{20} \frac{40xy}{(x^2 + 20)(y^2 + 36)} dy dx$

6. (10%) The ratio of working-age population to the elderly in the Taiwan (including projections after 2000) is given by

$$f(t) = \begin{cases} 4 & \text{if } 0 \leq t < 10 \\ -0.05t + 4.55 & \text{if } 10 \leq t < 20 \\ -0.085t + 5.07 & \text{if } 20 \leq t < 35 \end{cases}$$

with  $t = 0$  corresponding to the beginning of 1995. What will be the ratio at the beginning of 2006?

7. (10%) Analyze the graph of  $\sqrt{x - 1}$

8. (15%) The population density (number of people per square mile) of a certain city is given by the function

$$f(x, y) = 3000e^{-0.3|x| - 0.1|y|}$$

where the origin  $(0, 0)$  gives the location of the government center. Find the population inside the rectangular area described by

$$R = \{(x, y) | -10 \leq x \leq 10; -30 \leq y \leq 30\}$$