

系級	經濟學系二年級	考試時間	100 分鐘
科目	微積分	本科總分	100 分

請標明題號，並將答案寫在答案紙上，需寫出計算過程。

1. Compute the following limits:

(a) $\lim_{x \rightarrow 4} \frac{\sqrt{x}-2}{x-4}$ (5%)

(b) $\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{n^2+2in+i^2}{n^3}$ (5%)

2. Compute the derivatives of the following functions:

(a) $f(x) = e^{2x}$ (5%)

(b) $g(x) = x^2(3x^2 + 2)^2$ (5%)

(c) $h(x) = \int_{\sin x + \cos x}^{x^2+2} (t^2 - 1) dt$ (5%)

3. Find the absolute extrema of the function $f(x) = \frac{x}{\ln x}$ on $[2,5]$. (10%)

4. Compute the following integrals:

(a) $\int 6x^2(2x^3 + 4)^4 dx$ (5%)

(b) $\int xe^x dx$ (5%)

(c) $\int_1^{\infty} \frac{e^{-\sqrt{x}}}{\sqrt{x}} dx$ (5%)

5. It is found that the Lorenz curve for the distribution of income of college teachers is described by the function

$$f(x) = \frac{3}{4}x^2 + \frac{1}{4}x.$$

Compute the coefficient of inequality for the Lorenz curve (the Gini Index of Lorenz curve). (10%)

6. Find the extrema of the function $f(x,y,z) = x + y + z$ subject to the constrain $z = 2x^2 + 4y^2$. (10%)

7. Evaluate the double integral

$$\iint_{\mathbf{R}} f(x,y) dA$$

for the function $f(x,y) = y^2 e^{xy^2}$ and the region \mathbf{R} bounded by $y = x$, $y = 2x$ and

$y = \frac{1}{x}$. (10%)

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8. Use the fifth Taylor polynomial at $x = 0$ to approximate the area the graph of $f(x) = \ln(1+x)$ from $x = 0$ to $x = 1$. (10%)

9. Determine the relative extrema of the function

$$f(x) = \frac{1}{4}x^4 - \frac{1}{3}x^3 - 3x^2 - 5$$

using the second derivative test. (10%)