

國立臺北大學 110 學年度碩士班一般入學考試試題

系（所）組別：都市計劃研究所甲組

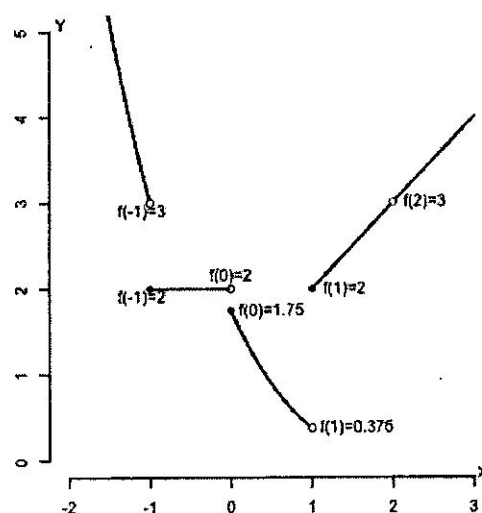
科目：微積分

第1頁 共2頁

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1. (10%) Consider a function $f(x)$ defined as follows:

$$f(x) = \begin{cases} 1.5x^2 - 0.5x + 1 & \text{if } x < -1 \\ 2 & \text{if } -1 \leq x < 0 \\ -\frac{1}{24}x^3 + \frac{3}{4}x^2 - \frac{50}{24}x + \frac{7}{4} & \text{if } 0 \leq x \leq 1 \\ x + 1 & \text{if } 1 \leq x \text{ and } x \neq 2 \end{cases}$$



A. Find the following limit.

- $\lim_{x \rightarrow -1} f(x)$
- $\lim_{x \rightarrow -0.5} f(x)$
- $\lim_{x \rightarrow 0} f(x)$
- $\lim_{x \rightarrow 1.5} f(x)$
- $\lim_{x \rightarrow 2} f(x)$

B. Find the following derivatives.

- $f'(-1)$
- $f'(-0.5)$
- $f'(0)$
- $f'(1.5)$
- $f'(2)$

2. (10%) Suppose the function $f(x) = x^3 + ax^2 + bx + c$ has extreme values at $x = 1, 3$ and $f(-1) = 0$. Find a, b, c .

3. (20%) Evaluate the following limit.

A. $\lim_{x \rightarrow 0} \left(\frac{\sin^2 2x}{x} \right)$

B. $\lim_{x \rightarrow \infty} (\sqrt{4x^2 + x + 1} - 2x)$

試題隨卷繳交

接背面

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4. (20%) Evaluate the following integrals.

A. $\int_0^5 x\sqrt{16-3x} \, dx$

B. $\int x \sin 2x \, dx$

C. $\int \frac{1}{2+e^x} \, dx$

D. $\int \frac{1}{2x^2-3x+1} \, dx$

5. (10%) Find the local extrema of $f(x) = 3x^5 + \frac{15}{4}x^4 - 10x^3$, where $-2 \leq x \leq 3$.

6. (10%) Find the tangent line of $x^4 - 3x^2y + xy^4 = -1$ passing through $(-1,1)$.

7. (10%) Find $\iint_R \frac{\ln y}{x} \, dA$, where $R = \{(x,y) | 0.1 \leq x \leq 1, 0.1 \leq x \leq y\}$.

8. (10%) Find the volume of the solid generated by rotating the region bounded by $y = \cos x$, $x = 0$, $x = \pi/2$ and x axis.

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