

科目：微積分 適用：財金所

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。

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1. Analyze and sketch a graph of the function. Label any intercepts, relative extrema, points of inflection, and asymptotes. (24%)

(a) $f(x) = 3x^4 + 4x^3$.

(b) $f(x) = (x+3) + \frac{9}{x+3}$.

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

2. True or False? Determine whether the statement is true or false. If it is false, explain why or give an example that shows it is false. (15%)

(a) If $\lim_{x \rightarrow c} f(x) = L$ and $f(c) = L$, then f is continuous at c .(b) If $p(x)$ is a polynomial, then the graph of the function given by

$$f(x) = \frac{p(x)}{x-1}$$
 has a vertical asymptote at $x = 1$.

(c) Consider the function $f(x) = \sqrt{x}$. Then $\lim_{x \rightarrow 0.25} \sqrt{x} = 0.5$ and

$$\lim_{x \rightarrow 0} \sqrt{x} = 0.$$

3. Find the limit (if it exists). If it does not exist, explain why. (15%)

(a) $\lim_{\Delta x \rightarrow 0^+} \frac{\frac{1}{x+\Delta x} - \frac{1}{x}}{\Delta x}$.

(b) $\lim_{x \rightarrow 3} (2 - [-x])$, where $[x]$ = greatest integer n such that $n \leq x$.

(c) $\lim_{x \rightarrow 0} \frac{\int_0^{x^3} \sin t^2 dt}{x^9}$.

4. Find the volume of the solid generated by revolving the region

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bounded by the graphs of the equations $y = x^2$, $y = 4x - x^2$ about the given lines (a) the x -axis, (b) the line $y = 6$. (10%)

5. Calculate: (20%)

(a) $\int \frac{1 + \sin x}{1 - \cos x} dx$.

(b) $\int \ln \sqrt{x^2 - 1} dx$.

(c) $\int \frac{x^2 + 2x}{x^3 - x^2 + x - 1} dx$.

(d) $\int \frac{x^3}{\sqrt{4 + x^2}} dx$.

6. Let R be the region bounded by the lines $x - 2y = 0$, $x - 2y = -4$, $x + y = 4$, and $x + y = 1$. (10%)

(a) Find a transformation T from a region S to R such that S is a rectangular region (with sides parallel to the u - or v -axis).

(b) Evaluate the double integral $\iint_R 3xy \, dx \, dy$ by the indicated change of variables in (a).

7. Find the derivative of $y = \frac{(\sin x + 1)^{1/3} (\tan x + 2)^{1/5}}{(\sec x + 3)^{1/7}}$. (6%)