

科目：微積分

適用：經濟系二

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. **(30%)** Find the derivative of the following functions:
 - a. $y = (3 - e^{-4x})^3$
 - b. $f(x) = 5(x^4 - x)^7$
 - c. $g(x) = \ln \left| \frac{(5x+3)^6}{(4x+2)^9(8x+9)} \right|$

2. **(20%)** The total weekly revenue (in dollars) of the company realized in manufacturing and selling its rolltop desks is given by $R(x, y) = -0.2x^2 - 0.25y^2 - 0.2xy + 224x + 180y$ 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 $C(x, y) = 120x + 80y + 2000$ 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 (P) realizable?

3. **(15%)** The present value of a perpetual stream of income that flows continually at the rate of $p(t)$ dollars per year is given by the formula $PV = \int_0^{\infty} p(t)e^{-rt} dt$ where r is the interest rate compounded continuously. Using this formula, find the present value of a perpetual net income stream that is generated at the rate of $p(t) = 30000 + 2000t$ dollars per year.

4. **(20%)** Find the indefinite integral.
 - a. $\int xe^{8x} dx$
 - b. $\int x^8(2x^9 - 1)^6 dx$

5. **(15%)** Find the second-order partial derivatives of the function $f(x, y) = x^4y - xy^3$. Show that the mixed partial derivatives f_{xy} and f_{yx} are equal.

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