

# 東吳大學 101 學年度碩士班研究生招生考試試題

第 1 頁，共 2 頁

系級	企業管理學系碩士班 C 組	考試時間	100 分鐘
科目	微積分	本科總分	100 分

每題 10 分，指數值、對數值如果無法算出，可保留指數項、對數項至最精簡處。

1. A factory installs new machinery that saves  $S(x) = 1200 - 20x$  dollars per year, where  $x$  is the number of years since installation. However, the cost of maintaining the new machinery is  $C(x) = 100x$  dollars per year.
  - a. Find the year  $x$  when the new machinery should be replaced.
  - b. Find the accumulated net saving during the period from  $t = 0$  to the replacement time found in part (a).
  
2. A cube of ice is melting so that the edge is decreasing at the rate of 2 inches per hour. Find how fast the volume of the ice is decreasing at the moment when each edge is 10 inches long.
  
3. The following headlines appeared recently in the *New York Times*. For each headline, sketch a curve representing the type of growth described and indicate the correct signs of the first and second derivatives.
  - a. Consumer Prices Rose in October at a Slower Rate.
  - b. Households Still Shrinking, but Rate Is Slower.
  
4. An oil-producing country can sell 1 million barrels of oil a day at a price of \$120 per barrel. If each \$1 price increase will result in a sales decrease of 10,000 barrels per day, what price will maximize the country's revenue? How many barrels will it sell at that price?
  
5. If the original concentration of a drug in a patient's bloodstream is  $c$  (mgs per liter),  $t$  hours later the concentration will be  $C(t) = ce^{-kt}$ , where  $k$  is the absorption constant. If the original concentration of the asthma medication theophylline is  $c = 20$  and the absorption constant  $k = 0.23$ , when should the drug be readministered so that the concentration does not fall below the minimum effective concentration of 5?
  
6. An oral medication is absorbed into the bloodstream at the rate of  $5e^{-0.04t}$  milligrams per minutes, where  $t$  is the number of minutes since the medication was taken. Find the total amount of medication was absorbed within the first 30 minutes.
  
7. A party can raise campaign funds at the rate of  $50te^{-0.1t}$  million dollars per week during the first  $t$  weeks of a campaign. Find the average amount raised during the first 5 weeks.
  
8. A factory installs new equipment that is expected to generate saving at the rate of  $800e^{-0.2t}$  dollars per year, where  $t$  is the number of years that the equipment has been in operation. If the equipment originally cost \$2000, when will it "pay for itself"?

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第 2 頁，共 2 頁

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科目	微積分	本科總分	100 分

9. Suppose that for a group of 10,000 people, the number who survive to age  $x$  is  $N(x) = 1000\sqrt{100-x}$ . Find  $N'(96)$  and interpret your answer.
10. A nursing home uses two vitamin supplements, and the nutritional value of  $x$  ounces of the first together with  $y$  ounces of the second is  $4x + 2xy + 8y$ . The first costs \$2 per ounce, the second costs \$1 per ounce, and the nursing home can spend only \$8 per patient per day. Use Lagrange multipliers to find how much of each supplement should be to maximize the nutritional value subject to the budget constraint.