

所別： 產業經濟研究所 碩士班 產經組(一般生)

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科目： 經濟學

\*本科考試可使用計算器，廠牌、功能不拘

計算或說明題。請列出詳細計算或說明否則不予計分。

1. **Geometric series, 40 points.** Consider the following series:

$$\sum_{i=1}^n e^{-ix} = e^{-x} + e^{-2x} + \dots + e^{-nx}$$

where  $x > 0$ .

- Simplify the above geometric series. (Hint:  $\sum_{i=0}^{n-1} e^{-ix} = \frac{1-e^{-nx}}{1-e^{-x}}$ .)
- Find the limit of the above series when  $n \rightarrow +\infty$ .
- How does the limit of this series change with  $x$ ? Explain.
- Evaluate your answer in part (b) when  $x \rightarrow 0$  and when  $x \rightarrow +\infty$ . Plot your results.

2. **Market concentration, 40 points.** According to the National Communications Commission (NCC), the number of mobile network subscribers in August 2020 is distributed as follows. In this exercise, please round all numbers to two decimal places.

| Operator             | Number of subscribers |
|----------------------|-----------------------|
| ChungHwa Telecom     | 10,555,342            |
| Far EastOne Telecom  | 7,050,283             |
| Taiwan Star Telecom  | 2,425,267             |
| Taiwan Mobile        | 7,089,905             |
| Asia Pacific Telecom | 2,035,230             |

- Find the market share of every firm.
- Find the 4-firm concentration ratio, defined as the sum of market shares of 4 largest firms.
- Find the Herfindahl-Hirschman Index, which is the sum squares of all firms' market shares.
- Is the market concentrated? Explain your answer.

注意：背面有試題

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3. Advertising intensity, 20 points. Consider the following advertising formula,

$$\frac{A}{pQ} = \frac{\varepsilon_A}{\varepsilon_D}$$

where  $A$ ,  $p$ , and  $Q$  stands for advertising dollars, price, and output, respectively. In this context,

$\varepsilon_A = \frac{\partial Q}{\partial A} \frac{A}{Q}$  ( $\varepsilon_D = -\frac{\partial Q}{\partial p} \frac{p}{Q}$ ) represents the advertising (price, respectively) elasticity of demand.

- (a) Does the firm advertise more or less when demand is more responsive to advertising?
- (b) Does the firm advertise more or less when demand becomes more sensitive to price?

注意：背面有試題