

## **MATH29599 Calculus – Assignment 2**

Due Date: Monday Feb 13, 8:00AM

Type: Individual Assignment

### **Instructions:**

- Answer the questions below, showing all relevant work and the methods used to obtain your results.
- Submit your answers on SLATE by the due date specified.
- Answers may only be submitted in the following formats:
  - Microsoft Word Document (.docx)
  - Adobe PDF Document (.pdf)
  - MatLab MuPAD notebook (.mn)
- Do not submit external links.
- This is an individual assignment. Assignments copied in whole or in part will receive a grade of ZERO.

### **Questions:**

1. (6 marks) George Orwell's 1984 is currently a top selling book on amazon:  
<http://money.cnn.com/2017/01/25/media/george-orwell-1984-best-seller/>  
One of the editions of 1984 that typically sells 50 copies a day is normally priced at \$11.99, but is now being discounted to increase sales. The assumption is that for every \$1.00 that the price is reduced an additional 16 copies will be sold per day. The cost of producing this edition of 1984 is about \$4.75 per copy.
  - a) Determine the revenue function  $R(x)$  for this edition of 1984, where  $x$  is the discount in price.
  - b) Determine the optimal price that maximizes revenue by finding the critical points of  $R(x)$ .
  - c) Use Matlab to plot  $R(x)$  from  $-3 \leq x \leq 10$ .
  - d) Determine the profit function  $P(x)$  for this edition of 1984, where  $x$  is the discount in price.
  - e) Determine the optimal price that maximizes profit by finding the critical points of  $P(x)$ .
  - f) Use Matlab to plot  $P(x)$  from  $-3 \leq x \leq 10$ .
  
2. (4 marks) Suppose you are investing in a stock with three other artificial investors (AI#1, AI#2, AI#3) and you know the algorithm that each of them will use. If you invest an amount  $x$  between \$100 and \$30000:  
AI#1 will invest \$500 plus half of the amount you invested.  
AI#2 will invest \$30000 minus the amount that you invested.  
AI#3 will invest 0.02% of AI#1's investment multiplied by AI#2's investment.
  - a) Determine the investment function  $F(x)$  that predicts the total amount invested by all investors, including the amount  $x$  that you invested.
  - b) Determine the optimal investment  $x_0$  that maximizes the total amount invested by finding the critical points of  $F(x)$ .
  - c) Show that  $x_0$  is a maximum using the second derivative test.
  - d) Use Matlab to plot  $F(x)$  from  $100 \leq x \leq 30000$ .