

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 $100 \leq x \leq 30000$.