

MTH U131 Quiz 6 review

This quiz requires the TI 83/84. Always tell which function is in  $Y_1$ ,  $Y_2$ , etc. in your calculator.

1. Fred's band makes and sells CD's. By conducting a marketing poll they have found how to model the demand function for CDs.

Let  $x$  stand for the selling price in dollars of a CD. If  $8 \leq x \leq 20$ , the demand function  $D(x)$  can be modelled by the logistic function:

$$D(x) = \frac{1063}{1 + .012e^{0.355x}}$$

Enter this formula carefully into  $Y_1$  on your calculator. Check that you have entered the formula correctly by computing the demand if  $x = 13$ . Your answer should be 480.592312.

- a) Each CD costs Fred's band \$3.20 to make and the band has fixed costs of \$230, write down the formulas for  $R(x)$ ,  $C(x)$ , and  $P(x)$  (the revenue, cost and profit functions in dollars). Write each formula out in full. Do not use any abbreviations.

$$R(x) = D(x) \cdot x = 1063x / (1 + .012e^{.355x})$$

$$C(x) = 3.2 D(x) + 230 = (3.2)(1063x)(1 + 0.012e^{0.355x})^{-1} + 230$$

$$P(x) = R(x) - C(x)$$

- b) Use  $nDeriv$  to determine the price that maximizes REVENUE. Write the answer with all the decimal places the calculator gives.

calculator answer: 9.8723534

Circle the equation you solved:

(i)  $nDeriv(R(x), x, x) = R(x)$

(ii)  $nDeriv(R(x), x, x) = 0$

(iii)  $nDeriv(D(x), x, x) = 0$

(iv)  $nDeriv(P(x), x, x) = 0$

(v)  $nDeriv(R'(x), x, x) = 0$

Circle the calculator procedure you used:

(i) 2nd/Calc/Zero

(ii) 2nd/Calc/Intersect

(iii) SOLVER

*Each may be used*

- c) Show by comparing function values that the price you found in part (b) maximizes the revenue.

$$R(9.8) = 7499.24$$

$$R(9.9) = 7499.84$$

$$R(9.8723534) = 7499.95$$

*Since R(*

*This Data is consistent with R(x) having its Max. revenue at x = 9.8723534.*

d) Round the selling price from part (b) to the nearest penny and fill in the following table with the values when REVENUE is maximized (put unit in the second line). Note that demand must be a whole number.

Selling Price	Demand	Revenue	Cost	Profit
\$ 9.87	760	\$7501.20	\$2661.59	\$4838.35
\$	CD's	\$	\$	\$

f) Use *nDeriv* to determine the price that maximizes PROFIT. Show your work especially any equations you solve and tell how you use the calculator. Write the answer with all the decimal places the calculator gives.

calculator answer: 10.905728658

$$\text{Solve } P'(x) = 0$$

g) Use the second derivative test to show that the answer in part (f) maximizes the profit.

$$P''(10.905728) = -239.4 < 0 \quad \therefore \text{The Graph is concave down and Concave Down and This is consistent with } P(x) \text{ being a Max. at } x = 10.906$$

2. Use your calculator to approximate the  $x$ -coordinate of the inflection point on the graph of  $f(x) = \frac{x^2}{2x}$ ,  $x = 10.906$

over the interval (1, 10). Use the fact that  $f'(x) = \frac{(2x - x^2 \ln(2))}{2x}$ .

Show your work especially any equations you solve and tell how you use the calculator. Give all the decimal places that the calculator gives:

Calculator Answer: 4.925669124

We are looking for a sign change in  $f''(x)$ . Let  $Y_1 = f'(x)$  and

Solve  $Y_2 = 0$  and verify by looking at  $Y_2 = \text{nDeriv}(Y_1, x, x)$

The graph of  $Y_2$  that  $Y_2 = f''(x)$  changes sign at this solution.

Sketch the graph of  $f(x)$  over the interval (1, 10) and label the inflection point. Use the graph to decide if the inflection point is a (circle one):

point of fastest increase

point of slowest increase

point of fastest decrease

point of slowest decrease

Window settings  $X_{min} = 1$ ,  $X_{max} = 10$ ,  $Y_{min} = -0.5$ ,  $Y_{max} = 2$ .

GRAPH: 2

