Name: _____   Date: _____

Section 5.2 Example 3 Use Technology

Tools
• TI-Nspire™ CAS Graphing Calculator

Example 3   Maximize Revenue

Trevor sells hot dogs for $2.00 each from his cart at the beach. He currently sells an average of 120 hot dogs per day. If he increases the price, he will earn more per hot dog but may lose sales due to the increased price. He decides to gradually increase the price in steps of 10¢, and keep track of the effect on sales. Trevor's records are shown.

Price ($)	Average Daily Sales (hot dogs)
2.0	120
2.10	117
2.20	114
2.30	111
2.40	108
2.50	105
2.60	102
2.70	99

a) Calculate the average daily revenue from hot dog sales.
b) Calculate the first and second differences for the daily revenue. What do the first differences tell you? What do the second differences tell you?
c) Use technology to fit a quadratic relation to the price and revenue data. What is the equation that models the data?
d) Determine if the revenue will continue to increase as the price increases or if it will reach a maximum and then decrease. If the revenue does reach a maximum, determine the price that results in this maximum.

Solution
a) The revenue is determined by multiplying the price of each hot dog by the number of hot dogs sold.

Price ($)	Average Daily Sales (hot dogs)	Revenue ($)
2.00	120	240.00
2.10	117	245.70
2.20	114	250.80
2.30	111	255.30
2.40	108	259.20
2.50	105	262.50
2.60	102	265.20
2.70	99	267.30

b)

Price ($)	Revenue ($)	First Differences	Second Differences
2.00	240.00		
		5.70	
2.10	245.70		−0.60
		5.10	
2.20	250.80		−0.60
		4.50	
2.30	255.30		−0.60
		3.90	
2.40	259.20		−0.60
		3.30	
2.50	262.50		−0.60
		2.70	
2.60	265.20		−0.60
		1.90	
2.70	267.30		

c) Open a **Lists & Spreadsheet** page.
  • Enter the price and revenue data from the table.
  • Open a **Graphs & Geometry** page.
    Plot the price and revenue data as a scatter plot.
  • Return to the **Lists & Spreadsheet** page and press (menu).
  • Select **4: Statistics**, and then, **1: Stat Calculations**.
  • Select **6: Quadratic Regression**.
  • Select **price_dol** for the **X List,** and **revenue_dol**
    for the **Y List**.
  • Tab down and select **OK**.

The quadratic equation of best fit will be displayed.
The equation of best fit is $y = -30x^2 + 180x$.

d) Return to the **Graphs & Geometry** page.
  • Set the graph type back to **1:Function**.
  The regression equation will be displayed as *f1*.

  This graph reaches a maximum, and then, decreases.
  • Press (menu), and select **6: Points & Lines**. Select **2: Point On**.
  • Move the cursor to the curve. Press (enter) to plot a point on **f1**.
  • Press (esc) to deselect the point plotting tool.
  • Move the cursor over the point until the hand appears.
    Press and hold (🖘) until the hand closes to grab the point.
  • Drag the point to determine where the line crosses the horizontal axis.
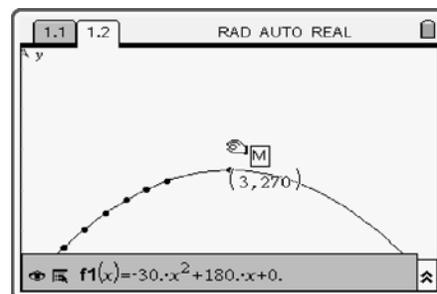
The text **maximum** or an "M" in a box will appear, along with coordinates, when the point reaches
the maximum on the curve.
The maximum revenue of $270.00 occurs at a price of $3.00 per hot dog.