Chapter 2: Graphical and Tabular Analysis

E. Smith

MAT 1020
Section 2.1 & Section 2.2: Using the Calculator to Help

Section 2.1 & 2.2 Key Ideas

- Tables with your calculator
- Limiting values
- Graphing with your calculator
- Graph options: evaluate, solve, zeros, locate maximum’s and minimum’s
Example 1: Create a table of values for \( f(t) = 12e^{-0.02t} + 15 \) for \( t \)'s between 0 and 100 with the entries increasing by 10 each time.

Steps:
1. Press the “Y=” button and input the function
2. Now, click “2ND”, then press then window key, scroll down to where it says “\( \Delta \text{Tbl}=1 \)” and replace it with 10.
3. Finally, press “2ND” again and select the “GRAPH” button near the top.
Limiting Value:
• **Limiting Value:** Informally, the limit is the value that the function approaches as the input values become very large in both the negative and positive direction. We write it using the following notation:

\[
\lim_{x \to \pm \infty} f(x) = b, \quad \text{(assuming the limit is not infinity)}
\]
Example 2: Does the function \( f(t) = 12e^{-0.02t} + 15 \) have a limiting value? If so, what is the limiting value of the given function?
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Let’s use the calculator to evaluate.
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Let’s use the calculator to evaluate.

1. Enter the function into “Y=” on the calculator.
2. Now create a table in the calculator starting at zero and increasing by increments of 100. HINT: Follow the previous steps for creating a table.
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<table>
<thead>
<tr>
<th>( t )</th>
<th>0</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(t) )</td>
<td>27</td>
<td>16.624</td>
<td>15.22</td>
<td>15.03</td>
<td>15.004</td>
<td>15.001</td>
<td>15</td>
</tr>
</tbody>
</table>
Example 3: Astronauts looking at Earth from a spacecraft can see only a portion of the surface. The fraction $F$ of the surface of Earth that is visible at a height of $h$, in kilometers above the surface is given by the formula $F = \frac{0.5h}{R+h}$. Here $R$ is the radius of the earth, about 6380 kilometers.
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1. Make a table for the function $F(h)$ covering heights up to 500,000 kilometers.
2. Does $F(h)$ have a limiting value? If so, what is this limiting value? Explain in practical terms what your answer means.
Example 4: A potato is placed in a preheated oven to bake. Its temperature $P = P(t)$ is given by $P = 400 - 325e^{-t/50}$, where $P$ is measured in Fahrenheit and $t$ is the time in minutes since the potato was placed in the oven.
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2. Use your calculator’s graphics feature to determine what the potato’s temperature is 17 minutes after it is put into the oven.
3. Use your calculator’s graphics features to determine at what time the potato is 270° \( F \).
Example 5: One class of models for population growth rates in marine fisheries is given by

\[ G = 0.3n \left(1 - \frac{n}{2}\right) - 0.1n. \]

Here \( G \) is the growth rate of the population, in millions of tons of fish per year, and \( n \) is the population size, in millions of tons of fish. We are interested in studying population sizes up to 1.5 million tons.
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4. Select “ZERO”.
5. Choose a value a little to the left and a little to the right, then a little in the middle and press “ENTER”.

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Example 6: The profit $P$, in thousands of dollars, that a manufacturer makes is a function of the number $N$, of items produced in a year and is given by the formula $P = -0.2N^2 + 3.6N - 9$. The manufacturer can produce at most 20 items per year.
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1. Create a good graph of $P(N)$. 

We say the manufacturer is breaking even when his profit is equal to 0 (so he's not making money, but he's not losing money either). At what production level(s) is the manufacturer breaking even?

At what production level is the manufacturer making the maximum profit?

What is the minimum profit the manufacturer could make during the year? At what production level would he be making this minimum profit?
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