It Is Not the Same Old Graphics Calculator!

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Graphing Inequalities Using the “Inequalz” Apps on TI-83Plus Silver Calculator

Problem:
A craftsman makes wooden toy cars and trucks. He wants to make at least 2 cars and 2 trucks but no more than 5 trucks. He can make a total of 15 toys in his spare time in a month. At craft fairs, he makes a profit of $8 per car and $10 per truck sold. Tell him what to make to maximize his profit.

Let \( x \) = number of cars
Let \( y \) = number of trucks

Constraints
\[
\begin{align*}
x &\geq 2 \\
y &\geq 2 \\
y &\leq 5 \\
x + y &\leq 15
\end{align*}
\]

Objective function:
\[ P = 8x + 10y \]

Go to the Apps key, press the down arrow:

Rewrite the inequality \( x + y \leq 15 \) for \( y \) in terms of \( x \): \( y \leq -x + 15 \)

Enter three of the inequalities in the Y= screen. To make the equal sign change to the less than or equal to sign, press the green Alpha key (row 3, column 1) and the ZOOM key (these are called the soft keys). To choose any of the “soft keys” (keys which appear on the calculator screen) in this APPS, use the green Alpha key (row 3, column 1).
To input $x \geq 2$, go to the x in top left corner of the screen; press Enter (row 10, column 5):

Notice that x’s appear where there were y’s!

Input the x constraint. Remember to use the Alpha key when you choose the greater than or equal to “soft key”.

Go to the Window key (row 1, column 2) and input the following values:

Higher numbers on Shade Res provides less shading. Press Graph key (row 1, column 5)

Choose “Shades” by pressing green Alpha key and Y= key (row 1, column 1)
Choose 1: Ineq Intersection

Use the Alpha key and the Zoom key to find a point of intersection.

Store this point to lists named INEQX, INEQY by pressing the STO key (row 9, column 1)

Move the arrow keys to select another point of intersection. Store it, by pressing the STO key.

Move the arrow keys to select another point of intersection; store it. Do this until all four points of intersection are collected.

Go to Stat key (row 3, column 3), Choose Edit from the first menu, press Enter. Notice that all four corner points are in the lists INEQX and INEQY.
Input the objective function $P = 8x + 10y$ on the home screen but replace the $x$ with the list INEQX and the $y$ with the list INEQY. Type 8 on the home screen; go to 2nd List key (row 3, column 3), choose INEQX from the list. Repeat the process put “+ 10” on the home screen, then input the list INEQY.

The most profit of $130$ dollars comes from the second ordered pair in the list, namely, $(10, 5)$, that is, the craftsman should make 10 cars and 5 trucks to make a profit of $130.00$.

The objective function could be calculated in a list. The solution would be in the same row as the maximum profit of 130.

When finished with INEQUALZ APPS, go to the Apps, choose INEQUALZ, choose 2 to quit the application.
Graphing Function Using the "Transfrm" Apps on TI-83Plus Silver Calculator

Press the APPS key (row 4, column 2)

Go to the y= screen and input $Ax^2 + Bx + C$.

Notice the "liberty bells" to the left of Y1, Y2, etc.

Go to Windows, notice that there is a second drop down menu titled SETTINGS.

Push the up arrow and you will be able to set your parameters, A, B, C. Presently, A, B and C are set to 1. Change the step to 0.5

Press the Graph key. A is highlighted. Press the right arrow to increase A; left arrow to decrease A by .5. Notice that when A=0, the line with slope 1 and y-intercept 1 is graphed.

Move the down arrow to change the values for B; then the left and right arrow keys to increment the B values by .5. You could also just type in a value for B.
Change the $B = 1; C = -6$, press Trace key, type 2, notice you see one of the x intercepts.

Change $A$ to $A = -1$, $B = -1$, $C = 6$; notice that the x-intercepts stay the same.

Press Window and go to the SETTINGS. The second icon will slowly animate whichever parameter is highlighted; the third icon will quickly animate whichever parameter is highlighted.

To uninstall, go to APPS,
Measure length of five items using the metric and the English system. Record the data in a table.

<table>
<thead>
<tr>
<th>Item</th>
<th>Centimeters</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

1. Do you see any relationships between the two measures?

2. Plot the information collected using inches along the horizontal axis and centimeters along the vertical axis.
Measuring UP

Suppose these are the lengths of five items using the metric and the English system.

<table>
<thead>
<tr>
<th>Item</th>
<th>Centimeters</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>pen</td>
<td>16.0</td>
<td>6.25</td>
</tr>
<tr>
<td>Calc. screen width</td>
<td>6.3</td>
<td>2.5</td>
</tr>
<tr>
<td>Screen height</td>
<td>3.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Paper width</td>
<td>21.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Paper height</td>
<td>27.8</td>
<td>11</td>
</tr>
</tbody>
</table>

Work sheet attached at end of document.

Plot the information collected using inches along the horizontal axis and centimeters along the vertical axis.

What is a reasonable window to show the problem domain?

A linear model appears to be appropriate for this problem.

Let's use the Transfrm APP to explore the equation of the line and to approximate the slope and the intercept. Use the APPS key and select the Transfrm application. You may have different applications on your calculator.
Use Enter to start the application and any key to continue.

Note the change in the Y= screen. The left most symbol indicates that the graphs can be changed dynamically.

The graph screen shows the variables A and B. Only one can be varied at a time. Use the up-down cursor keys to switch variables. Use the right-left cursor to step the variables up or down by the step amount. Of course you can change the value of the highlighted variable by typing its value on the keyboard.

Note that the Window screen has an additional option, SETTINGS. We will explore this later.

First, change the window to more closely match the problem domain.
Use the up cursor to get to the SETTINGS. Note that the variables that show are those that are in the active function. Please note

1. That only the variables A, B, C, D can be varied in the Transfrm APP.
2. Only one equation on the Y= screen can be graphed.
3. If you want to show another equation on the graph you must use the DrawF command. The drawn function is lost when the value of a variable is changed.

The option >|| allows the user to change values interactively from the graph screen. The > and >> options allow slow and fast animation by playing a series of graph screens. We can explore this in other examples.

On the graph screen the up; down cursor keys allow selection of the variable to be modified.

While the intercept B = 0 looks good, the slope, A needs to be modified. Exploration shows that the step =.5 is too large.

Return to the window screen change step = .1

Return to the Graph screen and explore.
The precision of the process is controlled by the Step and is limited by the screen resolution.

We can explore the calculated values by returning to the List Edit screen, STAT Edit and creating a new list, L3 defined by \( L3 = Y1(L1) \) an error list could be calculated in \( L4 = L3 - L2 \) on a single error list \( L3 = Y1(L1) - L2 \)

Use the linear regression function to calculate a least square fit to check the results of the exploration.

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Other examples that can be explored interactively with the Transfrm APP are:
Exponential Decay - Temperature data
Linear – Fahrenheit vs. Celsius temperature
Quadratic - BallDrop Data
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