

Linear programming with vertical lines: converting $x = c$ to $y = mx + c$

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Select GRAPH mode from the main menu by using the arrow keys to highlight the GRAPH icon or pressing 5.



Introduction

Open the GRAPH-window, and make sure that the V-Window is appropriate to see the graphs that you will be drawing.

SHIFT **F3** Select **F1**, in this case for INITIAL conditions.



Now, the **EXIT** or **EXE** key to go back to the *Graph Func* window.

Vertical lines $x = c$, found by menu trail:

F3 for **TYPE** then **F4** for $x = c$ formatting.

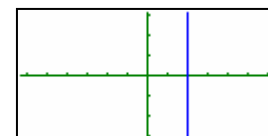
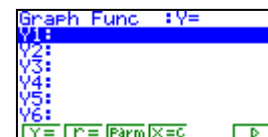
Example: Draw the graphs of $x = 2$

Answer: Enter into the **GRAPH** icon

Press

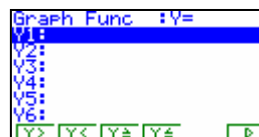
Type in '2' and then **EXE**

F6 to draw.



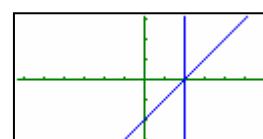
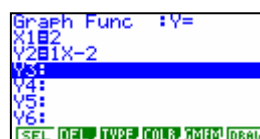
In linear programming usually the inequalities are required to find the 'feasible region' that satisfies the constraints given. You are not able to draw inequalities with $x \geq$ or $<$ or $>$ or \leq on the graphic calculator.

The menu trail for inequalities is: **F3** **F6**



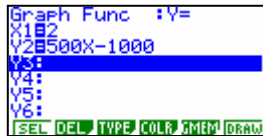
So, you need to 'trick' the calculator into thinking that it is drawing a vertical line but in the $y = mx + c$ format.

Type into the 'Y2' space ' $1x - 2$ ' and then **F6** to draw.

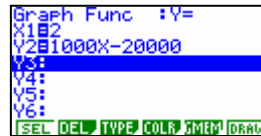


What do you notice?

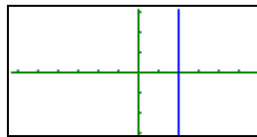
Now try



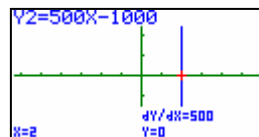
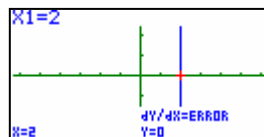
or



They both produce a 'vertical line' very similar to $x = 2$ over this Viewing window.



But, you have essentially tricked the calculator into drawing a 'vertical line'. You can check that they are NOT the same by doing a Trace – **SHIFT** **F1** and using the up / down arrows to trace either $x = 2$ and $y = 1000x - 2000$ (or similar).



Problem: Find the feasible region that satisfies the following constraints over the domain $0 \leq x \leq 25$ and range $0 \leq y \leq 25$:

$$x + y \leq 15 \quad y \geq 6 \quad 4x + y \leq 24 \quad x \geq 2 \quad y \geq 2x$$

Rearranging to make y the 'subject' gives:

$$y \leq 15 - x \quad y \geq 6 \quad y \leq 24 - 4x \quad x \geq 2 \quad y \geq 2x$$

becomes $y \leq 1000x - 2000$

The V-window **SHIFT** **F3** becomes:



Enter in the constraints and **F6** to draw them.



To find the intersection points (vertices) of the lines that intersect, use **G-Solve** **SHIFT** **F5** and then **F5** for **ISCT** (intersection), selecting two lines at a time and generating the 5 intersection points.

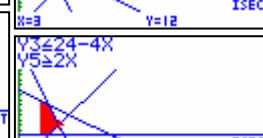
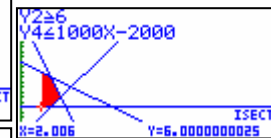
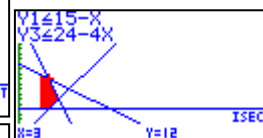
Y1 and Y4 gives (2 , 13)

Y1 and Y3 gives (3 , 12)

Y4 and Y2 gives (2 , 6)

Y2 and Y5 gives (3 , 6)

Y3 and Y5 gives (4 , 8)



[N.B. Some interpretation is required if the substitution line for $x = c$ is not 'extremely' vertical on the region the constraints are drawn.]