Chapter 4 / **Example 7**

Modelling with linear functions

Siria reads her English textbook at a pace of 2 minutes per page and her Biology textbook at 3 minutes per page. She has two hours available to read.

a Write an equation that shows the relationship between the number of pages of English (x) and of Biology (y) that Siria can read in this time. Define all the variables.

b **i** Find the x- and y-intercepts of the graph of your equation.

ii Use these to sketch a graph of the equation.

iii Interpret each intercept in the context of the problem.

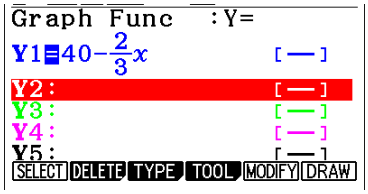
c Siria ends up reading 45 pages in total. Determine how many pages of English and of Biology she read.

The equation is $2x + 3y = 120$. Change this to gradient-intercept form $y = 40 - \frac{2}{3}x$.

Press [MENU] 5 [GRAPH] to display the equation entry screen.

Type $40 - \frac{2}{3}x$ and press [EXE] to enter the first equation as Y1.

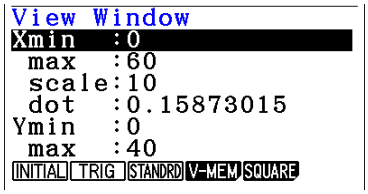
Press [▣] to use the fraction template.



Use the intercepts $(0, 40)$ and $(60, 0)$ to make suitable axes to display the graph.

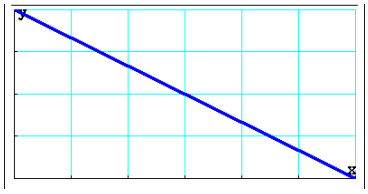
Press [SHIFT] [F3] V-WIN and set the axes so that $0 \leq x \leq 60$ and $0 \leq y \leq 40$ with scales of 10.

Press [EXIT] when you have finished.



Press [F6] DRAW to display the graph screen.

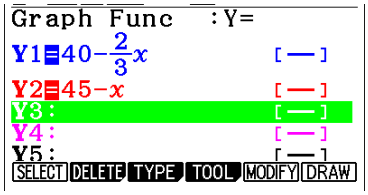
The GDC now displays $y = 40 - \frac{2}{3}x$ in a suitable window.



You now need to plot the line $x + y = 45$ on the same axes and find the intersection point. Change this to gradient-intercept form $y = 45 - x$.

Press [EXIT] to return to the equation entry screen.

Type $45 - x$ and press [EXE] to enter the equation as Y2.



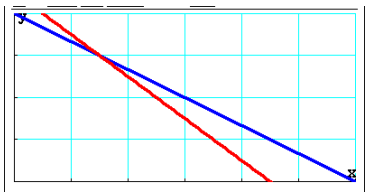
Chapter 4 / **Example 7**

Modelling with linear functions

Press [F6] DRAW. The GDC now displays both graphs:

$Y1 = 40 - \frac{2}{3}x$

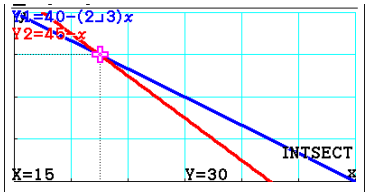
$Y2 = 45 - x$



To find the intersection press [F5] G-Solv [F5] Intersect.

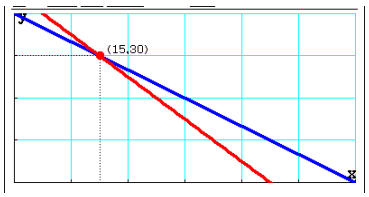
Press [EXE] to display the coordinates.

Press [EXIT] to leave G-Solv mode and [F6] DRAW to display the graph screen again.



The GDC displays the intersection of the two lines at $(15, 30)$.

Siria read 15 pages of English and 30 pages of Biology.



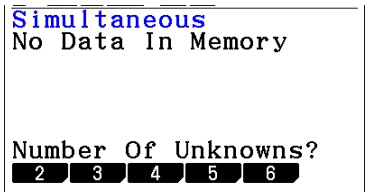
The alternative method is to solve the simultaneous equations

$\begin{cases} 2x + 3y = 120 \\ x + y = 45 \end{cases}$

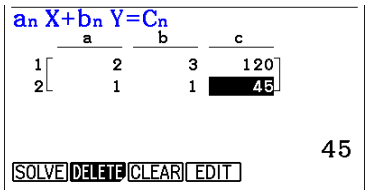
Press [MENU] A [EQUA] to enter equation mode.

Press [F1] Simultaneous.

There are 2 unknowns so press [F1] 2.



Enter to coefficients 2, 3, 120 and 1, 1, 45 into the matrix.



Press [F1] SOLVE.

The calculator displays the solution $x = 15$ and $y = 30$.

Siria read 15 pages of English and 30 pages of Biology.