

## Chapter 4 / Example 2

# Modelling with functions

Raquel invests \$1200 in a savings account whose value increases over time. The future value,  $V$ , of the account is a function of the time  $t$  (in years) invested, represented by the equation  $V(t) = 1200 \times (1.03)^t$  for  $0 \leq t \leq 50$ .

- a Find
  - i  $V(0)$
  - ii  $V(50)$
 Interpret each of these in context.
- b If Raquel keeps her money invested for 50 years, determine how much she will earn on her initial \$1200.
- c Sketch a graph of the function  $V$  for  $0 \leq t \leq 50$ .
- d If Raquel invests her money in 2015, determine the year when the value of her account will reach \$2500.

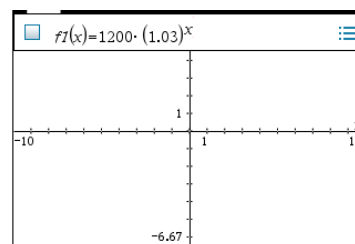
Open a new document and add a Graphs page.

The entry line is displayed at the top of the work area.

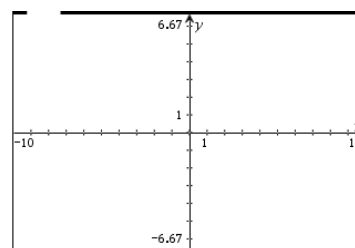
The default graph type is function, so ' $f1(x)=$ ' is displayed.

The default axes are  $-10 \leq x \leq 10$  and  $-6.67 \leq y \leq 6.67$ .

Type  $1200 \times (1.03)^x$  and press **enter**.



The GDC displays the graph  $f1(x) = 1200 \times (1.03)^x$  with the default axes, but there is nothing to be seen with these scales.

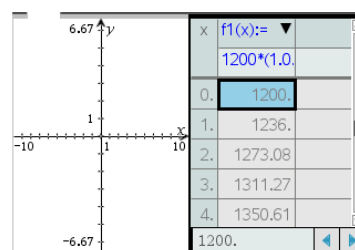


To get a better idea of the best window to view the graph in, it is helpful to use a table of values. Press **ctrl** **T**.

A table of values is displayed alongside the graph.

You can scroll through the table using **▲** and **▼** on the touchpad.

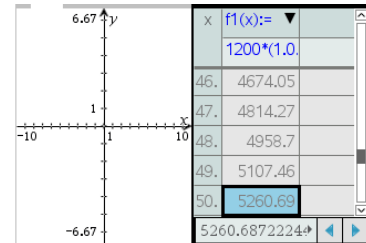
From the table, you can see that the graph can see that the curve will cross the  $y$ -axis at  $(0, 1200)$ .



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Scroll down with  $\blacktriangledown$  until you get to  $x = 50$ . The maximum value of  $Y_1$  is 5260.



Use this information to choose suitable window settings to display the graph.

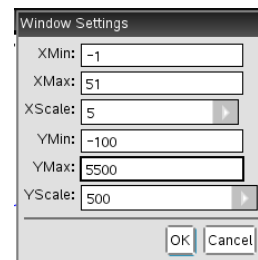
Press  $\text{ctrl}$   $\text{T}$  again to remove the table.

Press  $\text{menu}$  4:Window/Zoom | 1:Window Settings...

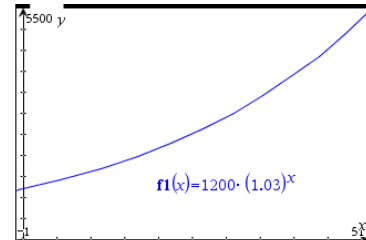
Set the axes to show  $-1 \leq x \leq 51$  with a scale of 5 and  $-100 \leq y \leq 5500$  with a scale of 500.

Press  $\text{enter}$  when you have finished.

It is advisable to set the window values just outside those needed.



The GDC displays the graph of the value of Raquel's savings in a suitable window.



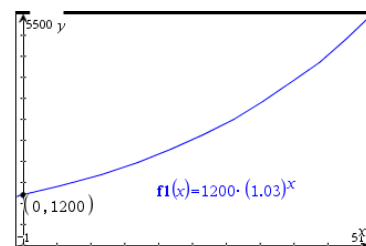
To find the value of  $V(0)$  press  $\text{menu}$  5:Trace | 1:Graph Trace.

Press  $\text{0}$   $\text{enter}$  to change the  $x$  coordinate to 0.

Press  $\text{enter}$  again and then press  $\text{esc}$  to leave the graph trace mode.

The GDC displays the coordinates of the  $y$ -intercept  $(0, 1200)$ .

Raquel invested \$1200 initially.



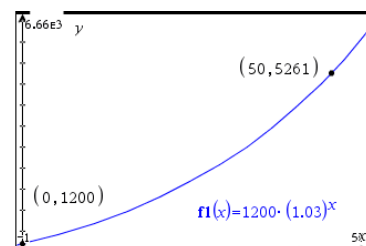
Press  $\text{menu}$  5:Trace | 1:Graph Trace.

Press  $\text{0}$   $\text{enter}$  to change the  $x$  coordinate to 0.

Press  $\text{enter}$  again and then press  $\text{esc}$  to leave the graph trace mode.

The GDC displays the coordinates of the  $y$ -intercept  $(50, 5260)$ .

Raquel will have \$5260 in the account after 50 years.

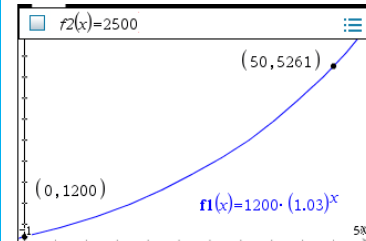


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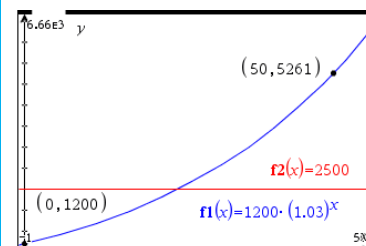
# Modelling with functions

Press **tab** to display the entry line again. This time ' $f2(x)=$ ' is displayed.

Type 2500 and press **enter**.



The GDC displays  $f1(x) = 1200 \times (1.03)^t$  and  $f2(x) = 2500$ .

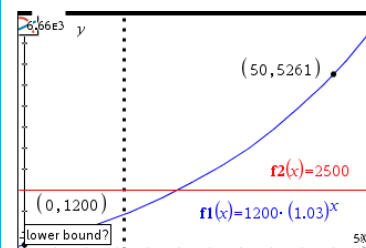


Press **menu** 6:Analyse Graph | 4:Intersection.

To find the intersection you need to give the lower and upper bounds of the region that includes the intersection.

The GDC shows a line and asks you to set the lower bound. Move the line using the touchpad and choose a position to the left of the intersection.

Click the touchpad.

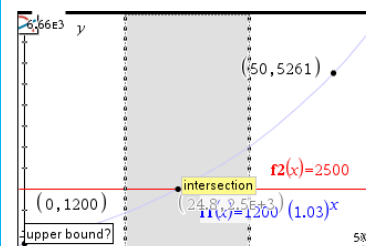


The GDC shows another line and asks you to set the upper bound.

Use the touchpad to move the line so that the region between the lower and upper bounds contains the intersection.

When the region contains the intersection, the calculator will display the word 'intersection' in a box.

Click the touchpad.



The GDC displays the intersection of the two straight lines at the point  $(24.8, 2500)$ .

Raquel's account will reach a value of \$2500 during the year 2039.

