

Chapter 4 / Example 8

Piecewise functions

Consider the piecewise function

$$h(t) = \begin{cases} \frac{1}{30}t & 0 \leq t \leq 315 \\ 15 - \frac{1}{70}t & t \geq 315 \end{cases}$$

- Sketch the graph of the function.
Suppose that $h(t)$ is modelling the height h (in centimetres) of water in a bathtub as a function of time t (in seconds).
- Give a possible explanation for what happens at $t = 315$.
- Find the number of minutes until the bathtub is empty.
- Hence, write down a practical domain for $h(t)$.

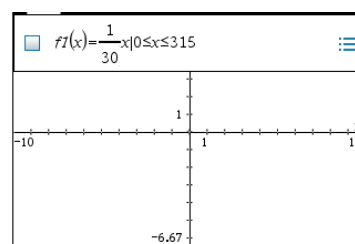
Open a new document and add a Graphs page.

The entry line ' $f1(x)=$ ' is displayed at the top of the work area.

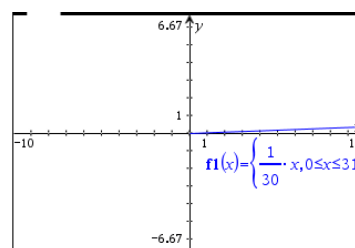
Type the function $\frac{1}{30}x \mid 0 \leq x \leq 315$ and press **enter**.

| and \leq can both be found by pressing **ctrl** **=** ($\frac{1}{2}$) and choosing the symbols.

Use the fraction template **ctrl** **=** ($\frac{1}{2}$).



The function is displayed with the default axes, $-10 \leq x \leq 10$ and $-6.67 \leq y \leq 6.67$.

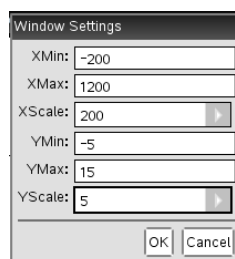


To view the curves in a suitable window Press

menu 4:Window/Zoom | 1:Window Settings...

Set the axes to show $-200 \leq x \leq 1200$ with a scale of 200 and $-5 \leq y \leq 15$ with a scale of 5.

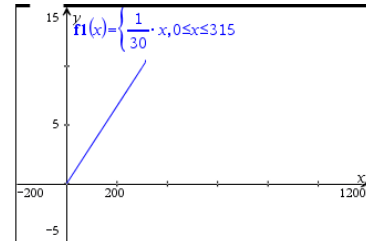
Press **enter** when you have finished.



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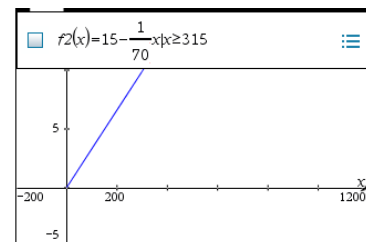
Piecewise functions

The GDC displays the curve $f1(x) = \frac{1}{30}x$ in a suitable window.



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

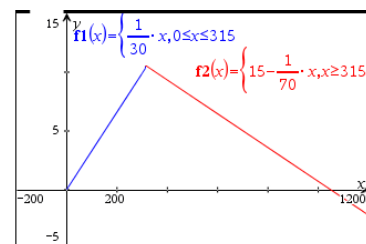
Type $15 - \frac{1}{70}x \mid x \geq 315$ and press **enter**.



The GDC now displays both graphs:

$$f1(x) = \frac{1}{30}x$$

$$f2(x) = 15 - \frac{1}{70}x$$

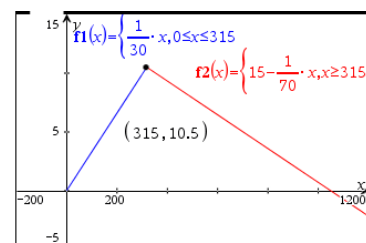


Because the graphs are not continuous at the point of where they join, the intersection function will not work.

To find the value of $f1(x)$ when x is 315 press **menu** 5:Trace | 1:Graph Trace.

Type 315 and press **enter**. Press **enter** again and press **esc**.

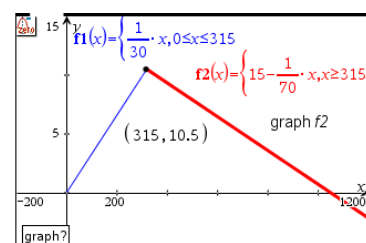
The GDC displays the coordinates of the point (315,10.5).



To find the zero of $f2(x) = 15 - \frac{1}{70}x$ press **menu** 6:Analyse

Graph | 1:Zero

Select graph $f2$ with the touchpad.



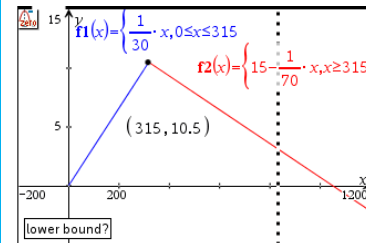
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You will need to give the lower and upper bounds of the region that includes the zero.

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 zero.

Click the touchpad.

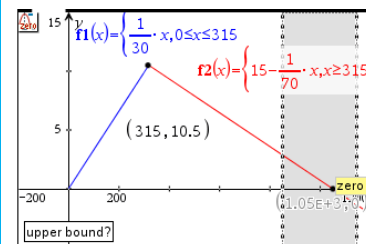


The GDC shows another line and asks you to set the upper bound.

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

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

Click the touchpad.



The GDC displays a zero at $(1050, 0)$.

The bathtub is empty in 17.5 minutes.

Hence the domain is $0 \leq t \leq 1050$.

