

## Chapter 4 / Example 7

# Reciprocal functions

Chas and Dev are planning to print their sports team logo on baseball caps, and sell the caps. They have to hire a printing machine, which costs \$500, and it will cost them an additional \$5 for every cap to be bought and printed.

- Develop a model which links the number of caps they produce with average cost, per cap, they incur.
- Use your GDC to determine how many caps must be printed and sold if they are to sell the caps at \$7 per cap and just break even.

Let the number of caps produced be  $x$ , and the average cost incurred, per cap, be  $y$ , then  $y = \frac{500 + 5x}{x}$ .

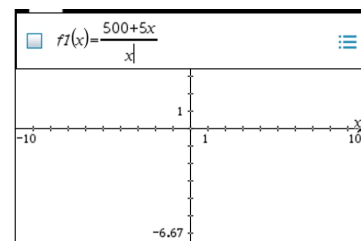
Open a new document and add a Graphs page.

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  $-6.67 \leq y \leq 6.67$ .

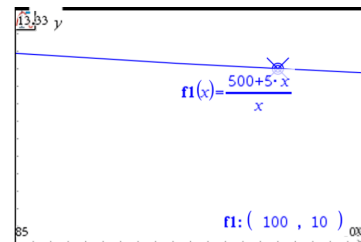
Type  $\frac{500 + 5x}{x}$ , using  $\boxed{\text{ctrl}} \boxed{\div}$  ( $\frac{\square}{\square}$ ) to enter the rational function, and press  $\boxed{\text{enter}}$ .



With the default axes, nothing will be displayed. To get an idea of the scale needed to show the function you can make use of the trace function.

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

Type in 100 and press  $\boxed{\text{enter}}$ .



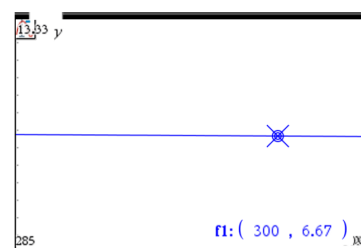
Clearly, if you need to see  $y = 7$  then you will need a larger value of  $x$  than 100.

Type in 300 and press  $\boxed{\text{enter}}$ .

This shows that 300 is a large enough value of  $x$ .

Press  $\boxed{\text{esc}}$  to exit trace.

For a suitable  $y$  value try 30.



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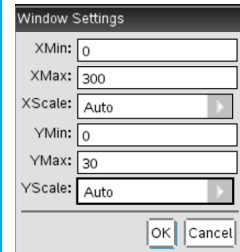
Using these values for  $x$  and  $y$  and showing only positive values

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

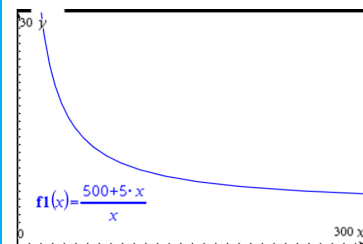
Set the axes to show  $0 \leq x \leq 300$  and  $0 \leq y \leq 30$

You can leave the scales set to Auto.

Press **enter** when you have finished.



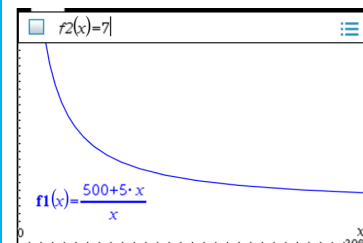
The GDC now displays  $y = \frac{500+5x}{x}$  in a suitable window.



You now need to Plot the line  $y = 7$  on the same axes and find the intersection point.

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

Type 7 and press **enter**.

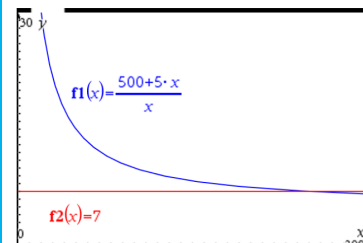


The GDC now displays both graphs:

$$f1(x) = \frac{500+5x}{x}$$

$$f2(x) = 7$$

with suitable axes.

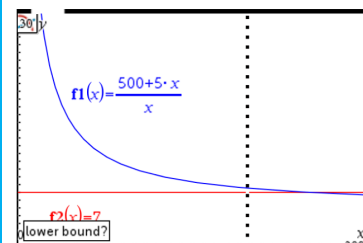


Press **menu** 6:Analyse Graph | 4:Intersection

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.



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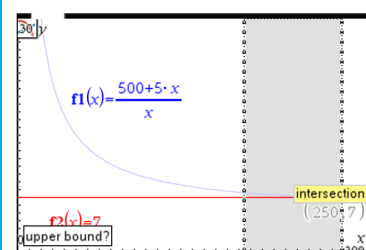
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The GDC shows another line and asks you to set the upper bound.

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 curve and the straight line at the point (250,7)

Chas and Dev must produce 250 caps to break even.

