Functions and calculators	Season Episode Time frame	1 AP06 1 period

Prerequisites : None.

Objectives :
- Discover how to use a calculator to obtain the table of values of a function.
- Discover how to use a calculator to graph a function.

Materials :
- *Calculator.*
- *Slideshow.*
- *Texas and Casio Emulator.*

1 – Instruction 10 mins

Using a slideshow or a calculator emulator, the teacher explains how to obtain the table of values of a function and how to graph it. Students are handed out a paper with the explanation for their own calculator.

2 – Practice Remaining time

Working alone with their calculator, students have to fill out an exercise sheet.

Functions and calculators	Season Episode Document	01 AP06 TI

Let f be the function define over $\mathbf{R}$ by $f(x) = x^2 + 1$.

Table of values

To get the table of values of f for x from -5 to 5 with step 1 by 1, follow the steps below.

- Press [Y=] and input the expression of f.
- Go to Tblset with [2nd] [WINDOW] and input the first value and the step (Δ Tbl) of the table.
- Show the table with [2nd] [GRAPH].

You should get the following table.

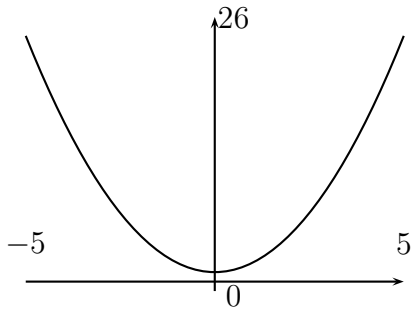
x	-5	-4	-3	-2	-1	0	1	2	3	4	5
$f(x)$	26	17	10	5	2	1	2	5	10	17	26

Graph of a function

The most difficult part of displaying a graph is to choose the right view window. To do so, you can use the Zoom options provided by your calculator. Another method is to look up in the table of values the minimum and maximum for the x values and for the y values, and set up the window accordingly. This is the method that is described below.

- Press [Y=] and input the expression of f (done for the table of values).
- Press [WINDOW] and set the appropriate values for X_{min}, X_{max}, Y_{min}, Y_{max}.
- Show the graph with [GRAPH].

Check that you get this graph.



Functions and calculators	Season	01
	Episode	AP06
	Document	Casio

Let f be the function define over $\mathbf{R}$ by $f(x) = x^2 + 1$.

Table of values

To get the table of values of f for x from -5 to 5 with step 1 by 1, follow the steps below.

- Choose the TABLE menu and input the expression of f.
- Go to the range page with F5 and input the first value, the last value and the pitch.
- Exit and show the table with Exit F6

Check that you get this table.

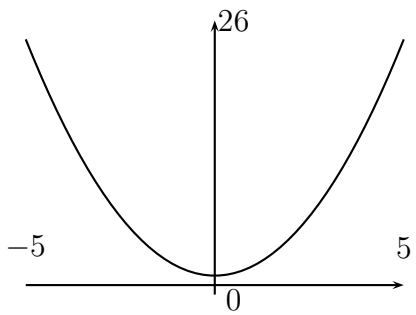
x	-5	-4	-3	-2	-1	0	1	2	3	4	5
$f(x)$	26	17	10	5	2	1	2	5	10	17	26

Graph of a function

The most difficult part of displaying a graph is to choose the right view window. To do so, you can use the Zoom options provided by your calculator. Another method is to look up in the table of values the minimum and maximum for the x values and for the y values, and set up the window accordingly. This is the method that is described below.

- Choose the GRAPH menu and input the expression of f.
- Set the table with V-Window and set the value for X_{min}, X_{max}, Y_{min}, Y_{max} according to the table of values.
- Draw the graph with F4

Check that you get this graph.



Functions and calculators	Season Episode Document	01 AP06 Exercises

1

1. Let f_1 be the function defined over $\mathbf{R}$ by $f_1 : x \mapsto -x^2 + 3x + 1$.
   (a) Fill out the table below :

x	-4	-3	-2	-1	0	1	2	3	4
$f_1(x)$									

   (b) Deduce from the table of values the best parameters for the view window :

Xmin		Xmax		Ymin		Ymax	

   (c) Draw a quick sketch of the graph in the space below :

2. Let f_2 be the function defined over $\mathbf{R}$ by $f_2 : x \mapsto x^3 - 15$.
   (a) Fill out the table below :

x	-5	-4.5									
$f_2(x)$											
x											5
$f_2(x)$											

   (b) Deduce from the table of values the best parameters for the view window :

Xmin		Xmax		Ymin		Ymax	

   (c) Draw a quick sketch of the graph in the space below :

2 Let g be the function defined by $g(x) = x^2 - x - 1$.

1. (a) Fill out the following table of value :

x	0	1	2	3	4	5	6	7
$g(x)$								

   (b) Between what values is the solution of the equation $g(x) = 0$?

2. (a) Build the table of value of g between 1 and 2 with a pitch of 0.1. Copy it below.

x											
$g(x)$											

   (b) Deduce an approximation at 1 DP of the solution of the equation $g(x) = 0$.

3. Use the same process to give an approximate value at 4 DP of the solution of the equation $g(x) = 0$.

3 For each function, give the values that define the best fit window and do a quick sketch of the graph.

$f_3(x) = x^5 + 32$ over $[-2; 2]$

Xmin		Ymin	
Xmax		Ymax	

$f_4(x) = \dfrac{1}{1 + x^2}$ over $[-4; 4]$

Xmin		Ymin	
Xmax		Ymax	

$f_5(x) = (4x + 1)^3(4x - 9) + 10$ over $[-2; 3]$

Xmin		Ymin	
Xmax		Ymax	

$f_6(x) = \dfrac{x-5}{100}$ over $[0;5]$

Xmin		Ymin	
Xmax		Ymax	

$\boxed{4}$ Let f and g be two functions defined over $\mathbf{R}$ by $f(x) = \dfrac{x^3-2x}{x^2+1}$ et $g(x) = 0.5x$. The aim of this exercise is to get an approximation of the coordinates of the intersection points of the graphs of f and g.

1. On your calculator, display the graphs of the two functions over the interval $[-5;5]$. Draw a quick graph of the screen below.
2. Use TRACE to read the coordinates of the intersection points of the graph of f and g.
3. Solve the equation $f(x) = g(x)$ to check the result.

$\boxed{5}$ Let g be the function defined by $g : x \longmapsto 5x^3 - 0.1x + 0.005$.

1. Draw with your calculator the graph $\mathcal{C}_g$ of this function in a standard window (the minimum on each axis must be -10 and the maximum 10).
2. How many times does $\mathcal{C}_g$ seem to pass through the x-axis ? What does it mean about the equation $g(x) = 0$?
3. Give approximate values of the solutions to the previous equation. For each of these solutions check that $f(x) = 0$.
4. Set the minimum and maximum on each axis respectively to -1 and 1.
5. How many times does $\mathcal{C}_g$ seem to pass through the x-axis ? What does it mean about the equation $g(x) = 0$?
6. Give approximate values of the solutions to the previous equation. For each of these solutions check that $f(x) = 0$.
7. Set the x-axis from -0.2 to 0.2 and the y-axis from -0.1 to 0.1.
8. How many times does $\mathcal{C}_g$ seem to pass through the x-axis ? What does it mean about the equation $g(x) = 0$?
9. Give approximate values of the solutions to the previous equation. For each of these solutions check that $f(x) = 0$.

6

1. Let f_1 be the function defined over $\mathbf{R}$ by $f_1 : x \mapsto -x^2 + 3x + 1$.

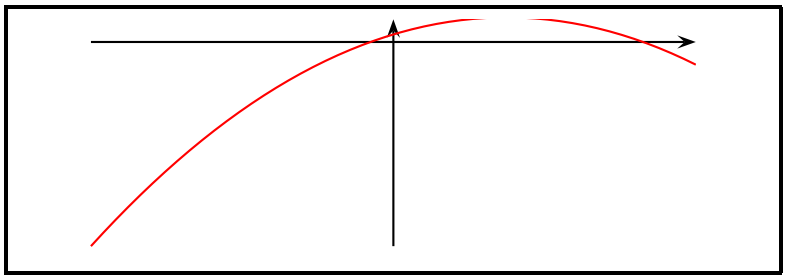
   (a) Fill out the table below :

x	-4	-3	-2	-1	0	1	2	3	4
$f_1(x)$	-27	-17	-9	-3	1	3	3	1	-3

   (b) Deduce from the table of values the best parameters for the view window :

Xmin	-4	Xmax	4	Ymin	-27	Ymax	3

   (c) Draw a quick sketch of the graph in the space below :



2. Let f_2 be the function defined over $\mathbf{R}$ by $f_2 : x \mapsto x^3 - 15$.

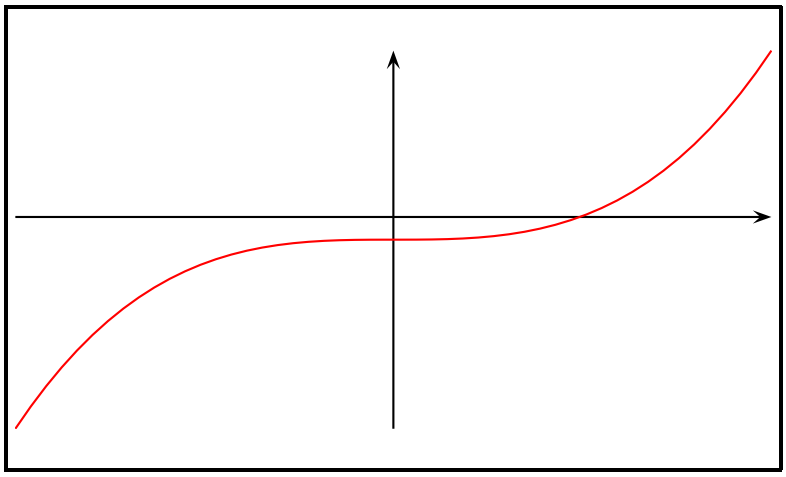
   (a) Fill out the table below :

x	-5	-4.5	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0
$f_2(x)$	-140	106.1	-79	57.9	-42	30.6	-23	18.4	-16	15.1	-15
x	0.5	1	1.5	2	2.5	3	3.5	4	4.5		5
$f_2(x)$	-14.9	-14	-11.6	-7	0.6	12	27.9	49	76.1		110

   (a) Deduce from the table of values the best parameters for the view window :

Xmin	-5	Xmax	5	Ymin	-140	Ymax	110

   (b) Draw a quick sketch of the graph in the space below :



7 Let g be the function defined by $g(x) = x^2 - x - 1$.

1. (a) Fill out the following table of value :

x	0	1	2	3	4	5	6	7
$g(x)$	-1	-1	1	5	11	19	29	41

   (b) Between what values is the solution of the equation $g(x) = 0$?

   between 1 and 2

2. (a) Build the table of value of g between 1 and 2 with a pitch of 0.1. Copy it below.

x	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
$g(x)$	-1	-0.89	-0.76	0.61	-0.44	-0.25	-0.4	0.19	0.44	0.71	1

   (b) Deduce an approximation at 1 DP of the solution of the equation $g(x) = 0$.

   between 1.6 and 1.7

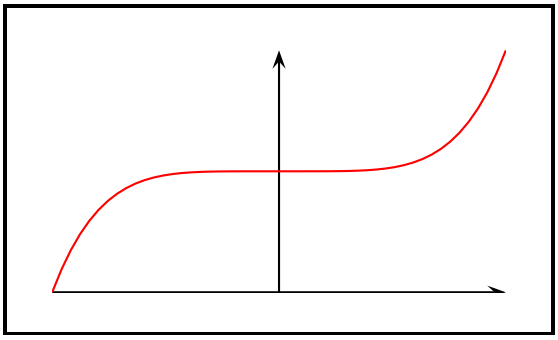
3. Use the same process to give an approximate value at 4 DP of the solution of the equation $g(x) = 0$.

   1.6180

8 For each function, give the values that define the best fit window and do a quick sketch of the graph.

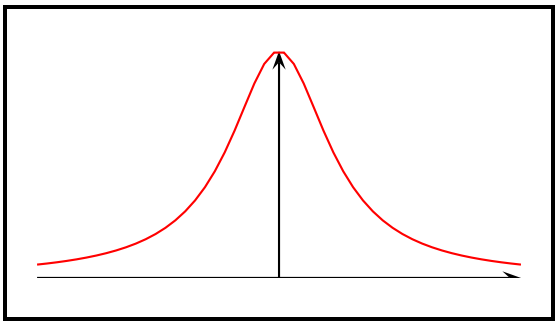
$f_3(x) = x^5 + 32$ over $[-2; 2]$

Xmin	-2	Ymin	0
Xmax	2	Ymax	64



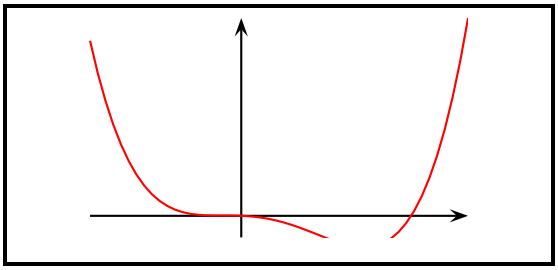
$f_4(x) = \dfrac{1}{1+x^2}$ over $[-4; 4]$

Xmin	-4	Ymin	0
Xmax	4	Ymax	1



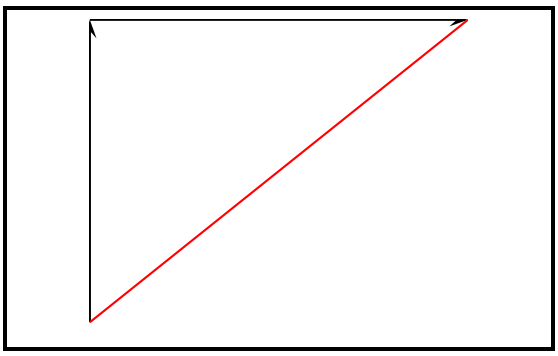
$f_5(x) = (4x+1)^3(4x-9) + 10$ over $[-2; 3]$

Xmin	-2	Ymin	-719
Xmax	3	Ymax	6601



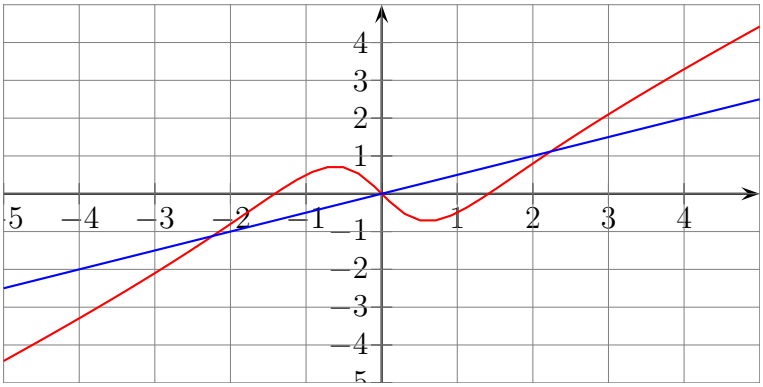
$f_6(x) = \dfrac{x-5}{100}$ over $[0;5]$

Xmin	0	Ymin	-0.05
Xmax	5	Ymax	0



$\boxed{9}$ Let f and g be two functions defined over $\mathbf{R}$ by $f(x) = \dfrac{x^3-2x}{x^2+1}$ et $g(x) = 0.5x$. The aim of this exercise is to get an approximation of the coordinates of the intersection points of the graphs of f and g.

1. On your calculator, display the graphs of the two functions over the interval $[-5;5]$. Draw a quick graph of the screen below.



2. Use TRACE to read the coordinates of the intersection points of the graph of f and g.

The coordinates of the intersection points seem to be

$$(-2,-1) \qquad (0,0) \qquad (2,1)$$

3. Solve the equation $f(x) = g(x)$ to check the result.

$$\begin{aligned}
f(x) &= g(x) \\
\frac{x^3-2x}{x^2+1} &= 0.5x \\
x^3-2x &= 0.5x(x^2+1) \\
x^3-0.5x^3-2x-0.5x &= 0 \\
x(0.5x^2-2.5) &= 0 \\
x=0 \quad OU \quad & x^2-5=0 \\
x=0 \quad OU \quad & x=\pm\sqrt{5}
\end{aligned}$$

$\boxed{10}$ Let g be the function defined by $g : x \longmapsto 5x^3 - 0.1x + 0.005$.

1. Draw with your calculator the graph $\mathcal{C}_g$ of this function in a standard window (the minimum on each axis must be -10 and the maximum 10).
2. How many times does $\mathcal{C}_g$ seem to pass through the x-axis ? What does it mean about the equation $g(x) = 0$?
3. Give approximate values of the solutions to the previous equation. For each of these solutions check that $f(x) = 0$.
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