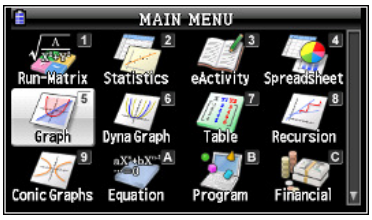
Investigating Graphs

This resource sheet is designed for use with the Casio fx-CG20. However it can be used with the Casio fx-9860GII or the Casio fx-9750GII although there may be some differences in the key sequences needed and in the screen displays.

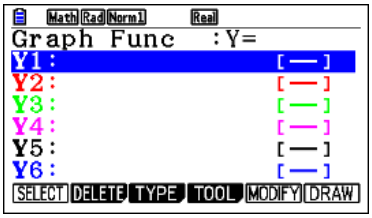
Aim

This activity will show you how the calculator can be used to display graphs. You will be exploring how to enter functions, change the range settings as well as learning about the trace, zoom and G-Solve functions. The investigations are designed to help students explore some features of quadratics and how the graphics calculator can be used to explore transformations.

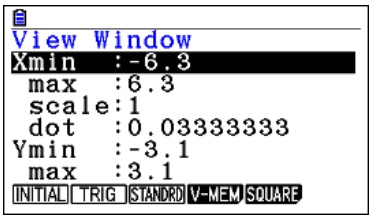
Set your calculator to GRAPH mode. Press [MENU] [5]



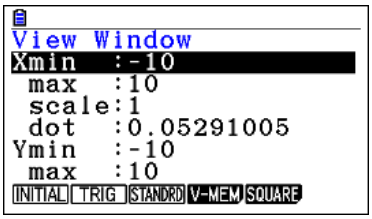
Clear all the entries before you start by selecting each function using the cursor and pressing [DEL] [F1]



Set the range of axes by using the viewing window (which is labelled V-Window). Press [SHIFT] [F3]



Set the range to 'standard' by pressing [F3]. This sets the range to -10 to +10 with a scale marked every 1 unit on both axes. You can set the ranges manually if you wish using the cursor keys to move up and down and [EXE] to store each setting. [EXIT] will return you to the Table screen.



Hint: You can store and recall up to 6 viewing window settings using [F4] to Store and [F5] to recall.

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You can now enter a function for Y1. Use the [X,θ,T] key to enter the variable, x and remember to press [EXE] to store your function when you are happy with it.

Try entering Y1= $x^2 + x - 2$

To view the graph select 'DRAW' on the mini menu by pressing [F6] which you can use to toggle between the graph and the function table screens.

You can find the coordinates of any point on the graph by using the TRACE function.
When in the graph screen, press [F1]. The x and y coordinates will appear at the bottom of the screen and you can move the cursor using the left and right cursor key. Pressing [EXE] at any point fixes a point and displays its coordinates.

The accuracy of the TRACE function depends on the scale you are using. To improve accuracy you can use the Zoom function.
When in the graph screen, press [SHIFT] [F2].

You can zoom in or out by a factor of 2 using [SHIFT] [F3] or [SHIFT] [F4] and moving the cursor to the point you are focussing on.

Press [EXE] to complete the zoom.

You can then use Trace again to get a more accurate set of coordinates.

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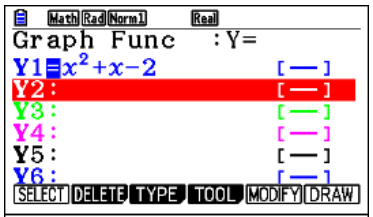

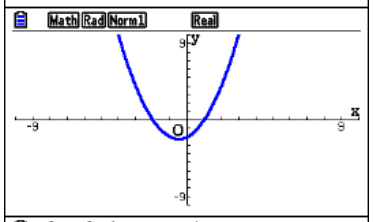

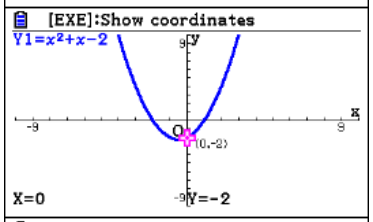

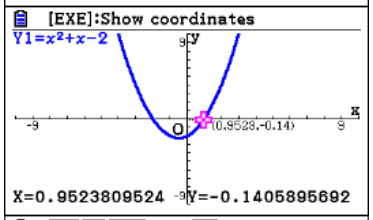

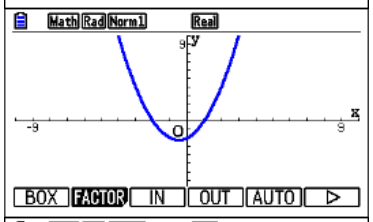

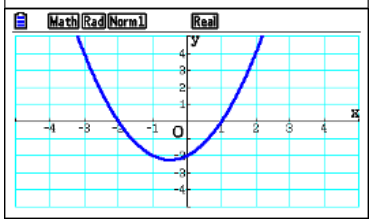

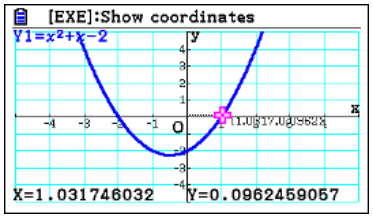

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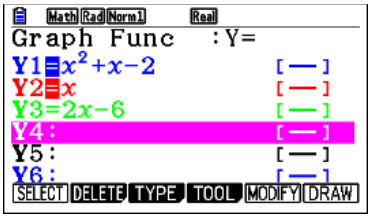
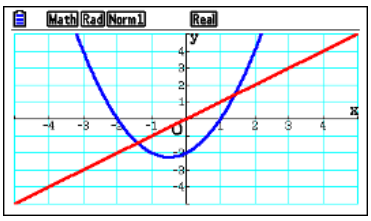
You can enter a number of functions into the calculator. In the function table window, you can select or deselect a function using F1.

Only the selected functions will display on the graph screen. You can always see which have been selected because they will have a highlighted '=' sign.



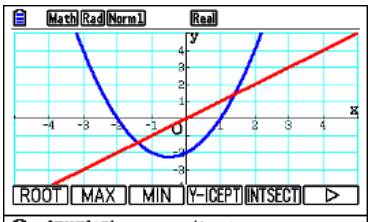


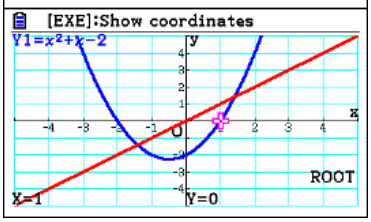
Hint

The 'trace' function is not very accurate. You could, of course, use 'zoom' and then trace on a larger scale graph, but the accuracy still depends on pixel size. To get a more accurate reading you could use 'G-Solve'.

With the graph displayed, press SHIFT F5 to get G-Solv.

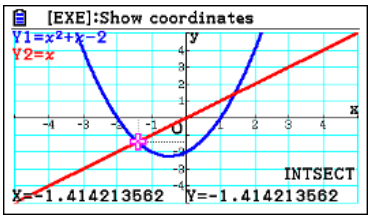
The mini menu bar now gives a selection of possible values to explore. To find the roots, press F1. You can select the graph that you are interested in by using the up or down cursor buttons and pressing EXE. Select each root using the left and right cursor buttons.





G-Solv can also be used to find maxima and minima, y intercepts, whilst the ISCT option allows you to find the point where two graphs intersect.

Pressing F6 offers options to find x or y values at particular points or areas under the graph.



You should now feel confident using the graphing facility on the calculator. Here are some investigations that will encourage your students to find out how the graphing functions of the graphics calculator can be used to explore features of quadratic functions.

Investigating Graphs

Some investigations:

Investigation 1

Explore quadratic functions of the form $y = ax^2 + bx + c$

- Describe the changes to the graph as 'a' is changed.
- What aspect of the graph is determined by the constant 'c'?
- What happens to the graph when 'a' is negative?

Investigation 2

$b^2 - 4ac$ is called the discriminant.

Make up a quadratic function where b^2 is equal to 4ac. Plot the graph. What do you notice about the graph? Is this always the case? Try other quadratic functions where b^2 is equal to 4ac and check.

- What happens when the discriminant is positive?
- What happens when the discriminant is negative? What does this mean about the roots of the equation?

Investigation 3

Plot $f(x) = x^2 + 3x + 4$ on your calculator.

Plot $f(x+2) = (x + 2)2 + 3(x + 2) + 4$. What do you notice?

Explore what happens to the graph $f(x + a)$ as you vary 'a'.

Does this also work for cubics? Does it work for any function?

What about $f(2x)$? Is this different to $2f(x)$? Can you explain why?