

Integration

CASIO®

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 to graph Integral functions on the calculator. It will show you how you can use the calculator to calculate areas under graphs. There is also an investigation for students to further explore these ideas.

Set your calculator to Graph mode. Press **MENU** **5**

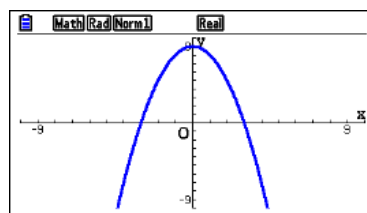
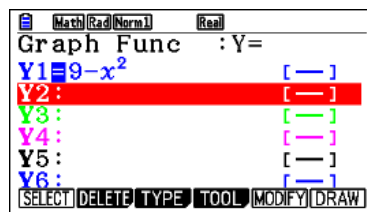
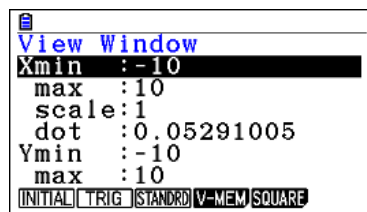
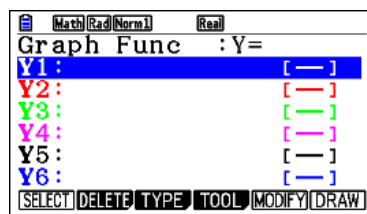
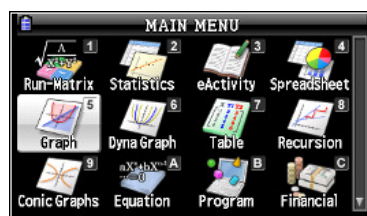
Delete any existing functions by selecting DELETE on the mini menu bar using **F2** **F1**.

You can set the range of the axes by using the viewing window (which is labelled V-Window). Press **SHIFT** **F3**

Set the range to the standard setting **F3** with -10 to +10 with a scale of 1 on both axes. Press **EXIT** to return to the List screen

Enter the function $y = 9 - x^2$ into the table. Press **EXE**

Then press Draw **F5** on the mini menu bar to draw the graph



Integration

To find the value of $\int_0^{+3} 9 - x^2 dx$ we can use the 'G-Solve' function.

In the graph screen, press G-Solv **SHIFT** **F5**

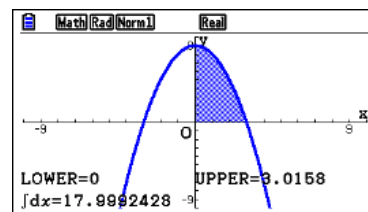
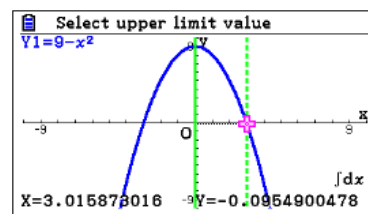
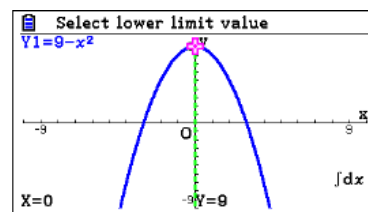
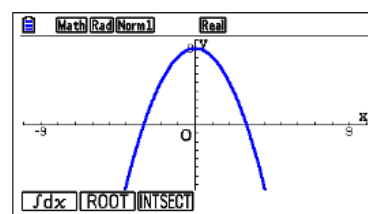
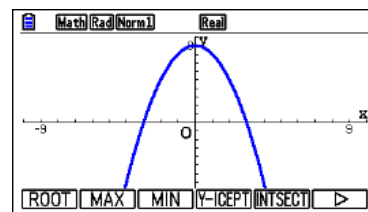
Press **F6** to get more options and select $\int dx$ **F3** and then $\int dx$ **F1**

The screen now displays the graph and is waiting for you to set the lower limit of the integration.

This can be done by moving the cursor using the right and left scroll keys and then 'fixing' the lower limit by pressing **EXE**

Do the same to fix the upper limit.

Press **EXE** to display the area under the graph and the value of the integration.



Integration



You can also find numerical values of integrals in RUN mode.

Go to the menu and choose RUN

Go to 'Set up' using **SHIFT** **MENU** and scroll to Input/output and select 'Math' using **F1** on the mini menu bar.

Press **EXE** to get back to the RUN screen

Select MATH using **F4**

Press **F6** to get more options and select $\int dx$ **F1**

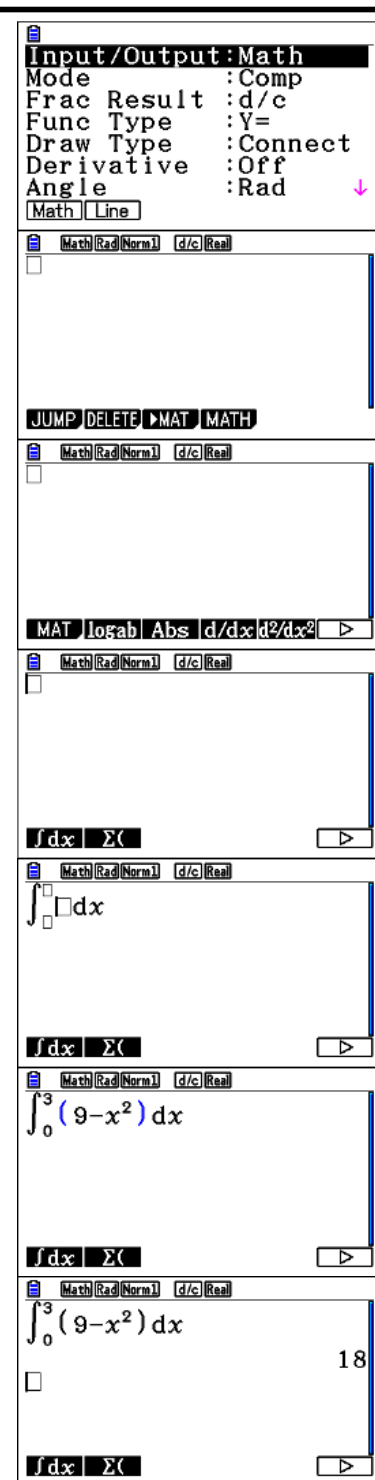
Enter the values for $\int_0^{+3} 9 - x^2 dx$ using the cursor keys to navigate between the function to be integrated and the limits.

Press **EXE** to show the result.

You will see that the calculator has now calculated the value of the integral which is 18

Question

What do you think the value of $\int_{-3}^{+3} 9 - x^2 dx$ will be? Check your answer by drawing the graph in the same way as before.



Integration

Hint

On the fx-CG20 you can also plot graphs in RUN mode

Set your calculator to RUN mode. Press **MENU** **1**

Go to 'Set up' using **SHIFT** **MENU** and scroll to Input/output and select 'Linear' using **F2** on the mini menu bar. Press **EXIT** to return to the Run screen

To draw the Integral graph of $\int_0^{+3} 9 - x^2 dx$

This involves the following stages:

Clear the screen **SHIFT** **F4** **F1** to get to **Cls**, then **EXE**.

To get the Integral graph function press **SHIFT** **F4** to get 'Sketch'.

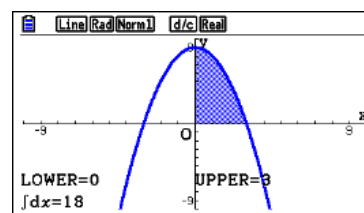
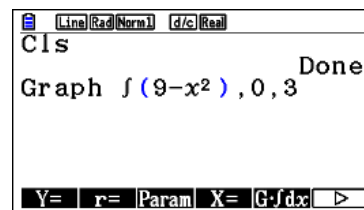
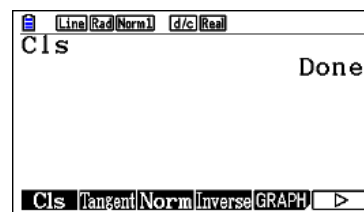
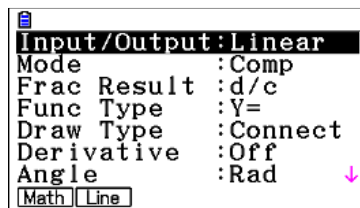
Then **F5** for 'Graph', and then **F5** for $G. \int dx$ and then enter $9 - x^2$ **,** **0** **,** **3** **EXE**.

The Integral graph function is always entered in the same sequence – the integral graph, the function, followed by a comma, the lower limit, a comma and then the upper limit

Press **EXE** to show the graph.

You will see that the calculator has also calculated the value of the integral – in this case 18

Why is this a more accurate way of calculating the value of the integral than the graphing method given at the start of this activity?



Questions

What do you think the value of $\int_{-3}^{+3} 9 - x^2 dx$ will be? Check your answer by drawing the graph in the same way as before. What do you think the value of $\int_{-3}^{+6} 9 - x^2 dx$ will be? Go on – be brave and make an estimate. Explain your reasoning. Now draw the graph and check.

If the question had asked for the area bounded by the curve and the x-axis between $x = -3$ and $x = 6$ what would the answer have been and why is this different to the previous question?

What do you think the value of $\int_0^{+6} 9 - x^2 dx$ is going to be?

Check your answer by drawing the graph, but you will have to clear the screen first and re-enter the expression.

What do you think the value of $\int_3^{+6} 9 - x^2 dx$ is going to be? Now draw the graph to check it.

What do you think the value of $\int_{-6}^{+6} 9 - x^2 dx$ is going to be? This should be easy now – but check it just to make sure!

Investigation

Find the area bounded by the curve $y = (x + 1)(x - 5)$ and the for $-1 < x < 5$.

Find the value of a for which:

$$\int_{-1}^{+a} (x + 1)(x - 5) dx = 0$$

Find the area bounded by the curve $y = (x + 1)(x - 5)$ and the line $y = -1$

Check your answer by solving the same problem using algebraic methods.