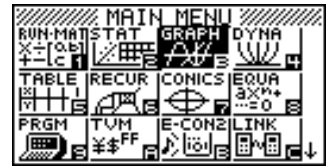# Graphing Integral Calculations

This resource was written by Derek Smith with the support of CASIO New Zealand. It may be freely distributed but remains the intellectual property of the author and CASIO.

Select **GRAPH** mode from the **Main Menu** by using the arrow keys to highlight the **GRAPH** icon or by pressing the **[3]** key respectively.

Having a good understanding of the families of lines and curves in mathematics is a solid foundation for calculus.

$\int_a^b f(x)dx$ is mathematical notation for calculating the definite integral of f(x) between $x = a$ and $x = b$.

Example: $\int_0^1 2xdx = [x^2]_0^1 = 1^2 - 0^2 = 1 - 0 = 1$. What about the family of curves expressed as: $\int_a^x f(x)dx$?

Example 1: Calculate $\int_0^x 1dx$ when x = 1 and 2.
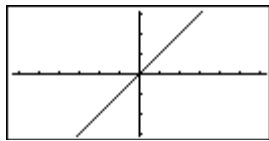

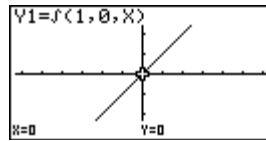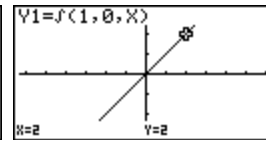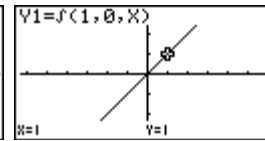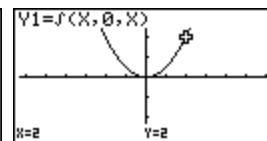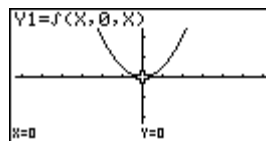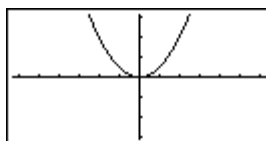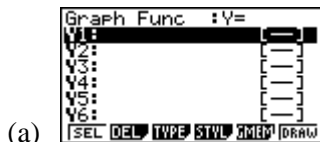| Enter **GRAPH** icon. | **OPTN** for **Calculus** tools, **SHIFT [F3]** then **[F3]** for ∫dx. | Enter the calculus expression. | Set up the **VIEW WINDOW.** |

[EXE] or **[F6]** to **DRAW**. Now **TRACE, SHIFT [F1]** and use the '→'button to trace over the curve stopping at $x = 1$ and recording the solution again at $x = 2$.

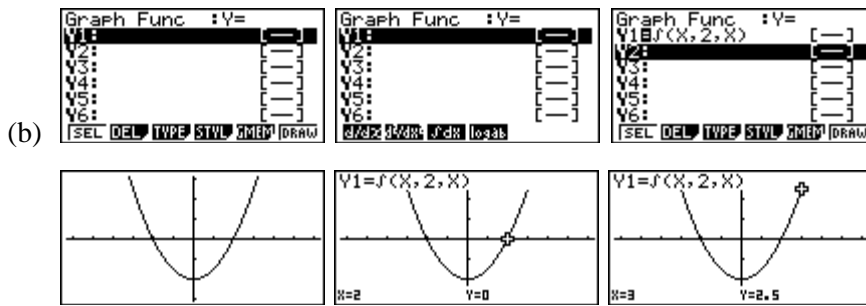*Solutions*: $\int_0^1 1dx = 1$ and $\int_0^2 1dx = 2$.

General solution: $\displaystyle\int_0^x 1dx = [x]_0^x = x - 0 = x$

Example 2: Calculate (a) $\int_0^x xdx$ when $x = 2$ and (b) $\int_2^x xdx$ when $x = 3$.
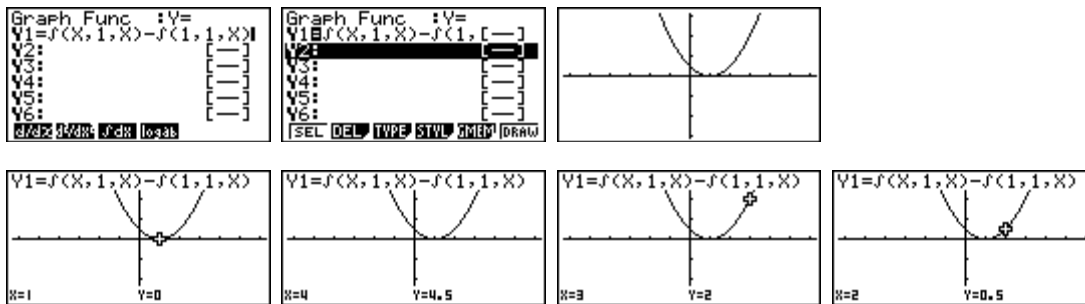
(a)

Solution: $\int_0^2 xdx = 2$ *General solution*: $\int_0^x xdx = [\frac{1}{2}x^2]_0^x = \frac{1}{2}x^2 - \frac{1}{2}0^2 = \frac{1}{2}x^2$
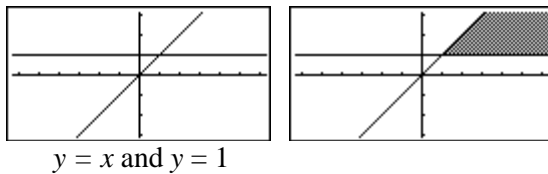
(b)

Solutions: $\int_2^3 x\,dx = 2.5$ *General solution*: $\int_2^x x\,dx = [\frac{1}{2}x^2]_2^x = \frac{1}{2}x^2 - \frac{1}{2}2^2 = \frac{1}{2}x^2 - 2$

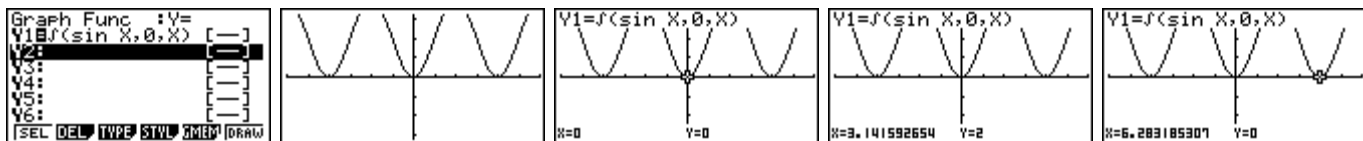**Example 3:** Calculate the area between $y = x$ and $y = 1$ from $x = 1$.

General solution: $\int_1^x x\,dx - \int_1^x 1\,dx = \int_1^x (x-1)\,dx = [\frac{1}{2}x^2 - x]_1^x = (\frac{1}{2}x^2 - x) - (\frac{1}{2}1^2 - 1) = (\frac{1}{2}x^2 - x - 1)$

[Note: The area is always positive and is the area bound as illustrated below.]

$y = x$ and $y = 1$

Example 4: Calculate $\int_0^x \sin(x)\,dx$

Question: What do you notice?

[Note: Make sure that the calculator is in radians!]