

Chapter 11 / Example 17

Volume of revolution

Let $f(x) = \frac{2x+4}{x+1}$, $0 \leq x \leq 4$. Find the volume of revolution formed when the curve $f(x)$ is rotated through 2π radians about
a the x -axis **b** the y -axis.

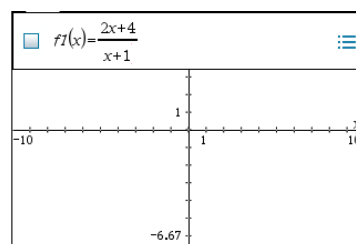
Open a new document and add a Graphs page.

The entry line is displayed at the top of the work area.

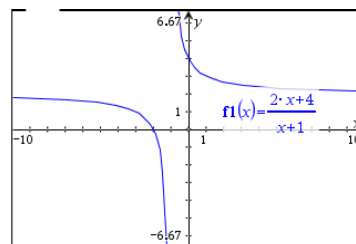
The default graph type is function, so 'f1(x)= ' is displayed.

The default axes are $-10 \leq x \leq 10$ and $-6.67 \leq y \leq 6.67$.

Type $\frac{2x+4}{x+1}$ and press **enter**.



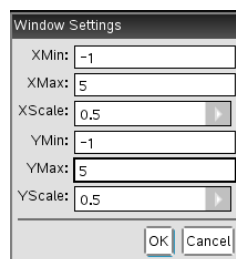
The GDC displays the graph $f1(x) = \frac{2x+4}{x+1}$ with the default axes.



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

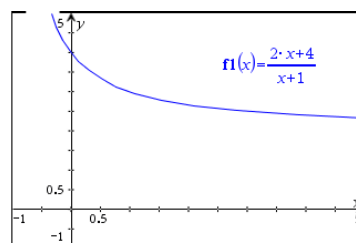
Set the axes to show $-1 \leq x \leq 5$ and $-1 \leq y \leq 5$ with the scales set to 0.5.

Press **enter** when you have finished.



The GDC displays the graph $f1(x) = \frac{2x+4}{x+1}$.

$$V = \int_0^4 \pi \left(\frac{2x+4}{x+1} \right)^2 dx$$



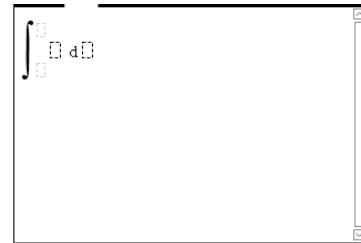
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Press **ctrl** **doc** (**+page**) and add a new Calculator page.

Press **∫dx** and select **∫dx** with the trackpad.

The template shows places for the limits, the function and the variable that you are integrating with respect to.



Enter the lower limit 0 and using the upper limit 4.

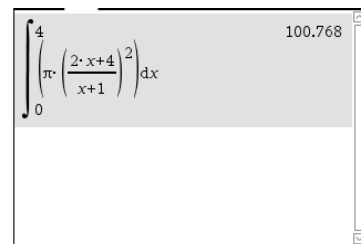
Enter the function $\pi \left(\frac{2x+4}{x+1} \right)^2$

Use **◀▶▲▼** to navigate around the template.

Type x.

Press **enter**.

$$V = \int_0^4 \pi \left(\frac{2x+4}{x+1} \right)^2 dx = 101.$$



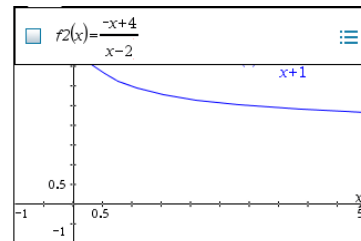
$$y = \frac{2x+4}{x+1} \Rightarrow x = \frac{-y+4}{y-2}$$

Express this function as $f2(x) = \frac{-x+4}{x-2}$

Press **ctrl** **◀** to return to the Graphs page.

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

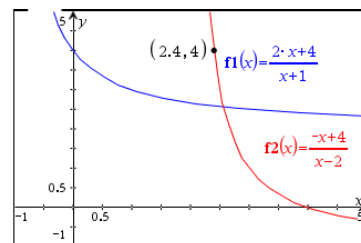
Type $\frac{-x+4}{x-2}$.



The GDC displays the graph $f2(x) = \frac{-x+4}{x-2}$.

$x = 0 \Rightarrow y = 4$ and $x = 4 \Rightarrow y = 2.4$ so

$$V = \int_{2.4}^4 \pi \left(\frac{-x+4}{x-2} \right)^2 dx$$



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Press **ctrl** **▶** to return to the Calculator page.

Press **⏏** and select **∫dx** with the trackpad.

Enter the lower limit 2.4 and using the upper limit 4.

Enter the function $\pi \left(\frac{-x+4}{x-2} \right)^2$

Use **◀▶▲▼** to navigate around the template.

Type x.

Press **enter**.

$$V = \int_{2.4}^4 \pi \left(\frac{-x+4}{x-2} \right)^2 dx = 9.93$$

$$\int_0^4 \pi \left(\frac{2 \cdot x + 4}{x + 1} \right)^2 dx$$

$$\int_{2.4}^4 \pi \left(\frac{-x + 4}{x - 2} \right)^2 dx = 9.9345$$