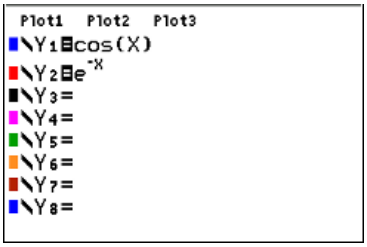
Chapter 11 / **Example 18**
Volume of rotation of an area between two curves

a Sketch $f(x) = \cos x$ and $g(x) = e^{-x}$ on the same axes for $0 \leq x \leq 1.5$.
b Find the intersection points of the two curves in the given interval.
c Find the volume of revolution formed when the region enclosed by the curves f and g is rotated through 2π radians about the x-axis.

Press [F1] [Y=] to display the equation entry screen.

Type $\cos(x)$ and press [ENTER] to enter the equation as Y_1.

Type e^{-x} and press [ENTER] to enter the equation as Y_2.

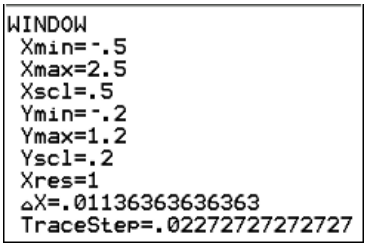


Press [F2] [WINDOW]

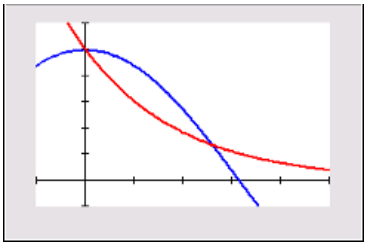
Set the axes to show $-0.5 \leq x \leq 2.5$ with a scale of 0.5 and $-0.2 \leq y \leq 1.2$ with a scale of 0.2.

You can leave the other items as they are.

Press [F5] [GRAPH] when you have finished.



The GDC now displays the curves $Y_1 = \cos x$ and $Y_2 = e^{-x}$

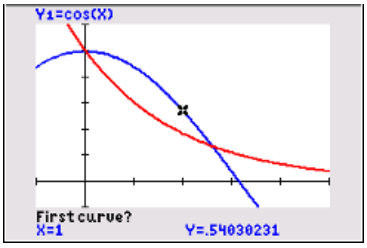


Press [2nd] [F4] [CALC] 5:intersect

To find the intersection you need to choose the two lines that intersect.

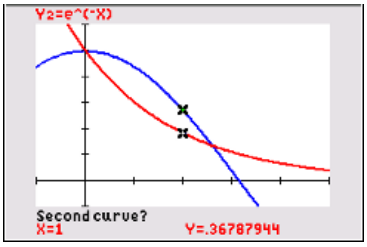
The GDC shows a cross on the curve and 'First curve?'.

Press [ENTER].



The GDC shows a cross on the line and 'Second curve?'.

Press [ENTER].



Chapter 11 / **Example 18**
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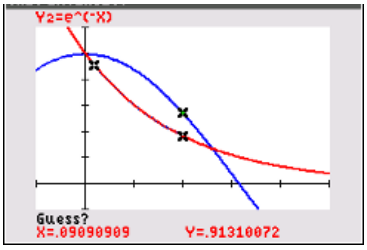
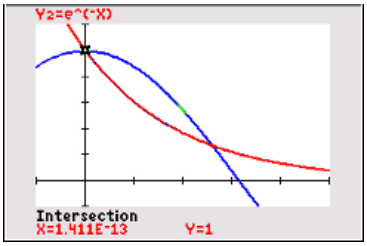
The GDC requires an initial guess for the position of the intersection. Choose a point close to the first intersection by moving the cursor with the | ~ keys.

Press ENTER.



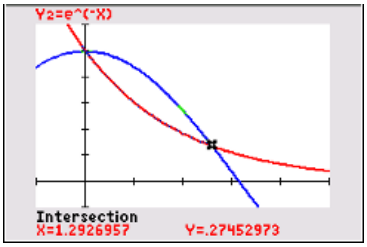
The GDC displays the first intersection at $(0,1)$.

X = 1.411E- 13 *means* 1.411´ 10^{-13} = 0.0000000000001411 *which is very close to zero. The small difference is due to the numerical way that the GDC calculates the value.*



Repeat for the second intersection.

The GDC an intersection at $(1.293, 0.275)$.

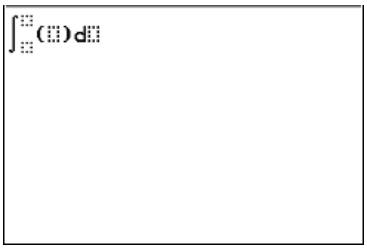


$V = \int_0^{1.293} \pi(\cos x)^2 \, dx - \int_0^{1.293} \pi(e^{-x})^2 \, dx$

Press 2nd [QUIT].

To enter the integral template press ALPHA [F2] 4:fnInt(.

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 the upper limit 1.293.

Type $\pi(\cos(x))^2$ and type X.

Type –

Press ALPHA [F2] 4:fnInt(

Enter the lower limit 0 and the upper limit 1.293

Type $\pi(e^{-x})^2$, type X. and press ENTER.

The volume is 0.993.