

Chapter 8 / Example 2

Multiple solutions of trigonometric equations

Use your GDC to find all values of x , $-\pi \leq x \leq 2\pi$ for which:

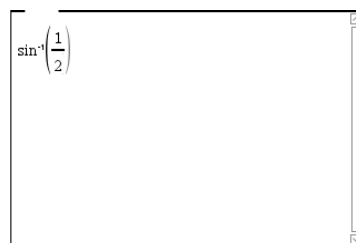
a $\sin x = \frac{1}{2}$

b $\cos x = -0.2$

Open a new document and add a Calculator page.

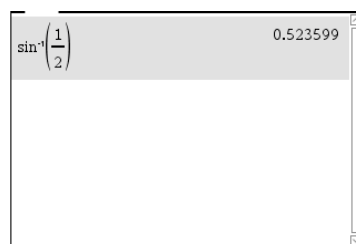
Enter \sin^{-1} by pressing $\boxed{\text{trig}}$ and selecting \sin^{-1} from the menu with the touchpad.

Type $\frac{1}{2}$ using $\boxed{\text{ctrl}}$ $\boxed{\div}$ $\boxed{\frac{\square}{\square}}$ to enter the fraction template.



Press $\boxed{\text{enter}}$.

One solution of the equation is $x = 0.524$.



To get any remaining values of x in the given domain you must use a graph.

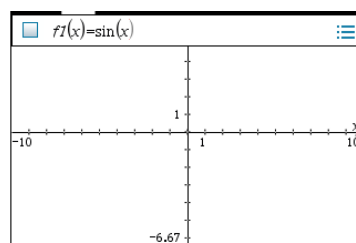
Add a new Graphs page to your document by pressing $\boxed{\text{ctrl}}$ $\boxed{\text{doc}}$ $\boxed{+}$ $\boxed{\text{page}}$ 2: Add Graphs.

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

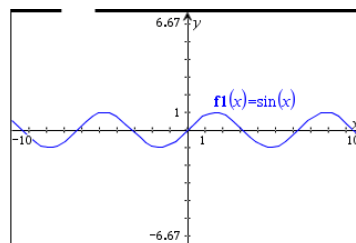
The default graph type is function, so $f1(x)=$ is displayed.

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

Type $\sin(x)$ and press $\boxed{\text{enter}}$.



The GDC displays the graph $f1(x) = \sin(x)$ with the default axes.

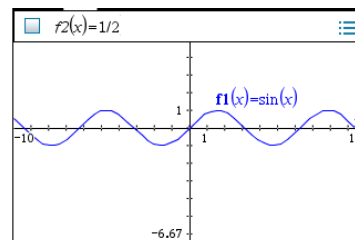


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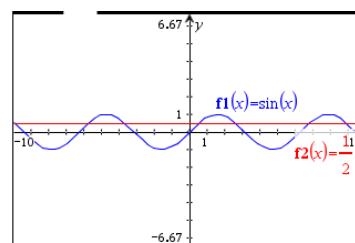
Multiple solutions of trigonometric equations

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

Type $1 \div 2$ and press **enter**.



The GDC displays both graphs.

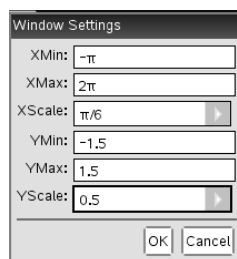


Select a viewing window that shows the domain and the range of the function so that you can identify all solutions.

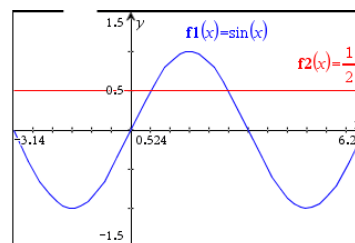
Press **menu** 4:Window/Zoom | 1:Window Settings...

Set the axes to show $-n \leq x \leq 2n$ and $-1.5 \leq y \leq 1.5$ with an x-scale of $\pi/6$ and a y-scale of 0.5.

Press **enter** when you have finished.



The GDC displays the graph $f1(x) = \sin(x)$ and $f2(x) = \frac{1}{2}$ in a suitable window.

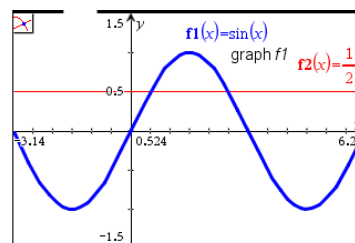


There are two ways to find intersection points. The first is to use **menu** 6:Analyse Graph | 4:Intersection. When there is more than one point, however, the following method is quicker.

Press **menu** 8:Geometry | 1:Points & Lines | 3: Intersection Point(s)

To find the points use the touchpad to highlight the curve. You will see '*graph f1*' displayed.

Click the touchpad.

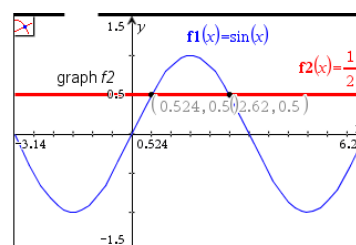


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Use the touchpad to highlight the straight line. You will see 'graph f2' displayed.

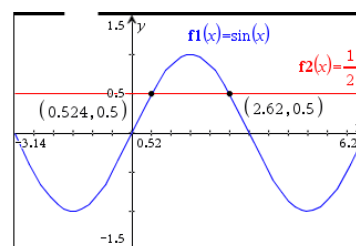
Click the touchpad.



The GDC now displays the coordinates of both points of intersection.

The points of intersection are $(0.524, 0.5)$ and $(2.62, 0.5)$.

There are two values x for which $\sin x = \frac{1}{2}$: 0.524 and 2.62 correct to three significant figures.



Press **[tab]** to display the entry line again.

Scroll up and change $f1(x)$ to $\cos(x)$ and $f2(x)$ to -0.2 . Press **[enter]**.

The GDC displays all both graphs and their intersection points. (Since these had been found previously).

The points of intersection are $(-1.77, -0.2)$, $(1.77, -0.2)$ and $(4.51, -0.2)$.

There are three values x for which $\cos x = -0.2$: -1.77 , 1.77 and 4.51 correct to three significant figures.

