

Mathematical Methods

Unit 2 Topic 3 Trigonometric Graphs

Each of the questions included here can be solved using either the TI-Nspire CX or CX CAS.

Question 1

Find all solutions to the equation $\cos(x) = \frac{1}{\sqrt{2}}$ for $x \in [0, 4\pi]$.

Question 2

Find all solutions to the equation $2\sin(x) - \sqrt{3} = 0$ for $x \in [0, 2\pi]$

Question 3

Sketch the graph of $y = 2\sin\left(x - \frac{\pi}{2}\right) + 1$ for $x \in [0, 2\pi]$. List the x intercepts of the graph for this interval.

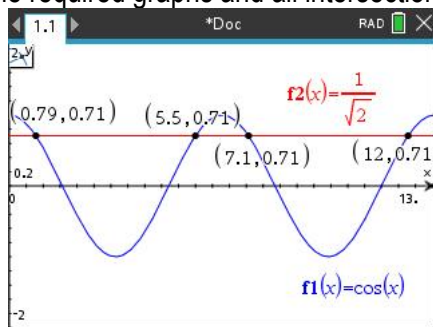
Question 4

Sketch the graph of $y = 2\cos\left(x + \frac{\pi}{6}\right) - 1$ for $x \in [0, 2\pi]$. List the x intercepts of the graph for this interval.

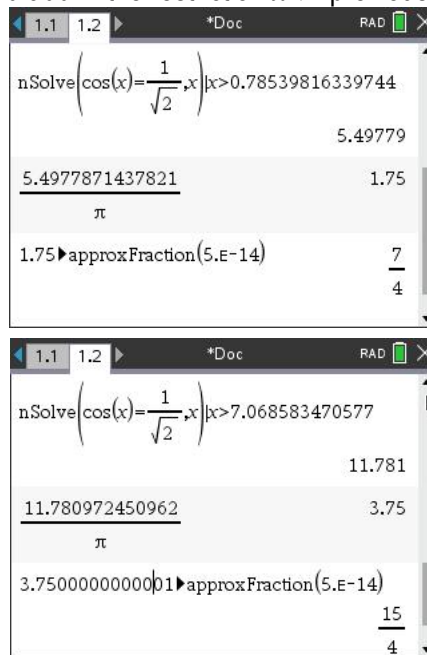
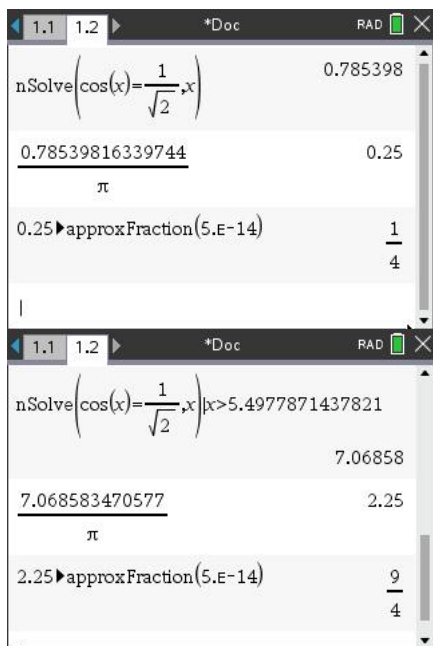
Question 5

The temperature, $T^\circ\text{C}$, in a town over a day is modelled by the function with the rule $T = 17 - 8\cos\left(\frac{\pi t}{12}\right)$

Using a geometry command in a Graph application: Menu > Geometry > Points and Lines > Intersection point(s)
 Choose the required graphs and all intersection points are labelled



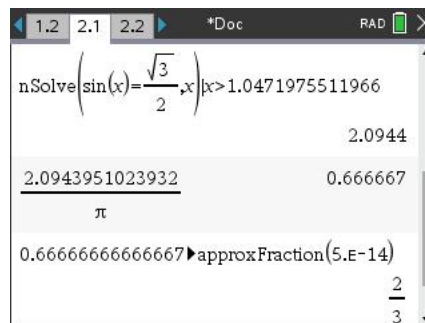
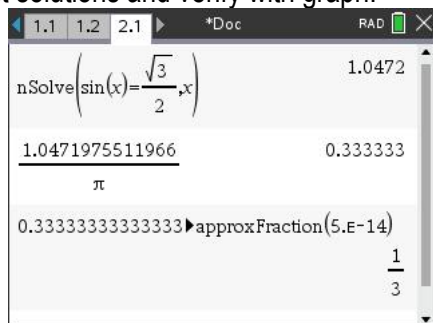
Using Numerical Solve in a Calculator application; divide by π ; Menu > Number > Approximate to fraction.
 To find subsequent solutions: copy the initial nSolve equation down, and add in the restriction $x >$ previous answer

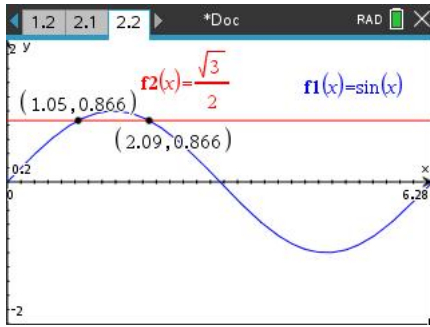


$$\therefore x = \frac{\pi}{4}; \frac{7\pi}{4}; \frac{9\pi}{4}; \frac{15\pi}{4}$$

Question 2

Find exact solutions and verify with graph.

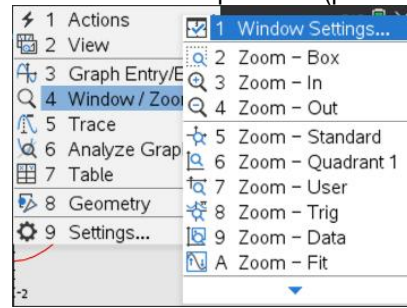
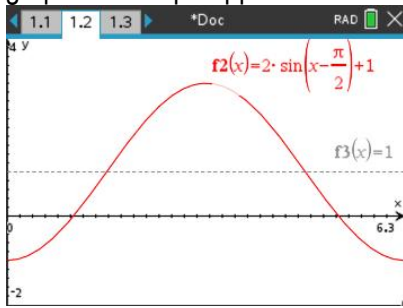




$$\therefore x = \frac{\pi}{3}; \frac{2\pi}{3}$$

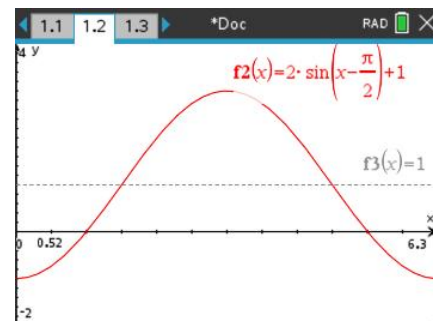
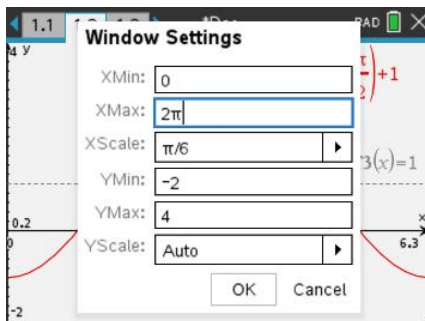
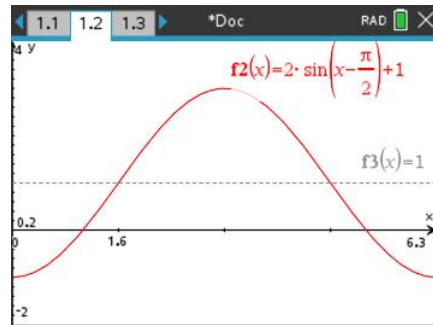
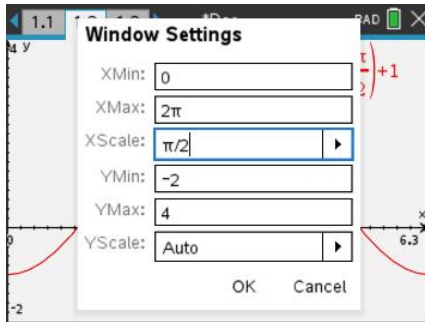
Question 3

Sketch the graph in a Graph application. Use the Window settings to make the x scale equal to C (phase shift).



Consider the tick marks on the x axis, to refine the scale. In this case, visually a better scale is $\frac{\pi}{6}$.

Change the scale to read off the x intercepts.

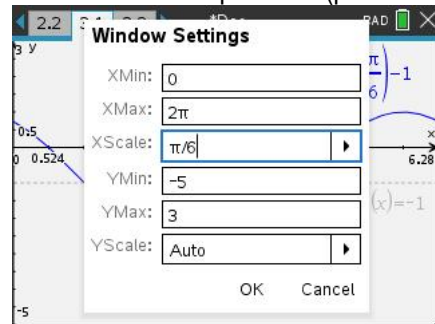
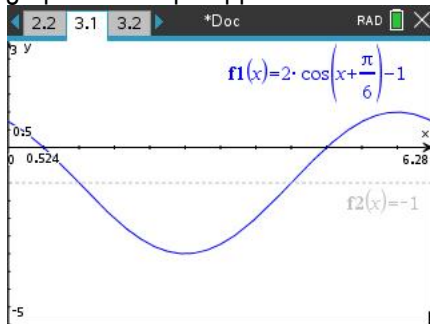


$$\therefore \text{the } x \text{ intercepts are } \frac{2\pi}{6}; \frac{10\pi}{6}$$

$$\text{simplified to } \frac{\pi}{3}; \frac{5\pi}{3}$$

Question 4

Sketch the graph in a Graph application. Use the Window settings to make the x scale equal to C (phase shift).

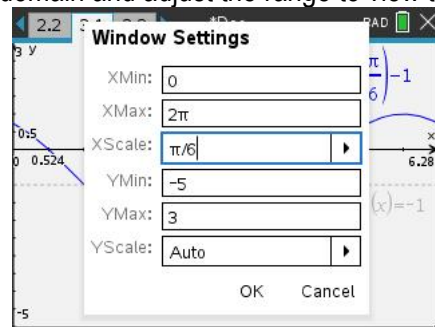
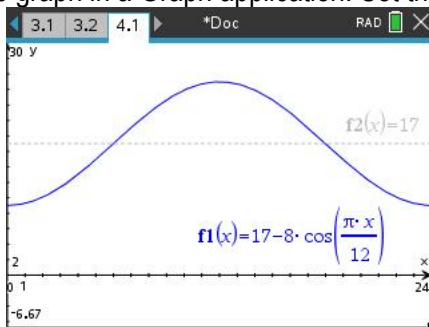


Consider the tick marks on the x axis, and read off the x intercepts
Change the scale if required to read off the x intercepts.

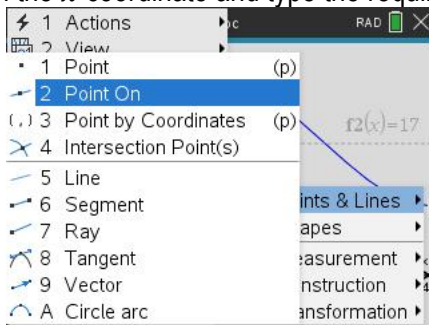
\therefore the x intercepts are $\frac{\pi}{6}$; $\frac{9\pi}{6}$ which simplifies to $\frac{\pi}{6}$; $\frac{3\pi}{2}$

Question 5

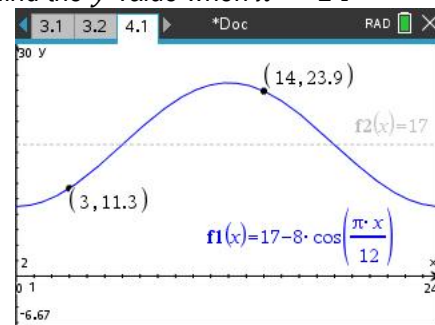
Sketch the graph in a Graph application. Set the window to reflect the domain and adjust the range to view the graph.



- a) Place a point on the graph using the Geometry tools: Menu > Geometry > Points & Lines > Point On
Remember click once to select the graph, again to place the point and then ESC to drop the tool. Double click on the x coordinate and type the required x value. Repeat to find the y value when $x = 14$



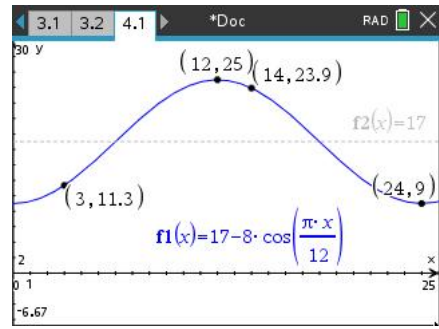
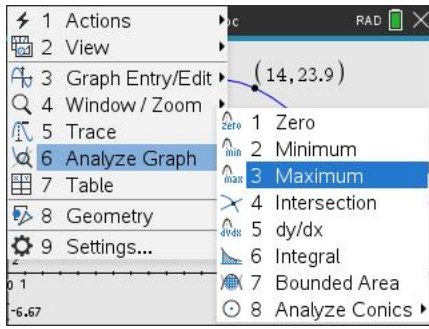
Place



i) The temperature at 3am is 11.3°C

ii) The temperature at 2pm is 23.9°C

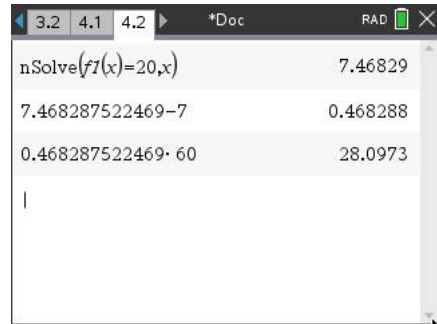
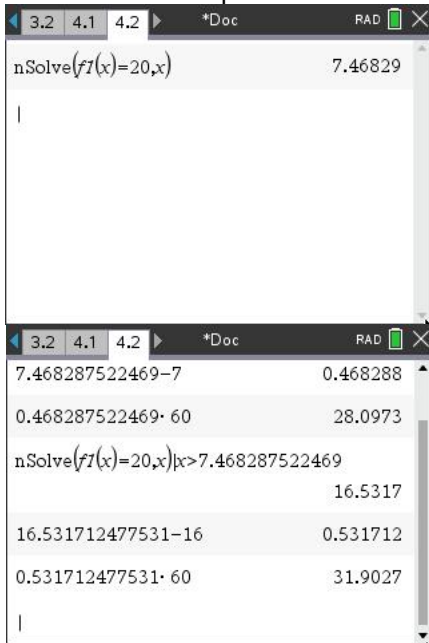
- b) Use the Analyse Graph tool to find the maximum and minimum of the function.



The minimum temperature is 9°C and the maximum is 25°C

- c) This can also be done using the graph, but using Numerical Solve in a Calculator application allows for calculating to the nearest minute more easily.

Convert the decimal part of the solution to minutes to generate the answers of 7: 28 and 14:32



The temperature is warmer than 20°C at 7: 28 and 14:32

