

Chapter 3 / **Example 14c**

Finding the minimum value of a function

At time $t = 0$ a model boat A is at $(2, 5)$ and is travelling with a speed of 4 ms^{-1} in the direction of $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$. The x component is the displacement due east from an origin and the y component due north. All distances are in metres.

- c Find the shortest distance between the two boats and the value of t at which this occurs.

The distance between the two boats is

$$\sqrt{(1 - 0.4t)^2 + (-7 + 4.2t)^2}$$

Press **MENU** 5 **GRAPH** to display the equation entry screen.

Type $\sqrt{(1 - 0.4x)^2 + (-7 + 4.2x)^2}$ and press **EXE** to enter the equation as Y1.

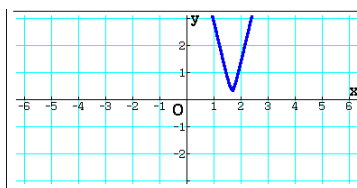
Graph Func :Y=
Y1: $\sqrt{(1-0.4x)^2 + (-7+4.2x)^2}$
Y2:
Y3:
Y4:
Y5:
Y6:
[SELECT] [DELETE] [TYPE] [TOOL] [MODIFY] [DRAW]

Press **F6** DRAW to display the graph screen.

The GDC now displays the quadratic function:

$$Y_1 = \sqrt{(1 - 0.4x)^2 + (-7 + 4.2x)^2}$$

The default axes are $-6.3 \leq x \leq 6.3$ and $-3.1 \leq y \leq 3.1$.



Choose suitable window settings to display the graph.

Press **F3** V-WIN.

Set the axes to show $0 \leq x \leq 3$ and $0 \leq y \leq 3$.

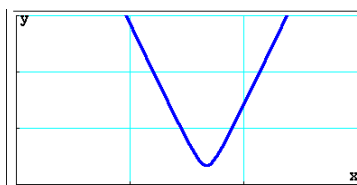
You can leave the other items as they are.

Press **EXIT** when you have finished.

View Window
Xmin : 0
max : 3
scale : 1
dot : 7.9365×10^{-3}
Ymin : 0
max : 3
[INITIAL] [TRIG] [STANDARD] [V-WIN] [SQUARE]

Press **F6** DRAW to display the graph screen.

The GDC now displays Y1 in a suitable window.



To find the minimum press **F5** G-Solv **F3** MIN.

Press **EXE** to display the coordinates.

Press **EXIT** to leave G-Solv mode and **F6** DRAW to display the graph screen again.

Y1 = $\sqrt{(1-0.4x)^2 + (-7+4.2x)^2}$
MIN
X=1.674157302 Y=0.3318318242

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The GDC displays the minimum at $(1.67, 0.332)$.

Minimum distance is 0.332 m when $t = 1.67$ s.

