Chapter 10 / **Example 10**

Finding the minimum value of a function

In this question the GDC could be used to check the results found otherwise.

A can of dog food contains 500 cm^3 of food. The manufacturer, wanting to make sure that the company received maximum profits, would like to make sure that the surface area of the can was as small as possible. Let the radius of the can be r cm and the height, h cm.

a Find an expression for the surface area S in terms of r.

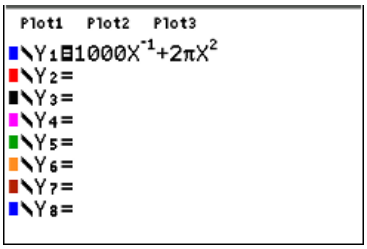
b Find $\frac{dy}{dx}$.

c Hence, find the dimensions of the can that will have the minimum surface area.

$S = 1000r^{-1} + 2\pi r^2$

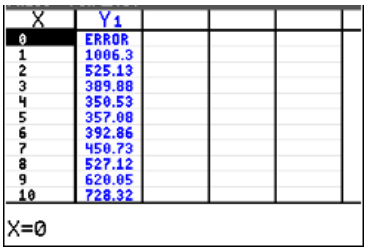
Press [F1] [Y=] to display the equation entry screen.

Type $1000x^{-1} + 2\pi x^2$ and press [ENTER] to enter the equation as Y_1.



Press [2nd] [F5] ([TABLE])

A table of values is displayed.

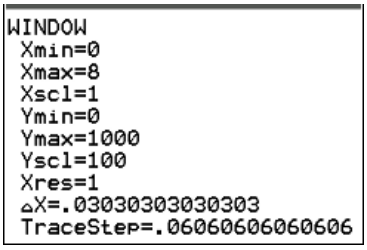


Use this information to choose suitable window settings to display the graph.

Press [F2] [WINDOW].

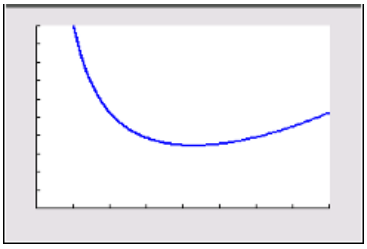
Set the axes to show $0 \leq x \leq 8$ with a scale of 1 and $0 \leq y \leq 1000$ with a scale of 100.

You can leave the other items as they are.



Press [F5] [GRAPH].

The GDC displays the graph Y1.



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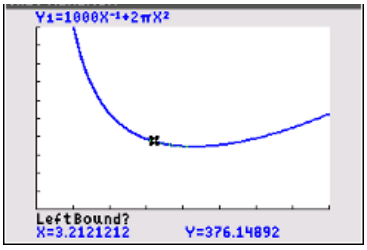
To find the minimum press 2nd a [CALC] 3:minimum

You will need to give the left and right bounds of the region that includes the minimum.

The GDC shows a point on the curve and asks you to set the left bound. Move the point using ~ | and choose a position to the left of the turning point.

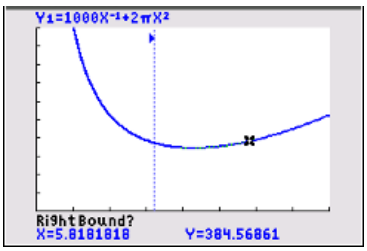
Press ENTER.



The GDC shows a line where you have set the left bound and a point on the curve.

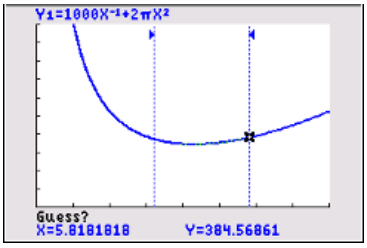
Move the point using ~ | and choose a position to the right of the turning point.

When the region contains the turning point, Press ENTER.



The GDC requires an initial guess for the position of the turning point. Choose the default position.

Press ENTER.



The GDC displays a minimum point at $(4.30, 349)$.

So, the best dimensions for the can are $r = 4.30$ cm and $h = 8.60$ cm with a surface area of 349 cm^2.