

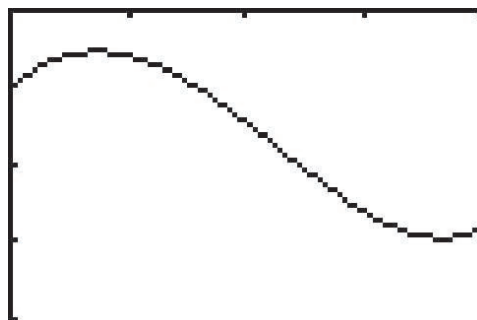
# Finding Minima/Maxima

**Problem:** Find the highest and lowest points on the graph of

$$y = 0.01x^4 + 0.1x^3 - x^2 + 1.3x - 1$$

in the window  $0 \leq x \leq 4$  and  $-4 \leq y \leq 0$ .

**Solution:** First, graph the given equation following the example given in the “Basic Graphing” worksheet. Also change the window to the one specified above.



To find the lowest point on the graph, we will use the *minimum* function. The following steps will determine the lowest point:

- (1) Access the **CALC** menu by pressing **2ND** and then **TRACE**.
- (2) Scroll down to **3:minimum** and press **ENTER**.
- (3) You are asked for a left bound. To answer the question, you may do one of two things:
  - (a) Enter the  $x$ -coordinate of a point on the graph to the left of the lowest point (say,  $x = 3$ )  
OR
  - (b) Use the scroll buttons to move the cursor along the graph until the cursor is to the left of the lowest point.

Press **ENTER**.

- (4) You are asked for a right bound. Perform one of the steps in (3), replacing the word “left” with “right.” If you enter an  $x$ -value, you can choose, say,  $x = 4$ .
- (5) You are asked for a guess. You may either:
  - (a) Enter the  $x$ -coordinate of a point on the graph that is very close to the lowest point (say,  $x = 4$ ) OR
  - (b) Scroll along the graph until the cursor is near the lowest point.

Press **ENTER**.

The calculator will give you the  $x$  and  $y$  coordinates of the lowest point:

Minimum :  $x = 3.682091$ ,  $y = -2.940835$

To find the highest point, perform the same steps as above, replacing the word “lowest” with “highest” and in step (2) scroll down to 4:maximum. The  $x$  and  $y$  coordinates of the highest point are:

Maximum :  $x = 0.74032977$ ,  $y = -0.5420789$