MM UNIT 3 'ABSOLUTE VALUE' INVESTIGATION ON TI-89 Titanium

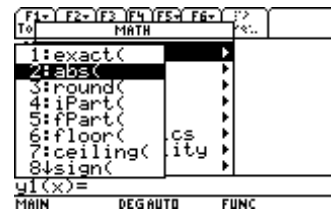*Please sketch all the graphs in your workbook. Label them clearly and describe the relationships <u>in words</u> so that you are be able to form a general statement based on your investigation.*

1. Sketch the graphs of $y = x$ and $y = |x|$ on the same set of axes. Comment on the relationship between the two graphs.

Calculator hint: Maths 1: Number 2: abs(is where the absolute value $|\;|$ is on the calculator.

2. Repeat for the following pairs of graphs:

   a. $y = x^2 - 4$ and $y = |x^2 - 4|$

   b. $f(x) = e^x - 3$ and $|f(x)| = |e^x - 3|$

   c. $g(x) = \sqrt{(2-x)} - 2$ and $|g(x)|$

   d. $h(x) = \log_{10}(x) - 1$ and $|h(x)|$

   e. $k(x) = \dfrac{1}{(x-2)^2} - 3$ and $|k(x)|$

3. State the general rule e.g. explain what happens to the graph of $f(x)$ when we want to sketch the graph of $|f(x)|$.

4. Sketch the following pairs of graphs on the separate set of axes for easier comparison:

   a. $f(x) = x^2 - 2x + 3$ and $f(|x|) = |x|^2 - 2|x| + 3$
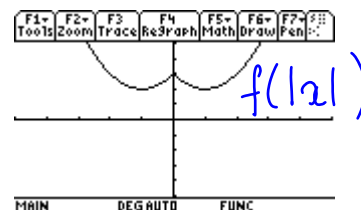
   Calculator hint:

   $Y_1 = x^2 - 2x + 3$

   $Y_2 = Y_1(abs(x))$

   b. $g(x) = \log_e(x-1)$ and $g(|x|) = \log_e(|x| - 1)$

   c. $h(x) = 2^x - 3$ and $h|x| = 2^{|x|} - 3$

   d. $k(x) = \dfrac{1}{x-1}$ and $k(|x|) = \dfrac{1}{|x| - 1}$

   Look at the original graph and then at the graph of $f(|x|)$ separately to see clearly what happens.

5. State the general relationship between the graphs of $f(x)$ and $f(|x|)$.

Definition of the absolute value function:

$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

6. To sketch the function $f(x) = e^{|x|}$ we may use the hybrid function as follows:

$$e^{|x|} = \begin{cases} e^x, & x \geq 0 \\ e^{-x}, & x < 0 \end{cases}$$

a. Use your graphics calculator to sketch this hybrid function by using 'when-else' command.
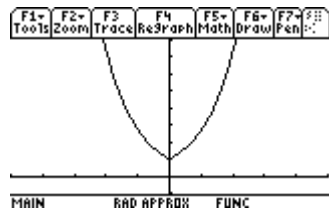
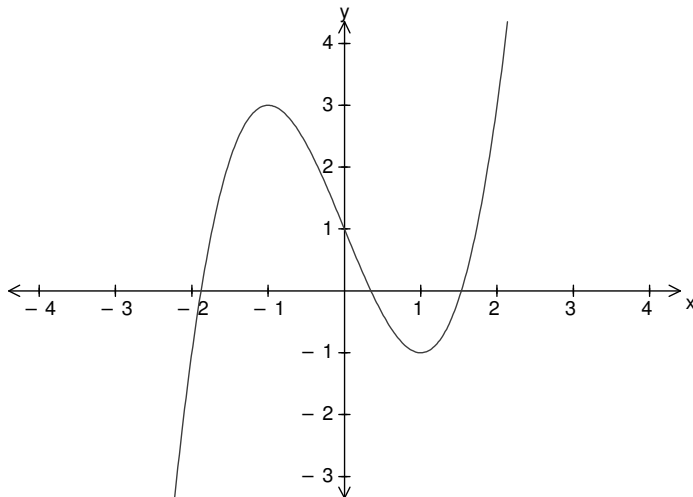b. Now sketch the graph of $e^{|x|}$ by entering the following on your calculator:

Comment on the two graphs.

7. Given the graph of $f(x) = \sin x,\ 0 \le x \le 2\pi$ as shown below, sketch the graphs of $|f(x)|$ and $f(|x|)$ without a calculator. Then check if your graphs are correct by sketching $|\sin x|$ and $\sin(|x|)$ on your calculator.
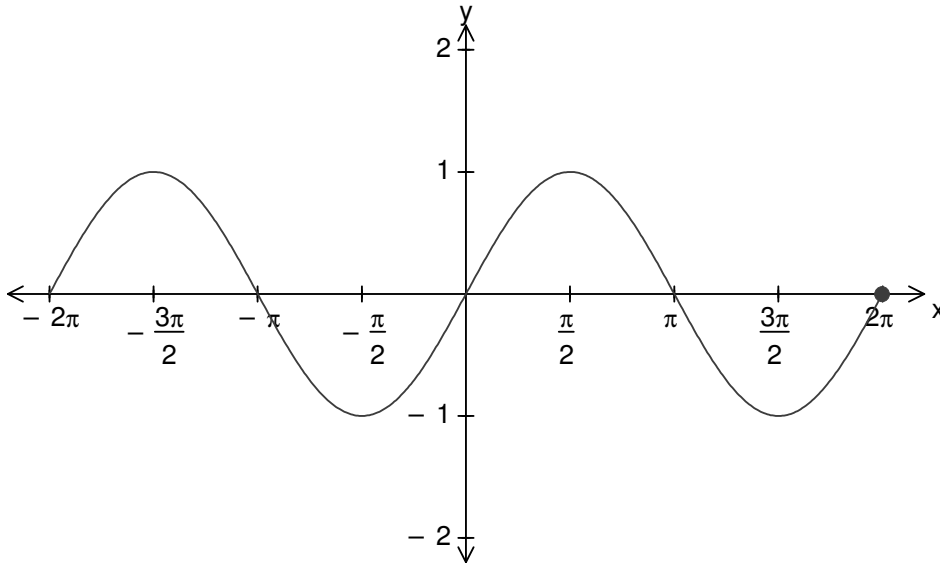
8. The graph of $f(x)$ is drawn.
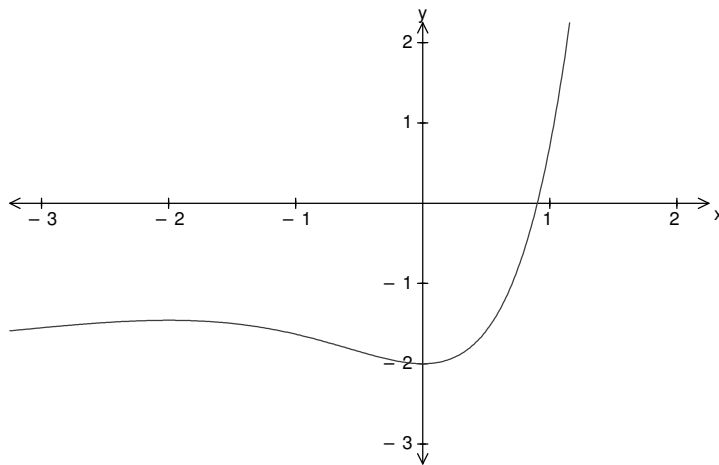

Sketch the following:

a. $|f(x)|$

b. $f(|x|)$

9. The graph of $g(x)$ is shown below:

Sketch:

a. $\left|g(x)\right|$ b. $g\left(\left|x\right|\right)$

10.

a. For the graph of $h(x) = 2x - 1$, sketch without a calculator $\left|h\left(\left|x\right|\right)\right|$.

b. Now check on your calculator by sketching the following: