## 2.5 Solve Inequalities Using Technology

- A polynomial inequality results when the equal sign in a polynomial equation is replaced with an inequality symbol.
- The real zeros of a polynomial function, or $x$-intercepts of the corresponding graph, divide the $x$-axis into intervals that can be used to solve a polynomial inequality.
- Polynomial inequalities may be solved graphically by determining the $x$-intercepts and then using the graph to determine the intervals that satisfy the inequality.
- TI-83+ may be used to solve a polynomial inequality numerically by determining the roots of the polynomial equation and then testing values in each interval to see if they make the inequality true.

Example:

Solving an inequality graphically on the TI-83+ : $-0.5(x + 3)(x - 1)(x - 4) \geq 0$

$f(x) = -0.5(x + 3)(x - 1)(x - 4)$

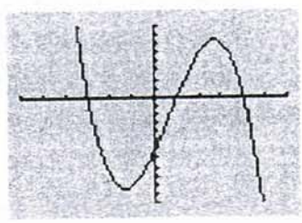
**To clear memory:**

| 2nd | + | 7 | 1 | 2 |
|---|---|---|---|---|
| | MEM | Reset | All RAM | Reset |

RAM cleared

Note: for TI-83, press 5 instead of 7 for Reset

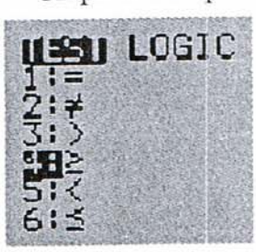
1. Graph the function. Note that the zeros of the function are $x = -3$, $x = 1$, and $x = 4$.



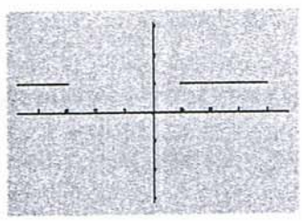
Y= (-) 0.5( X,T,θ,n +3 ) ( X,T,θ,n −1 ) ( X,T,θ,n −4 )

GRAPH ZOOM 6

2. • Return to the equation.
   - Press Y =.
   - Position the cursor at the end of the equation and choose the TEST function (2nd MATH).
   - Choose the ≥ symbol.
   - Graph the inequality by choosing the ZDecimal operation from the ZOOM Menu.



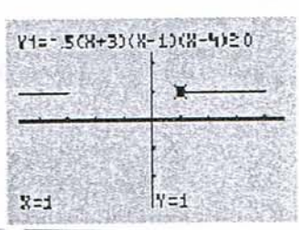




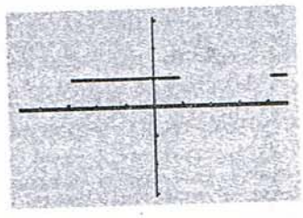
When an inequality is true, the test function plots a point at 1. Otherwise, the plot is set to zero. The intervals where the inequality is true are represented by the horizontal bars at 1.

Use the TRACE key to move the cursor to the end points of each interval.

This test shows that the solution to this inequality is $x \leq -3$, $1 \leq x \leq 4$.




Here is the TI-83+ test for the inequality $-0.5(x + 3)(x - 1)(x - 4) < 0$. The solution is $-3 < x < 1$, $x > 4$. Notice that there are no equal signs in this solution. Also, the solution to this inequality includes the intervals that are NOT in the ≥ inequality.



Exercise

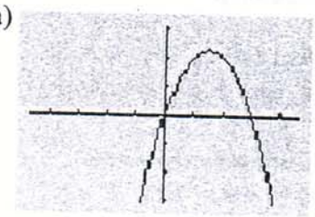
#1 For each graph, write

i) the $x$-intercepts

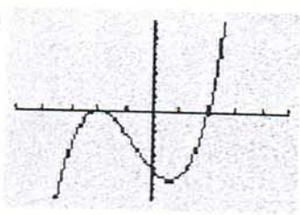
ii) the intervals of $x$ for which the graph is positive

iii) the intervals of $x$ for which the graph is negative

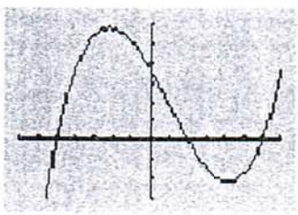
a)



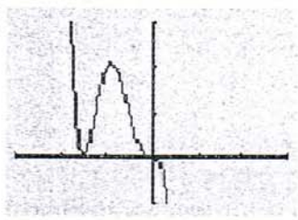
b)



c)

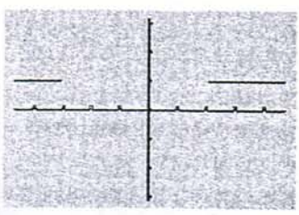


d)

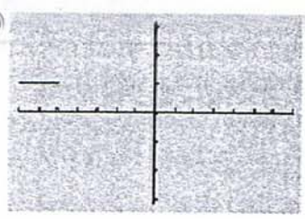


#2 Describe the solution to the inequalities as shown in the following graphs. Assume that the $x$-axis scale = 1, and give estimates of the solutions where appropriate.

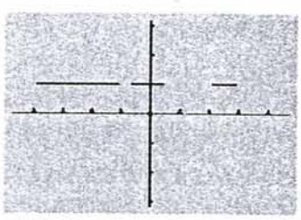
a)



b)



c)



#3 **Use Technology** Solve each polynomial inequality. Use a CAS or a TI-83 + graphing calculator if available.

a) $x^2 - 13x + 30 \leq 0$

b) $x^2 + 20x + 96 > 0$

c) $x^3 - 3x^2 - 4x + 12 \leq 0$

d) $x^3 - 3x^2 - 16x + 48 \geq 0$

e) $x^3 - 4x^2 + x + 6 < 0$

f) $x^3 + 8x^2 + 19x + 12 \geq 0$

g) $x^4 - x^3 - 11x^2 + 9x + 18 < 0$