

Completed

### 5.4 Day 1: Analyzing Graphs of Polynomial Functions

- objectives:** Identify zeros  
 Identify local max and min values  
 Identify increasing and decreasing intervals

**Maximum and Minimum Points:** Quadratic functions have either a maximum or a minimum point.

For higher degree polynomial functions, you can find turning points which represent relative (local) maximum or relative (local) minimum points.

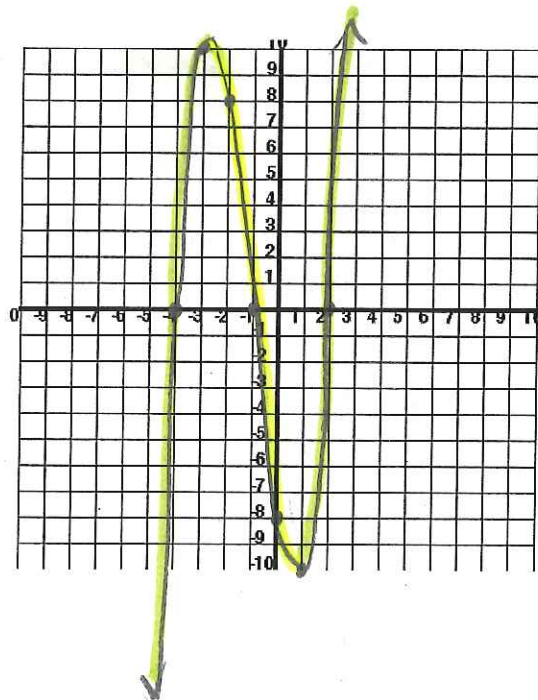
**The degree of a polynomial determines:** the maximum number of turning points (degree - 1) and maximum number of zeros (= degree)

A function with degree of  $n$  has at most  $n-1$  turning points and at most  $n$  x intercepts.  
*could be less* *could be less*

**Examples:**

1. Graph  $f(x) = x^3 + 3x^2 - 6x - 8$  on your calculator. Find the zeros, relative maxima & minima. Use these points to sketch the graph at the right.

x	f(x)
-5	-28
-4	0
-3	10
-2	8
-1	0
0	-8
1	-10
2	0
3	28



a. How many <sup>real</sup> zeros? 3

b. How many turning points? 2

c. What is the relative maximum?

$(-2.732, 10.392)$

d. What is the relative minimum?

$(.732, -10.392)$

e. On what interval(s) of  $x$  is  $f(x)$  increasing?

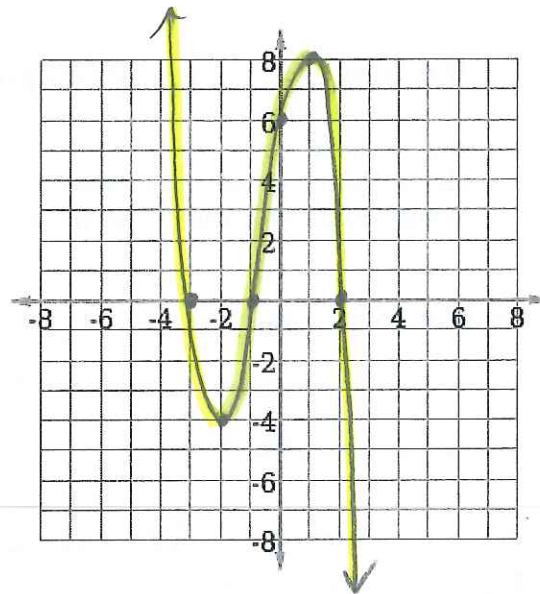
$(-\infty, -2.732) \cup (.732, \infty)$

f. On what interval(s) of  $x$  is  $f(x)$  decreasing?

$(-2.732, .732)$

2. Graph  $f(x) = -x^3 - 2x^2 + 5x + 6$  on your calculator. Find the zeros, relative maxima & minima. Use these points to sketch the graph.

x	f(x)
-4	18
-3	0
-2	-4
-1	0
0	6
1	8
2	0
3	-24



a. How many <sup>real</sup> zeros?

3

c. What is the relative maximum?

$(.786, 8.209)$

e. On what interval(s) of  $x$  is  $f(x)$  increasing?

$(-2.120, .786)$

b. How many turning points?

2

d. What is the relative minimum?

$(-2.120, 4.061)$

f. On what interval(s) of  $x$  is  $f(x)$  decreasing?

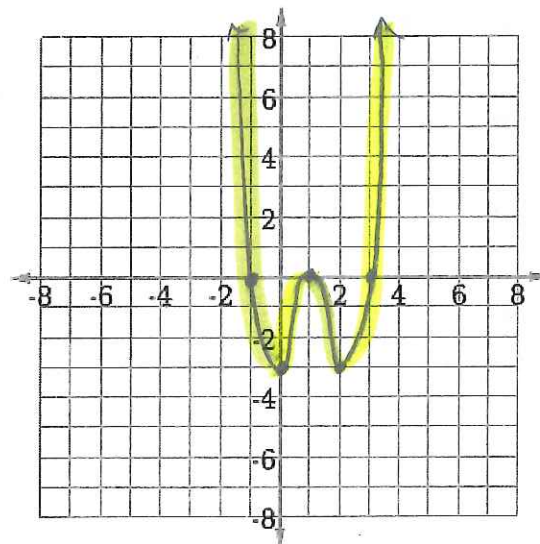
$(-\infty, -2.120) \cup (.786, \infty)$

3. Graph  $f(x) = x^4 - 4x^3 + 2x^2 + 4x - 3$  on your calculator. Find the the relative maxima and minima. Use these points to sketch the curve to the right.

Find the the relative maxima and minima.

Use these points to sketch the curve to the right.

x	f(x)
-2	45
-1	0
0	-3
1	0
2	-3
3	0
4	45



a. How many <sup>real</sup> zeros?

3 but 1 is a double root (1,0)

c. What is the relative maximum?

$(1, 0)$

e. On what interval(s) of  $x$  is  $f(x)$  increasing?

$(-.414, 1) \cup (2.414, \infty)$

b. How many turning points?

3

d. What is the relative minimum?

$(-.414, -4)$   $(2.414, -4)$

f. On what interval(s) of  $x$  is  $f(x)$  decreasing?

$(-\infty, -.414) \cup (1, 2.414)$