

38.7. Character of Polynomial Graphs

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leading term

$$f(x) = 5x^3 + 4x^2 + 3x + 2$$

leading coefficient

Power of leading term

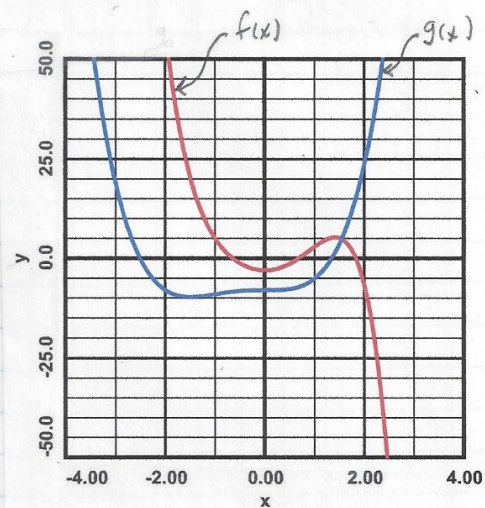
name

also called "degree"

0	constant
1	linear
2	quadratic
3	cubic
4	quartic
5	quintic
⋮	⋮

Leading Term Test

power of leading term (degree)	positive leading coefficient	negative leading coefficient
2, 4, 6, ...		
3, 5, 7, ...		



Example #1. Without using your calculator, i.e., by using Leading Term Test, identify the functions

$$f(x) = -x^5 + 7x^2 - 3 \quad \text{and}$$

$$g(x) = x^4 + 2x^3 - 9.$$

SOLUTION:

Example #2. For $f(x) = (x-1)^3(x-4)^2(x-7)$, state

(a) the degree of the graph

(b) the roots of $f(x)$ and their multiplicities

SOLUTION:

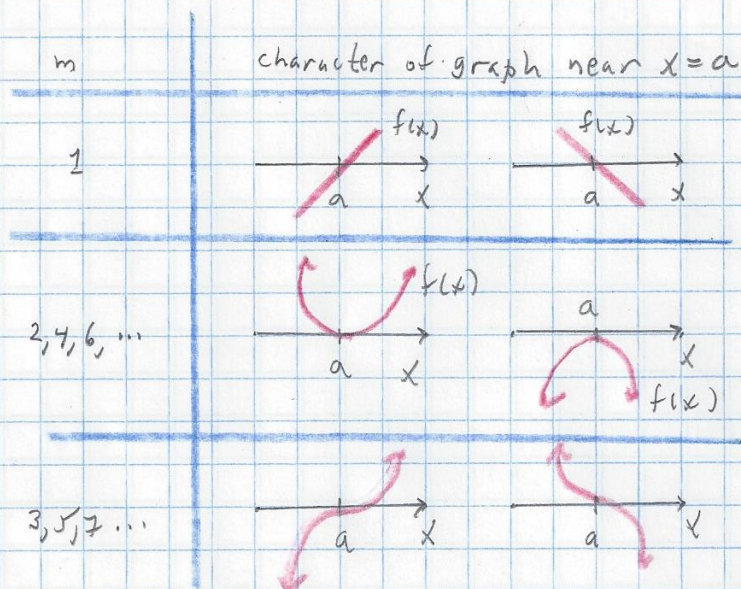
- (a) 6 (b) $x=1$, mult. = 3 $x=4$, mult. = 2 $x=7$, mult. = 1

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Character of Graphs Near Roots

Say $x=a$ is a root of $y=f(x) \rightarrow$
 $(x-a)^m$ is a factor of $y=f(x)$ [$m \equiv \text{multiplicity}$]

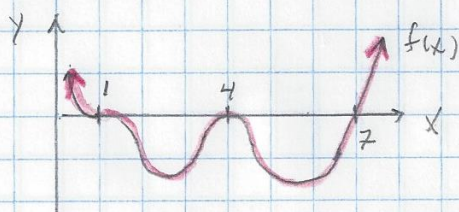


Fact:

If $y=f(x)$ has a factor $(x-a)^m$, then the graph of $y=f(x)$ looks like $\pm(x-a)^m$ near $x=a$.

Example #3. For $f(x) = (x-1)^3(x-4)^2(x-7)$, sketch the character of the graph of $y=f(x)$ without using your calculator.

Solution: $f(x) = (x-1)^3(x-4)^2(x-7) = x^6 + \dots$



Example #4. Check your answer to Example #3 by graphing $y=f(x)$ with your calculator. Use the window: $0 \leq x \leq 8$, $-600 \leq y \leq 200$.

Solution:

