3.2. Polynomial Functions and their graphs

Tuesday, October 31, 2017 10:05 AM

Obj 1: What is a polynomial function?

Last time: quadratic function

$$f(x) = \boxed{2}x^2 + 4x - 6$$

$$f(x) = \boxed{-3}x^5 + 2x^4 - \frac{1}{2}x^3 + 3.7x^2 - 10x + 100$$

These are examples of $\boxed{\text{polynomial}}$ functions

Examples of functions that are not polynomial function:

$$f(x) = \frac{x+3}{x+4} \quad ; \quad f(x) = \sqrt{x-3}$$

In general, a polynomial function is a function of the form:

$$f(x) = \boxed{a_n}x^n + a_{n-1}x^{n-1} + \dots + a_2x^2 + a_1x + a_0$$

where $a_n, a_{n-1}, \dots, a_2, a_1, a_0$ are constants. They are called the coefficients of the polynomial function.

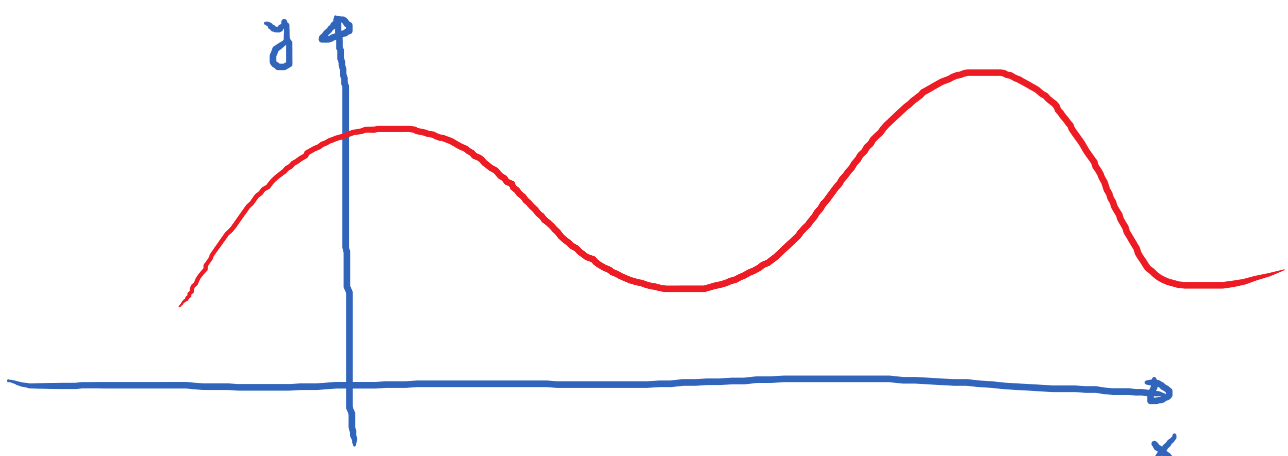
The number a_n is called the $\boxed{\text{leading coefficient}}$ of the polynomial.

E.g. $f(x) = -3x^5 + 2x^4 - \frac{1}{2}x^3 + 10x^2 - 7x + 100$

-3 is the leading coefficient.

Obj 2: Graphs of Polynomial Functions.

Note: The graphs of polynomial functions are continuous.

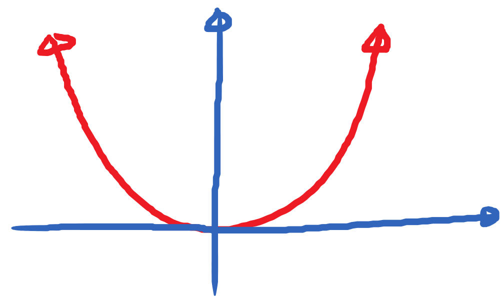


You can graph it without lifting your pencil from the paper

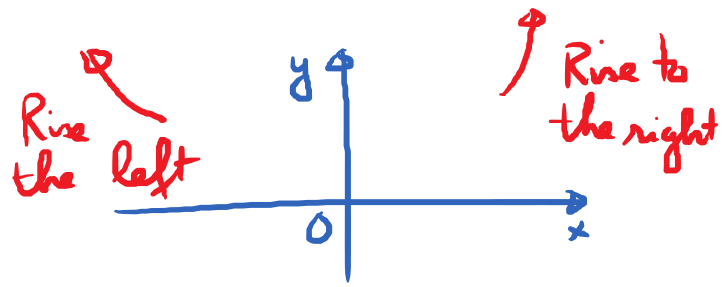
End Behavior of Polynomial Functions:

What is the behavior of the graph when we move very far to the right or very far to the left on the x-axis.

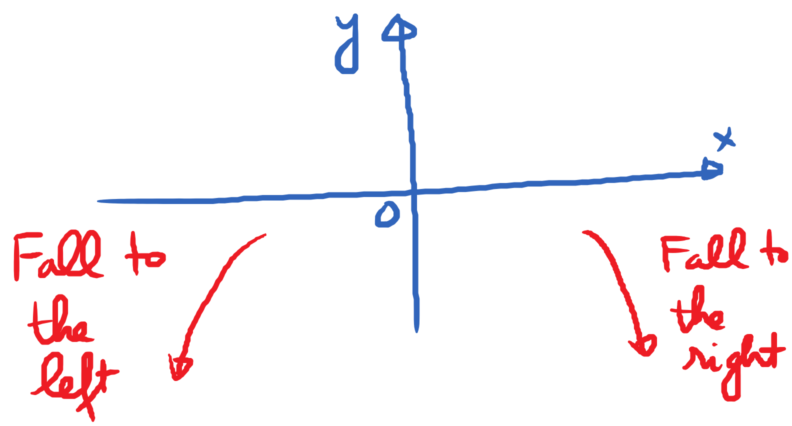
E.g. $f(x) = x^2$.



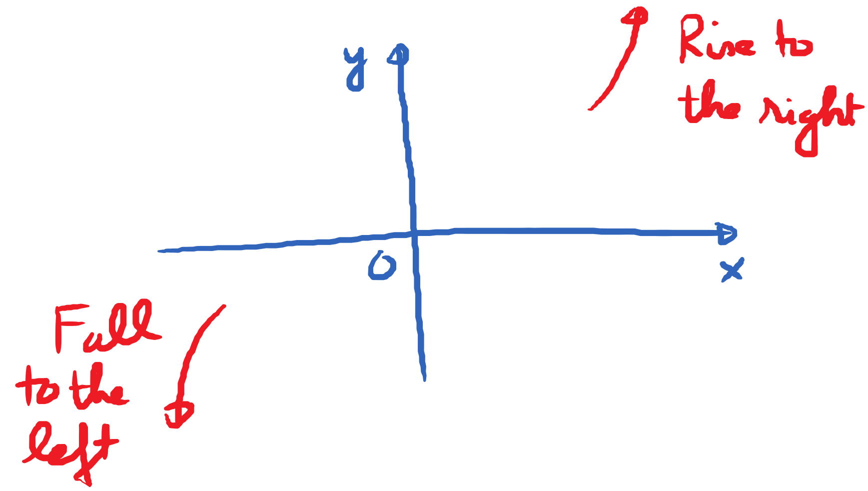
$$g(x) = \boxed{2x^4} + x^3 - 10x^2 - 7x + 17$$



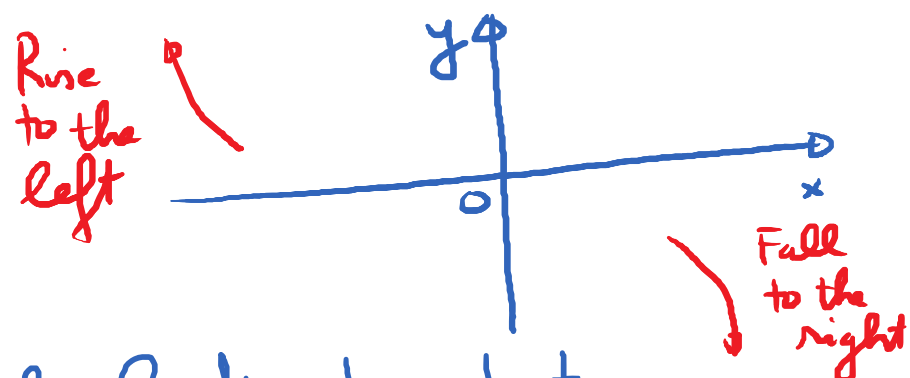
$$h(x) = \boxed{-2x^4} + 5x^3 - 7x^2 + 11x + 6$$



$$g(x) = \boxed{7x^3} + 2x^2 - 10x + 17$$



$$h(x) = -6x^3 + 14x^2 - 7x + 5$$



In general, we have the leading term test for the end behavior of polynomial function.

$$f(x) = \boxed{a_n x^n} + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$$

The leading term is $\boxed{a_n x^n}$

There are 4 scenarios

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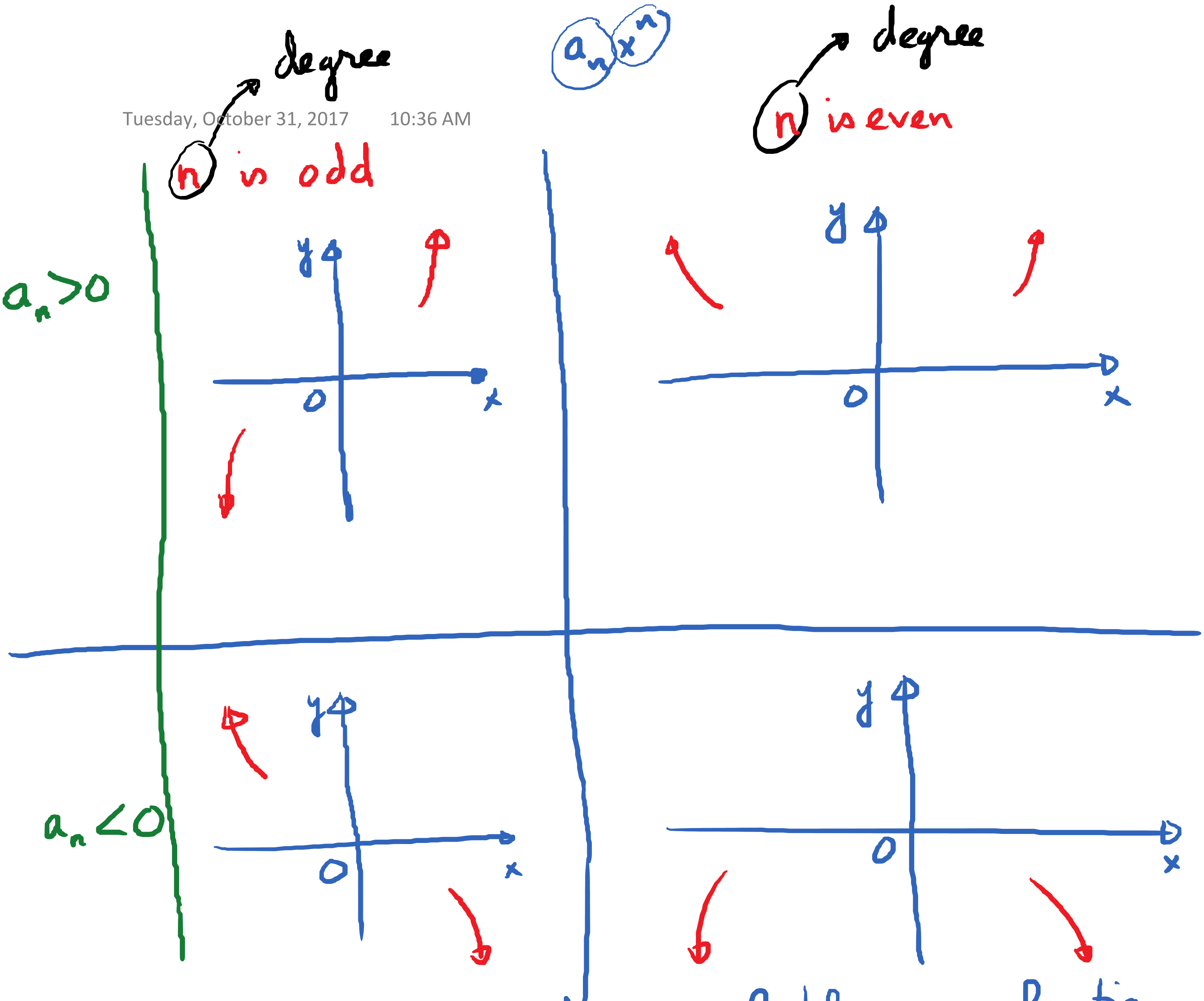

E.g. Determine the end behavior of the given function

ⓐ $f(x) = \boxed{\frac{1}{2}x^4} - 70x^2$.

Rise to the right, rise to the left.

ⓑ $g(x) = -\frac{3}{5}(x-1)(x+2)(x-10)$

leading term: $-\frac{3}{5}x^3$. Fall to the right.

leading term: $-\frac{3}{5}x^3$. Fall to the right.
Rise to the left.

(c) $h(x) = \boxed{-}(\boxed{2x^2} - x + 1)(\boxed{-3x^3} + 7)(\boxed{-x^4} + x^2 - 10)$

leading term: $-(2x^2)\cdot(-3x^3)(-x^4)$

$= -6x^9$

Fall right, Rise left.

Obj 3: Zeros of Polynomial functions.

A zero of a polynomial function f is an x-value for which $f(x)$ is equal to zero. (These zeros are also called the roots of the polynomial function). A zero is also the x-part of an x-intercept of the function.