# 3.1 Polynomial Functions & Modeling

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \ldots + a_2 x^2 + a_1 x + a_0$$

$a_n, a_{n-1}, \ldots, a_1, a_0$'s = real #'ed coefficients

$n$ = degree

$a_n$ = leading coefficient

$a_0$ = constant term

Is degree even or odd?

$y = x^2$

as $x \to \pm\infty$, $y \to \infty$

$y = x$

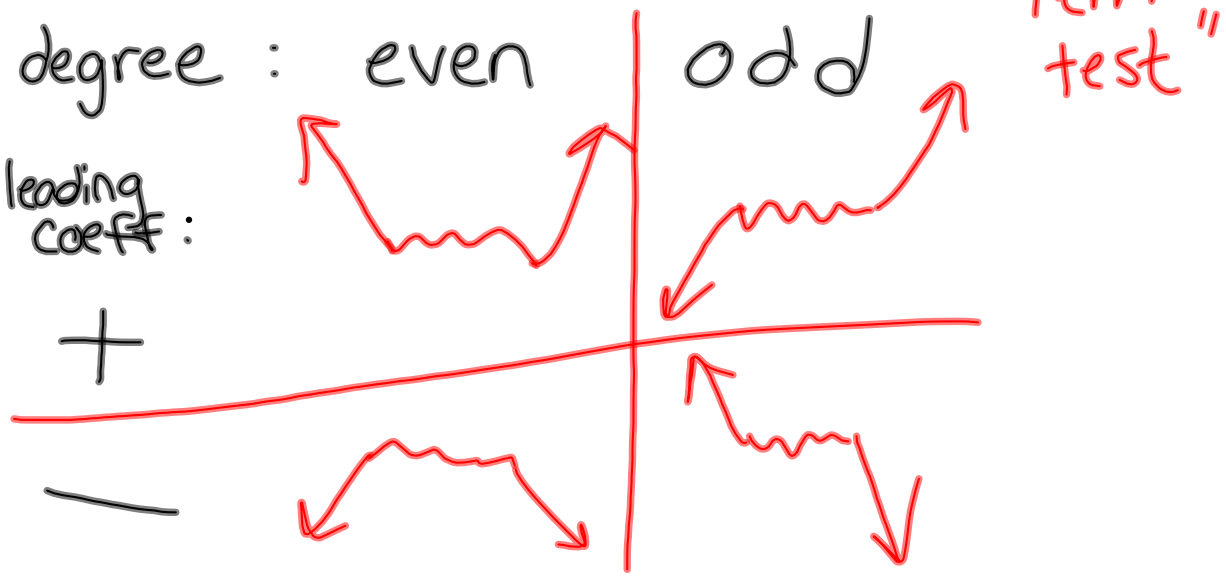
$y = x^3$

as $x \to \infty$, $y \to \infty$

as $x \to -\infty$, $y \to -\infty$

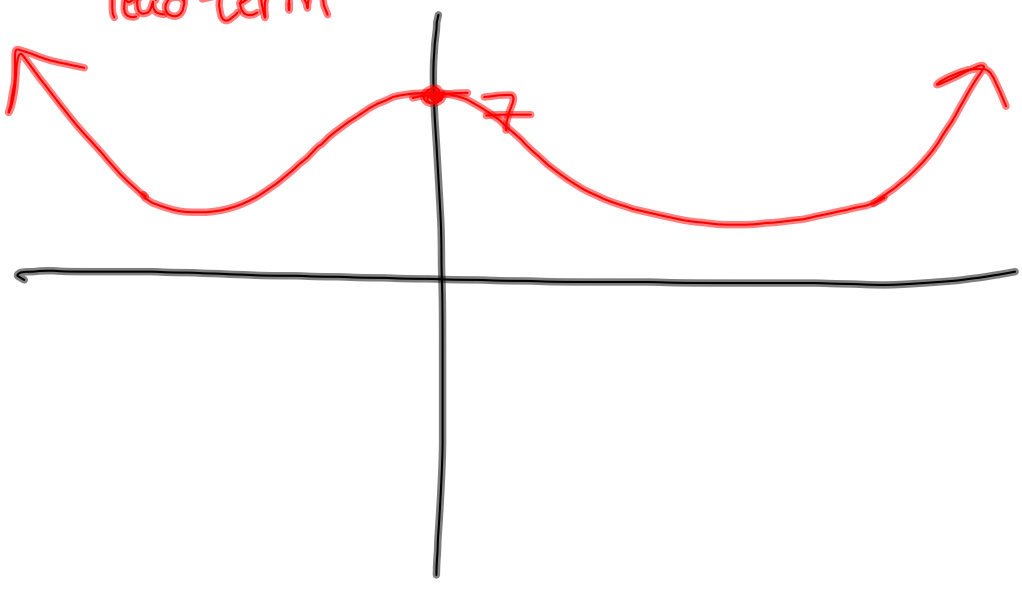
If leading coeff. is negative, vertical flip

"lead term test"




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

lead term



degree determines # of zeros:

The fundamental Theorem of Algebra

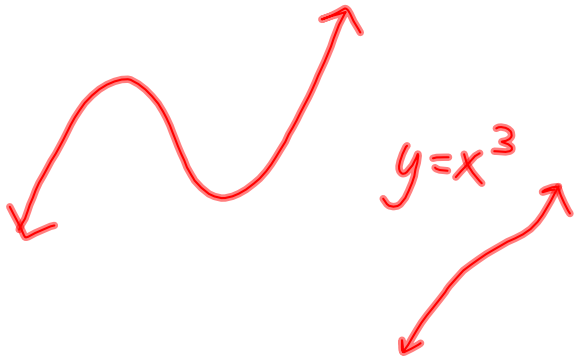
An $n^{th}$ degree polynomial has n zeros

$f(x) = (x-b_1)(x-b_2)\cdots(x-b_n)$

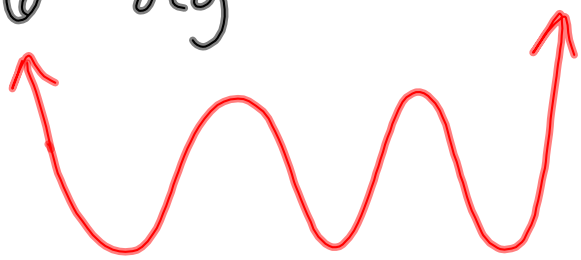
and can be written as the product of n linear factors

The graph of an $n^{th}$ degree polynomial has atmost $n-1$ turning points.

cubic:




$6^{th}$ deg:



$f(x) = -2x^5 + x^3 = -x^3(2x^2 - 1)$

$x = 0$

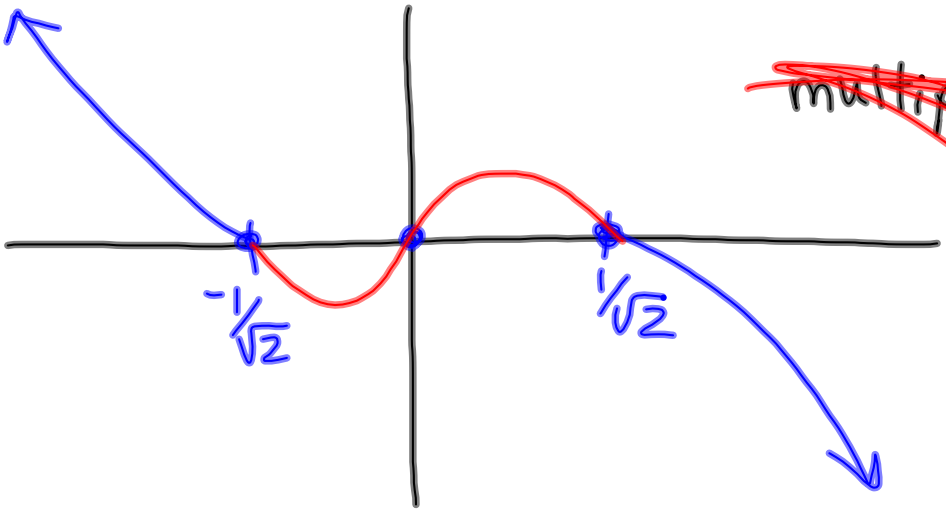
$2x^2 - 1 = 0$

$x^2 = \pm\frac{1}{2}$

$x = \pm\frac{1}{\sqrt{2}}$

lead term: $-2x^5$

multiplicity




$y = -x^4 + 7x^3 - 6x^2$

$= -x^2(x^2 - 7x + 6)$

$= -x^2(x-6)(x-1)$

lead term $-x^4$

0 has mult 2

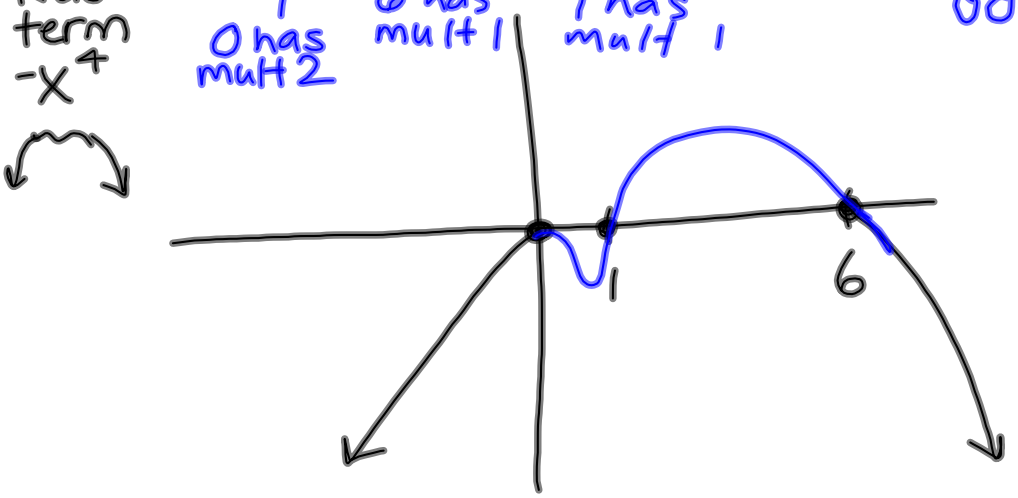
6 has mult 1

1 has mult 1

Multiplicity

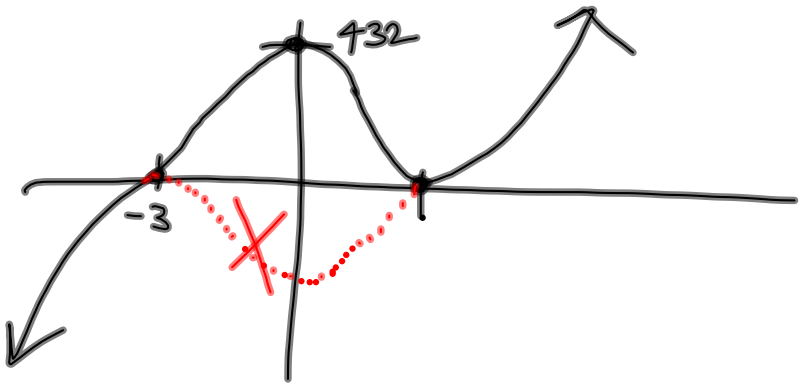
even - bounce off

odd - cross thru



$y = (x-2)^4(x+3)^3$

| zeros | multiplicity |
|---|---|
| 2 | 4 even |
| -3 | 3 odd |




Def: x is a zero of $y = f(x)$ if $f(x) = 0$.

lead term: $x^7$

y-int $(0, 2^4 3^3)$