

3.1/3.2 Polynomial Functions

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

$a_n, a_{n-1}, a_{n-2}, \dots, a_2, a_1, a_0 =$
real #'ed coefficients

$a_n x^n =$ lead term ; $a_0 =$ constant term
 $a_n =$ leading coefficient
 $n =$ degree of polynomial

all exponents are positive integers

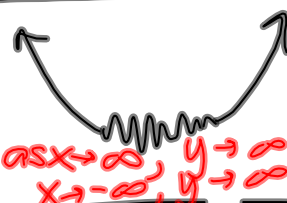

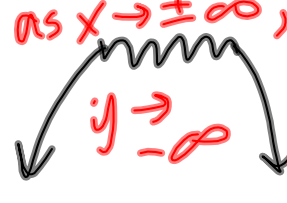
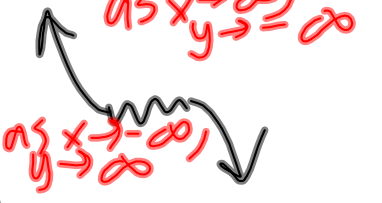
The Fundamental Theorem of Algebra

every polynomial of degree n has n zeros & can be factored as the product of n linear factors

$$P(x) = (x - b_1)(x - b_2)(x - b_3) \dots (x - b_n)$$

Lead term Test tells us what happens as $x \rightarrow \pm \infty$

$$P(x) = a_n x^n + \dots + a_1 x + a_0$$

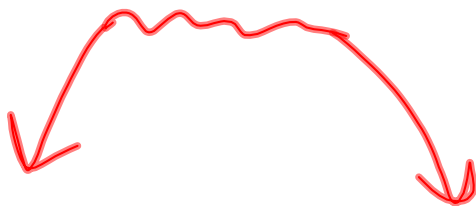
degree of polynomial:	even	odd
leading coefficient: +	 <p>as $x \rightarrow \infty, y \rightarrow \infty$ as $x \rightarrow -\infty, y \rightarrow \infty$</p>	 <p>as $x \rightarrow \infty, y \rightarrow \infty$ as $x \rightarrow -\infty, y \rightarrow -\infty$</p>
leading coefficient: -	 <p>as $x \rightarrow \pm \infty, y \rightarrow -\infty$</p>	 <p>as $x \rightarrow \infty, y \rightarrow -\infty$ as $x \rightarrow -\infty, y \rightarrow \infty$</p>

What is end behavior?

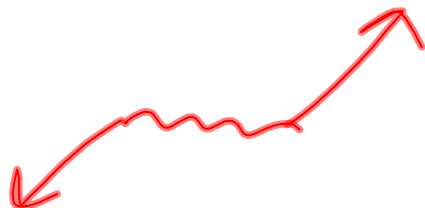
$$y = -3x^4 + 2x^7 - 6$$



$$y = 7 - 2x^4 + 3x^3 - 15x$$



$$y = 15x^2 - 3x^8 + 4x^9 - 7$$



$$y = 22x + 3x^4 - x^5 + 1$$

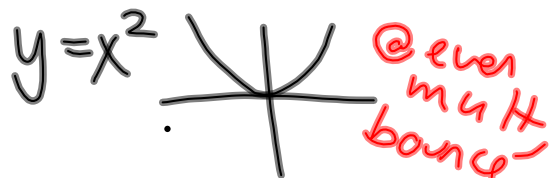


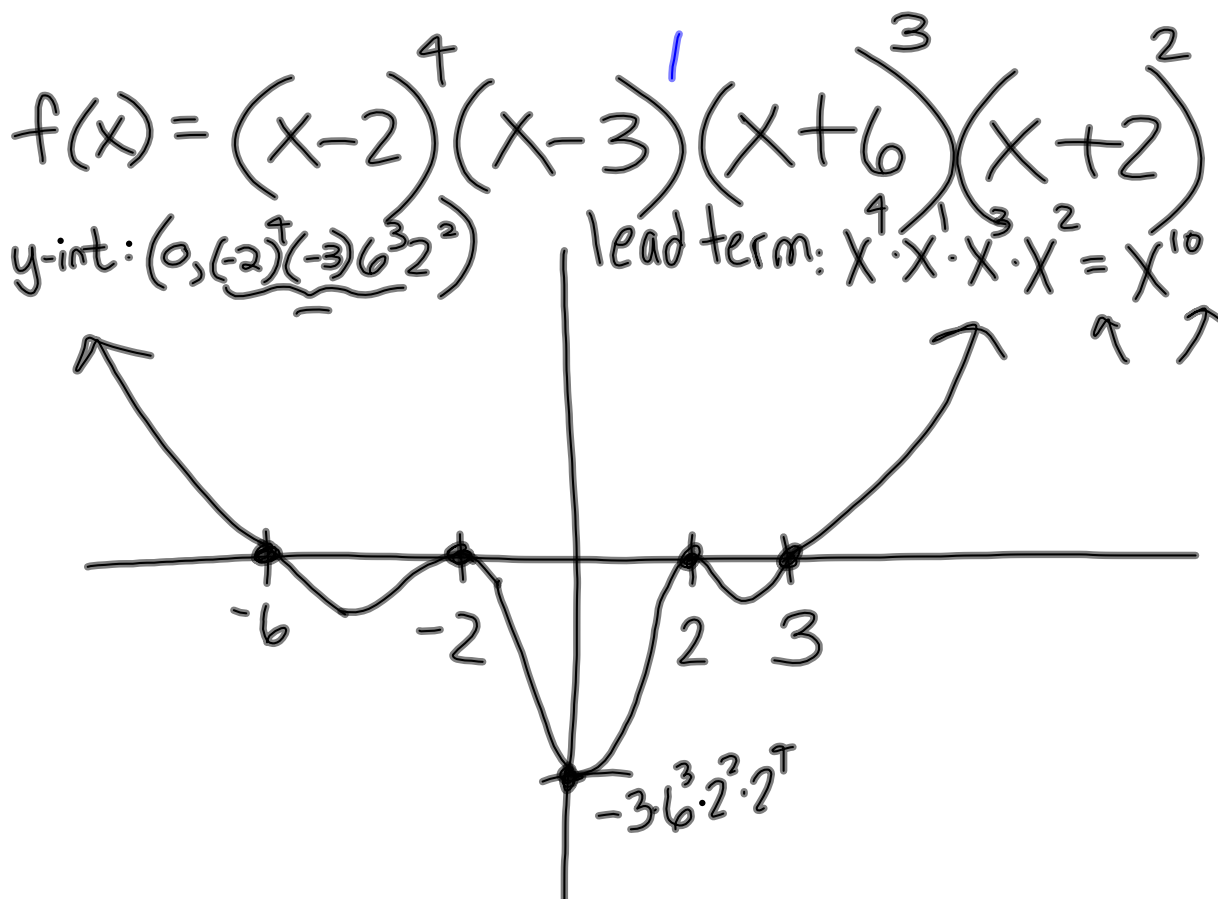
Multiplicity of a zero $f(x) = 0$. → x-value s.t.

$$f(x) = (x-2)^4 (x-3)^1 (x+6)^3 (x+2)^2$$

zeros: 2 3 -6 -2

mult: 4 1 3 2
 even odd odd even





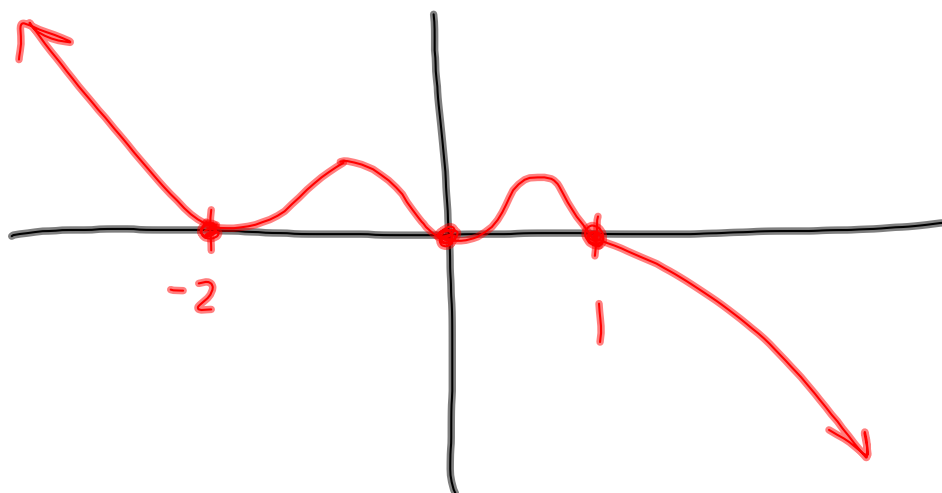
$$f(x) = -3x^2(x-1)^3(x+2)^2$$

zeros: 0 1 -2

mult: 2 even 3 odd 2 even

y-int: (0, 0)

lead term: $-3x^2 \cdot x^3 \cdot x^2 = -3x^7$



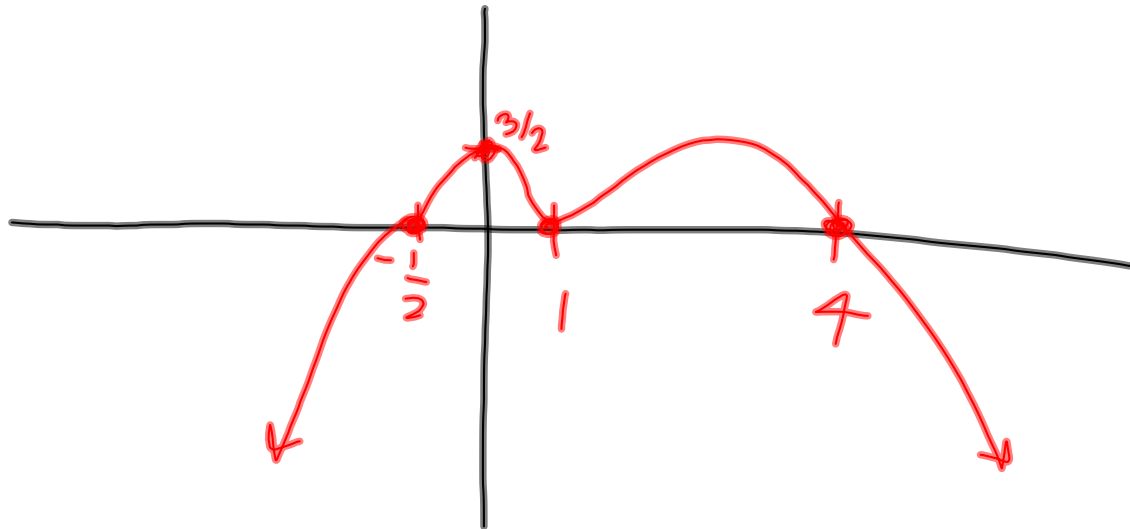
$$f(x) = -3(x-4)(x+\frac{1}{2})^3(x-1)^2$$

zeros:

mult:

y-int: $-3(4)(\frac{1}{2})^3(-1)^2 = 12(\frac{1}{8}) = \frac{3}{2}$ $(0, \frac{3}{2})$

lead term: $-3 \cdot x^1 x^3 x^2 = -3x^6$



$$f(x) = -x^5 + 5x^4 - 6x^3$$

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

$$= -x^3(x-2)(x-3)$$

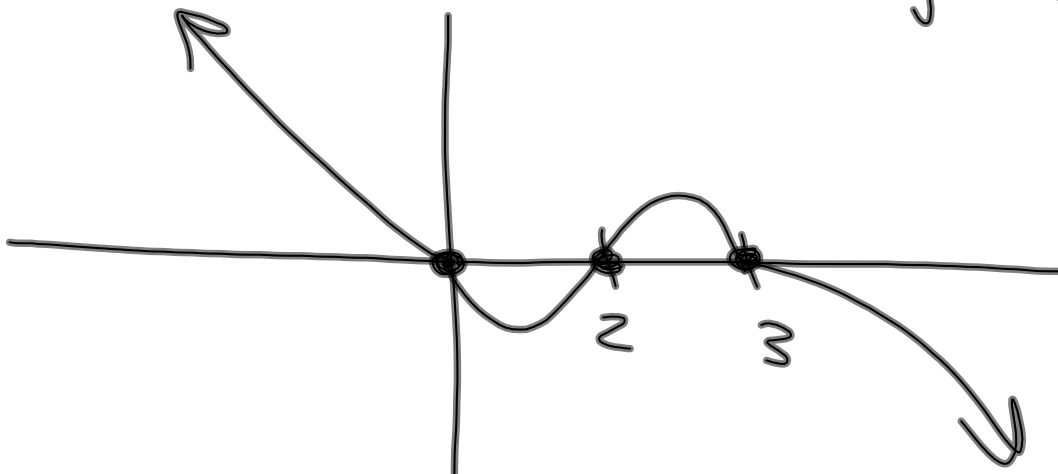
lead term:

$-x^5$

zeros: 0 2 3

mult 3 1 1

y-int: (0,0)



3.1# 8-14, 23-32 all!

3.2 # 16, 17, 21, 22, 24, 25, 27, 28