

## 3.1/3.2 Polynomial Functions

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

$a_n x^n$  is the lead term

$a_n$  is the leading coefficient

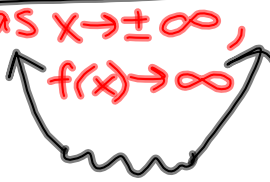
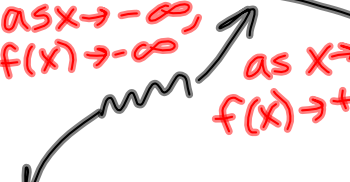

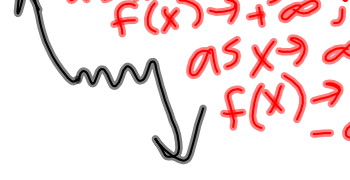
$a_0$  is the constant term

### The Fundamental Theorem of Algebra

# Lead term Test

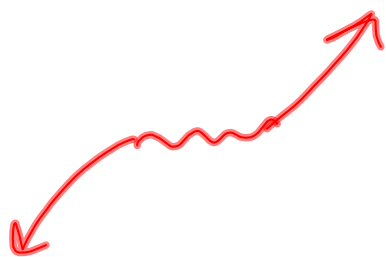
tells us what happens as  
 $x \rightarrow \pm \infty$

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

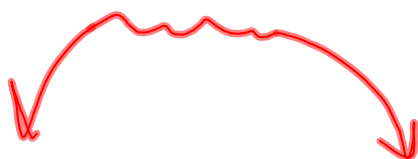
degree of polynomial:	even	odd
leading coefficient: +	$as x \rightarrow \pm \infty, f(x) \rightarrow \infty$ 	$as x \rightarrow -\infty, f(x) \rightarrow -\infty$ $as x \rightarrow +\infty, f(x) \rightarrow +\infty$ 
leading coefficient: -	$as x \rightarrow \pm \infty, f(x) \rightarrow -\infty$ 	$as x \rightarrow -\infty, f(x) \rightarrow +\infty$ $as x \rightarrow \infty, f(x) \rightarrow -\infty$ 

What is end behavior?

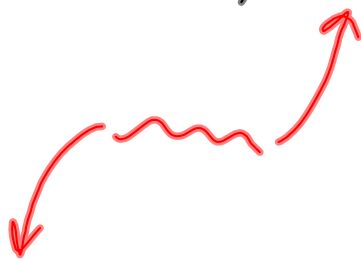
$$y = -3x^4 + 2x^7 - 6$$



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



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



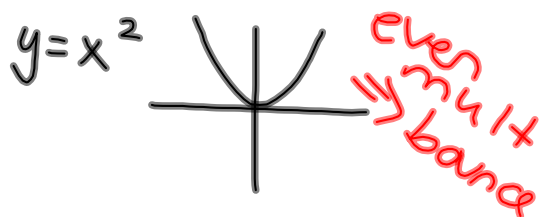
$$y = 22x + 3x^4 - x^5 + 1$$



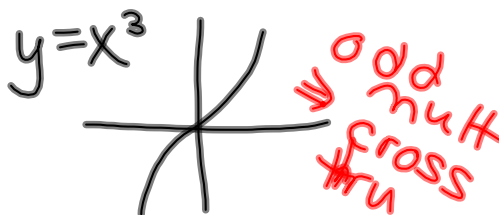
Multiplicity of a zero  $f(x) = 0$ .  
 ↗ x-value s.t.

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

zeros: 2                      3                      -6                      -2  
 mult: 4<sup>even</sup>                      1<sup>odd</sup>                      3<sup>odd</sup>                      2<sup>even</sup>



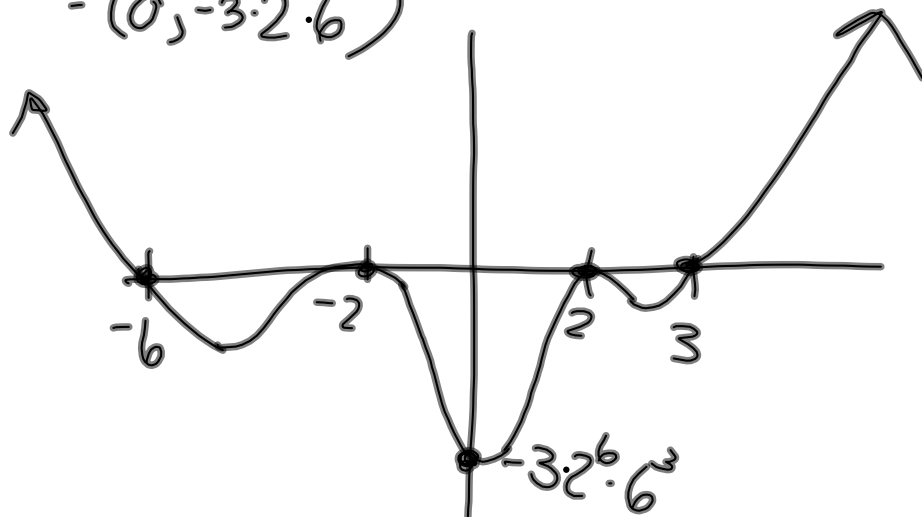
v.



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

y-int:  $(0, (-2)^4 (-3) \cdot 6^3 \cdot 2^2)$   
 $= (0, -3 \cdot 2^6 \cdot 6^3)$

lead term:  $x^4 \cdot x^1 \cdot x^3 \cdot x^2 = x^{10}$



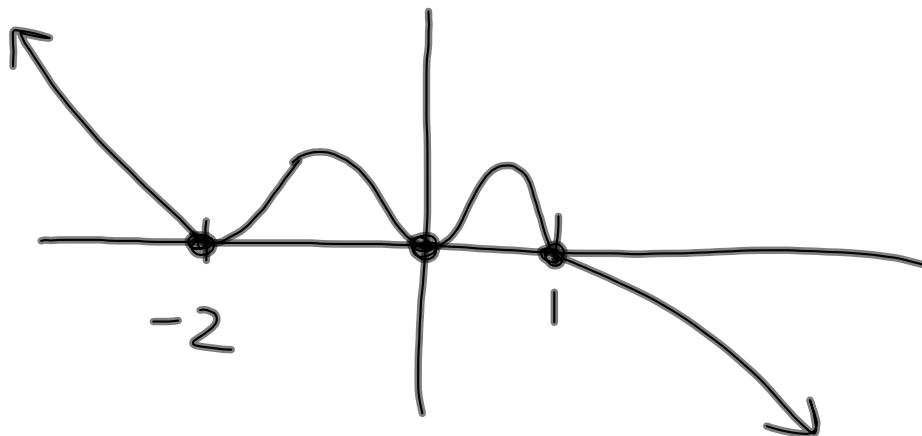
$$f(x) = -3x^2(x-1)^3(x+2)^2$$

zeros: 0 1 -2

mult: 2 even 3 odd 2 even

y-int: (0,0)

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



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

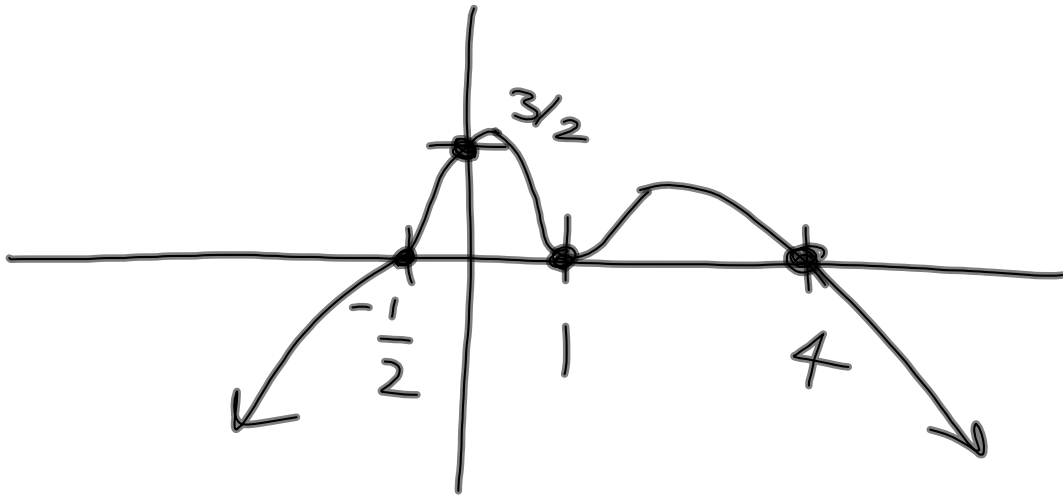
zeros:

mult:

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

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

4 1 odd 3 odd 2 even



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

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

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

Zeros:

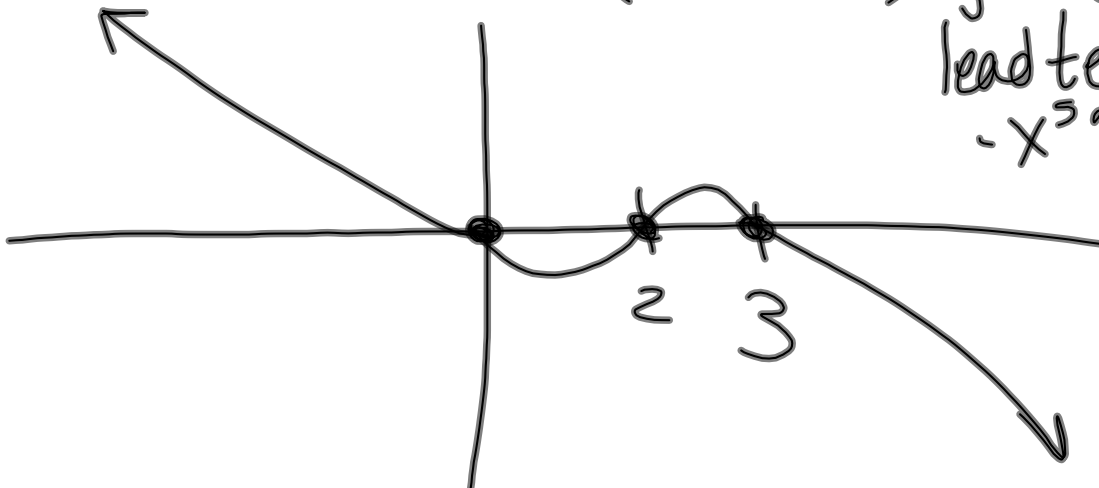
0, 2, 3

(all odd mult)

y-int: (0,0)

lead term:

$-x^5$



3.1# 8-14, 23-32 all!

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