

2.3 (part 1) Polynomial Functions & Their Graphs

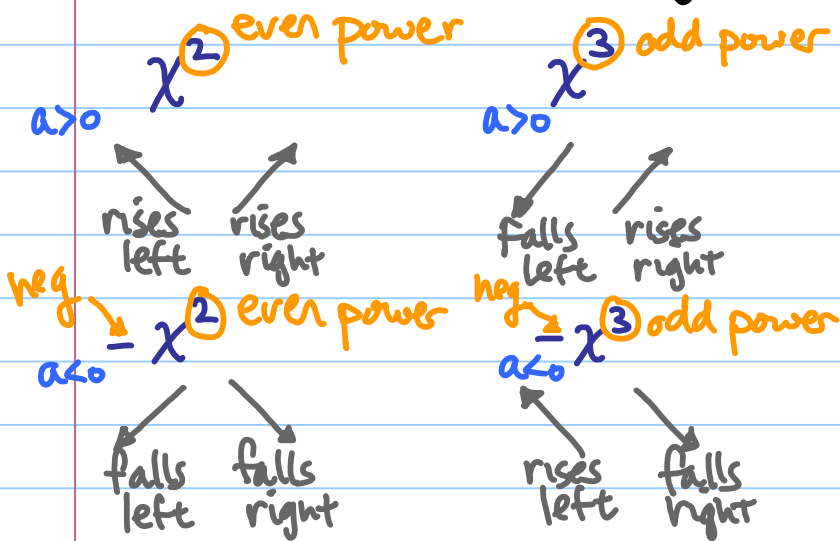
Polynomial: $A_n x^n + A_{n-1} x^{n-1} + \dots + A_1 x + A_0$ n : integer
 $n \neq$ fraction
 $n \neq$ negative

$f(x) = -3x^5 + \sqrt{2}x^2 + 5$ is a polynomial function

$f(x) = -\sqrt{x} + \sqrt{2}x^2 + 5$ $x^{\frac{1}{2}}$ is NOT a polynomial function

degree of poly n
leading coefficient

End Behavior of a Polynomial: x^2 x^3



ex 1) Determine End Behavior

a) $f(x) = x^4 - 4x^2$

$n = \text{even}$ $a_n > 0$ → rises left & rises right

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

$n = \text{odd}$ $a_n > 0$ → falls left & rises right

c) $f(x) = -3x^5 + 4x^2 - 5x^8$

$n = \text{even}$ $a_n < 0$ → falls left & falls right

and mention multiplicity.

ex 2) Find all the zeros of the polynomial function.

$f(x) = x^3 + 2x^2 - 4x - 8$

$x^2(x+2) - 4(x+2)$ factor by grouping

$f(x) = (x+2)(x^2-4)$ set $f(x) = 0$

$0 = (x+2)(x+2)(x-2)$ zero product prop

$x+2=0$ | $x-2=0$
 $x = -2$ | $x = 2$

zero
..... -2: multiplicity of 2 → touches
2: " " | → crosses

* Multiplicity
if even: touches x-axis @ zero
if odd: crosses " " " .

ex 3) $f(x) = 3(x+5)(x+3)^2$. Find zeros & Multiplicity.

$$0 = 3(x+5)(x+3)(x+3)$$

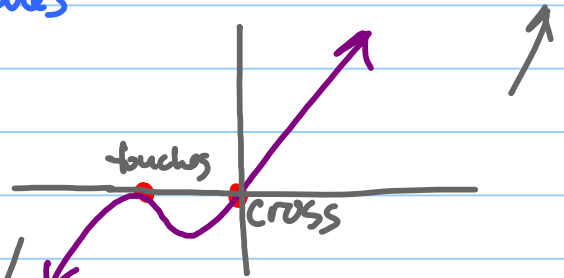
$\cancel{3 \neq 0}$ | $x = -5$ | $x = -3$ | $x = -3$
crosses | touches

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

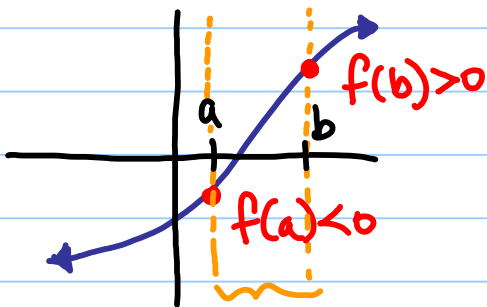
$$0 = x(x^2 + 4x + 4)$$

$$0 = x(x+2)(x+2)$$

$x = 0$ | $x = -2$ | $x = -2$
crosses | touches
(multiplicity of 1) | (multiplicity of 2)



Intermediate Value Thm



If $f(a)$ & $f(b)$ have opposite signs, then there is at least one zero between a & b .

ex 5) Use intermediate value thm:

$$f(x) = x^3 - 4x^2 + 2 \text{ between } 0 \text{ \& } 1$$

$$\rightarrow f(0) = 0^3 - 4(0)^2 + 2 = 2$$

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

} opposite signs
 \therefore real zero between 0 & 1

Turning Points of a Graph

x^n has $n-1$ turning points

ex 6) $3x^8$ - blah... has 7 turning points

Hw: p 312 #2-14 EOE, 15-18, 20-40 EOE