# MTH 30 LECTURE NOTES (Ojakian)

## Topic 11: Graph Polynomial Functions

**OUTLINE**
(References: 3.4)

1. Details on zeroes of polynomials
2. Graphing Polynomials

---

1. Recall Complex Numbers
   (a) Factor $x^2 - 9$
   (b) Factor $x^2 + 9$ (what happens)
2. Fundamental Theorem of Algebra

   **Theorem 1.** *A polynomial of degree n factors into exactly n linear factors (if complex numbers are allowed).*
3. Multiplicities of zeroes

   **Theorem 2.** *(Factor Theorem) For a polynomial function $p(x)$, $p(c) = 0$ is equivalent to $(x - c)$ being a factor.*
   (a) DEF: Multiplicity of $c$ is how many times $(x - c)$ appears as a factor.
   (b) Fact:
      i. If the multiplicity of $c$ is odd, then the graph CROSSES the axis at $c$.
      ii. If the multiplicity of $c$ is even, then the graph TOUCHES the axis at $c$.
4. What happens in between roots?
   (a) Check the sign.
   (b) Use that to determine if the graph is positive or negative in that interval.
5. Graph Polynomials
   (a) Show intercepts
   (b) Show intermediate positive/negative behavior
   (c) Show end behavior
   (d) Where are local max/min ... wait for calculus!
6. Problems
   (a) Do the problem of continuing a pattern (like 2, 4, 6, ...) any way you please.
   (b) Section 3.4: 43, 47
   (c) Section 3.4: 57
   (d) Section 3.4: 75