# Mini-Lecture 4.1
## Polynomial Functions and Models

**Learning Objectives:**

1. Identify polynomial functions and their degree
2. Graph polynomial functions using transformations
3. Identify the real zeros of a polynomial function and their multiplicity
4. Analyze the graph of a polynomial function
5. Build cubic models from data

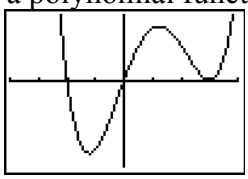
**Examples:**

1. Determine which functions are polynomials and state the degree. If not, state why.

$(a)\ f(x) = 5x^3 - 3x + 4 \quad (b)\ f(x) = \sqrt{3}x^2 \quad (c)\ f(x) = \dfrac{3+x}{x-3} \quad (d)\ f(x) = \sqrt{x-3}$

2. Form a polynomial whose degree and zeros are given. Don't expand.
   (a) Degree 3; zeros: -2,0,4 (b) Degree 4; zeros: -2, multiplicity 3; 1, multiplicity 1

3. Find a polynomial function that could form the graph shown below.



4. Use transformations of $y = x^4$ or $y = x^5$ to graph each function.

$(a)\ f(x) = (x+3)^5 \quad (b)\ f(x) = x^5 + 3 \quad (c) f(x) = (x-1)^4 - 2$

5. Sketch the graph of each function by using end-behavior and multiplicity of zeros.

$(a)\ f(x) = x^3(x-1)(x+3) \quad (b)\ f(x) = (x+2)^2(x-2)(x+4)$

**Teaching Notes:**

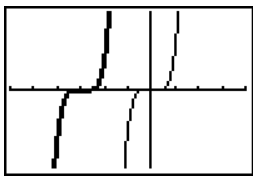
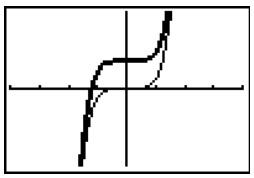
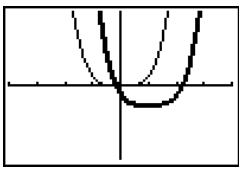
- It is essential that students understand what constitutes a polynomial function.
- Emphasize the behavior of the functions at their zeros and the end behavior
- Giving students a generic graph using a,b,c instead of numerical values can be helpful in getting them to master the concepts.

**Answers:**

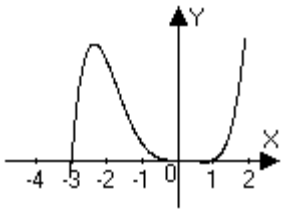
1. (a) Polynomial, degree 3 (b) Polynomial, degree 2 (c) Not a polynomial because the variable is in the denominator (d) Not a polynomial because of the radical

2. $(a)\ f(x) = x(x+2)(x-4) \quad (b)\ f(x) = (x+2)^3(x-1)$

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

4. (a)  (b)  (c) 

5. (a)




(b)