Concepts
Finding and Using Zeros of Polynomial Functions

Based on power point presentations by Pearson Education, Inc.
Revised by Ingrid Stewart, Ph.D.

Learning Objectives

1. Use the *Zeros* of polynomial functions to better analyze their graphs.
2. Find the *Zeros* of factorable polynomial functions.

NOTE: This lesson contains some examples. You can find more examples in the "Examples" document also located in the appropriate MOM Learning Materials folder.

1. Use the *Zeros* of Polynomial Functions (1 of 4)

In the previous lesson we discussed *Zeros* of polynomial functions. We actually use them to better analyze their graphs. Specifically,

a. The real *Zeros* are the *x*-intercepts of the graphs of polynomial functions.

b. Imaginary *Zeros* CANNOT be seen on the graphs, but they help shape them.

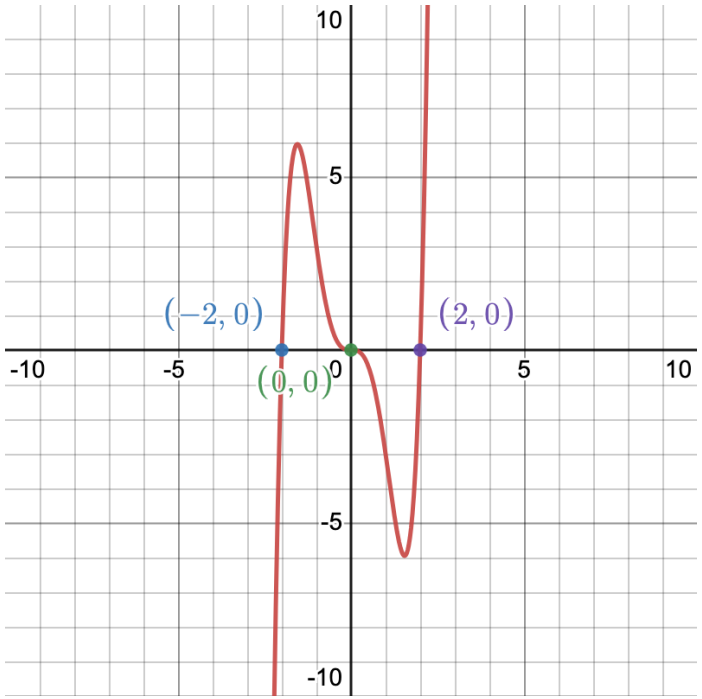
c. Multiplicity provides another connection between the *Zeros* and the graphs of polynomial functions. They also help shape them.

Use the *Zeros* of Polynomial Functions (2 of 4)

Assume that $(x - r)^m$ is a factor of a polynomial function where ***r*** is a *Zero* and ***m*** is the multiplicity of ***r***.

- If ***m*** equals ***1***, the graph of a polynomial function CROSSES the *x*-axis at **(r, 0)** in a straight line.

Example 1:

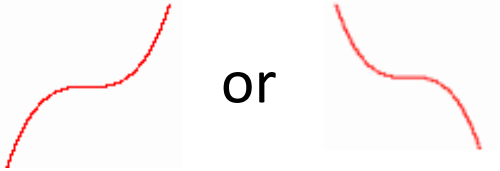


Graph of the function
$f(x) = (x - 0)^3 (x - (-2)) (x - 2)$

Note that the graph crosses the *x*-axis at (– 2, 0) and (2, 0) in a straight line.

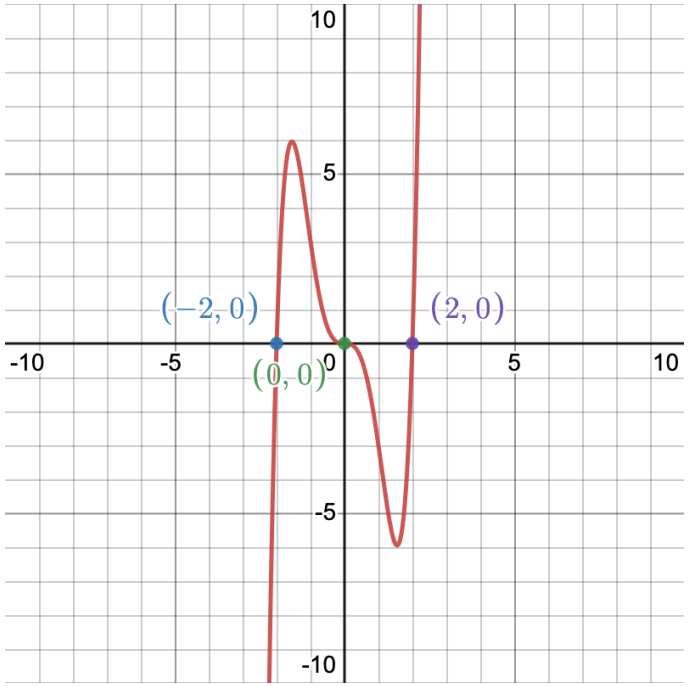
Use the *Zeros* of Polynomial Functions (3 of 4)

- If ***m*** is ODD and greater than ***1***, the graph of a polynomial function CROSSES the *x*-axis at **(r, 0)** mimicking the graph of a cubic function.



or

Example 2:

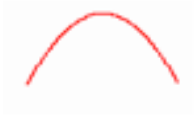


Graph of the function
$f(x) = (x - 0)^3 (x - (-2)) (x - 2)$

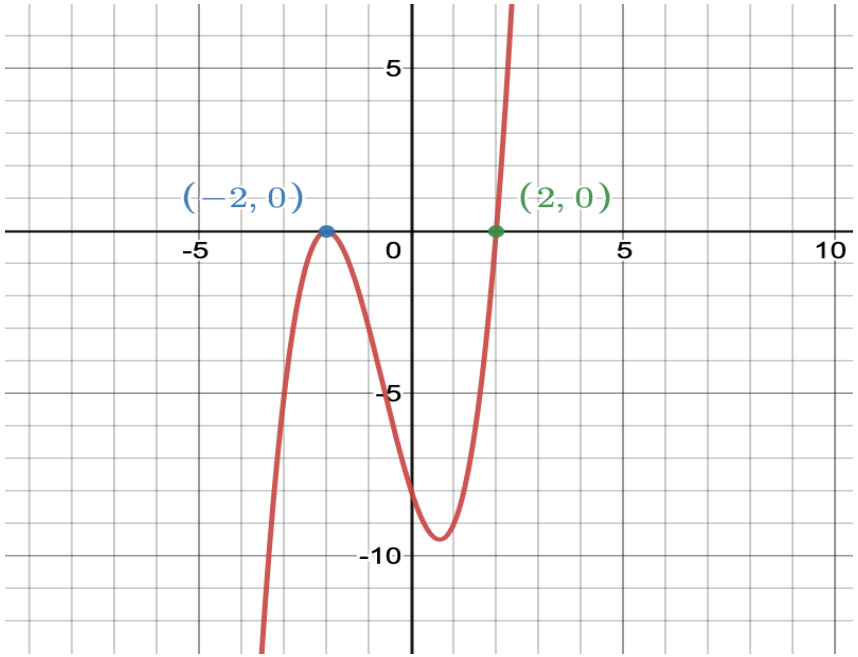
Note that the graph crosses the *x*-axis at (0, 0) mimicking the graph of a cubic function,

Use the *Zeros* of Polynomial Functions (4 of 4)

- If ***m*** is EVEN, the graph of a polynomial function TOUCHES the *x*-axis at **(r, 0)** mimicking the graph of a square function (parabola).


or


Example 3:



Graph of the function
$f(x) = (x - (-2))^2 (x - 2)$

Note that the graph touches the *x*-axis at (– 2, 0) mimicking the graph of a square function.

2. Find the *Zeros* of Factorable Polynomial Functions

In this course we will only find *Zeros* of certain factorable polynomial functions. Therefore, we must recall some factoring techniques, but also the *Quadratic Formula* and the *Square Root Property*. If necessary, review the "Factoring" lesson 10PRE and the "Quadratic Equations" lesson 10.

Algebraic Strategy:

1. Replace the dependent variable in the polynomial function with 0. We end up with a polynomial equation in one variable.
2. Write the polynomial equation as a product of factors by using factoring techniques.
3. Apply the *Zero Product Principle* to solve the equation. The solutions are the *Zeros*. They can be real or imaginary. More factoring, the *Quadratic Formula,* or the *Square Root Property* might have to be used in the process.

Be sure to study the problems located in the "Examples" document!