**5.2 Polynomials, Linear Factors, and Zeros**

Objectives: To Analyze the Factored form of a Polynomial.

To write a Polynomial function from its Zeros.

We are going to use very similar methods that we learned from factoring last chapter in order to factor and solve bigger polynomials.

**Given the polynomial, P(x)=anxn + an-1xn-1 + … + a1x + a0**

**If we are told that (x-b) is a linear factor of P(x) then we know that**

**b is a zero of the polynomial function y=P(x)**

**b is a root (solution, zero) of the polynomial equation P(x)=0**

**b is an x-intercept of the graph of y=P(x)**

Ex. 1

Writing a Polynomial in Factored Form:

We could take this a step further, if we we’re going to solve this instead of just factor we’d simply apply the Zero Product Property. Since our degree is 3 we know we’d have 3 solutions/zeros/roots. We set each piece equal to zero and solve.

**Therefore, .**

We now have enough information to get started on a graph of this function if we wanted.

Side Note: In general, b is a zero of multiplicity n means that x-b appears n times as a factor.

Example: (x+4)(x+4)(x-5)(x-5)(x-5)(x+7)

**The zeros are x=-4 (multiplicity of 2) and x=5 (multiplicity of 3)**

**and x=-7**

**Using Zeros to Write Polynomial Functions**

If k is a zero, then we know x – k is a factor.

If we know a, b, and c are the zeros, then:

f(x) = (x – a)(x – b)(x – c)

*Examples:*

*Write a polynomial function of least degree that has real coefficients, the given zeros, and a leading coefficient of 1*

2, 1, 4 -5, 2, -2

Note: The complex zeros of a polynomial function with real coefficients always occur in complex conjugate pairs

If a + bi is a zero, then a – bi must also be a zero.

What are the other roots?

4, 4, 2 + i 2, -6i

HMWK: page 293 #1-6, 7-23 (odd), 27-31 (odd)