ALGEBRA 4

Day 45

Bell Work: $f(x) = 2x^2 + 12x - 31x^2 - 8 - 3x^4$

- Standard Form:
- Lead Coefficient:
- Constant:
- Degree:
- End Behavior:

From Last Time

page 285 #3-5, 9-27 (odd), 39, 43, 48

***For 9–27 and 43 change directions to:

Write in Standard Form, Identify the Degree, Lead Coefficient, Constant, and End Behavior

5.2 Polynomials, Linear Factors, and Zeros

- Objective:
  - *To Analyze the Factored form of a Polynomial.*
  - *To write a Polynomial function from its Zeros.*

Given a polynomial P(x)…

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

- **b is a zero of the polynomial function P(x)**
- **b is a root (solution, zero) of the polynomial equation P(x)=0**
- **b is an x-intercept of the graph of P(x)**

What the heck did that mean?!

Think back to factoring: $x^2 + 2x - 15 = (x + 5)(x - 3)$

Since (x+5)(x–3) are factors then we know the roots can be found at: x+5=0 → **x= -5** and x–3=0 → **x= 3**

These -5 and 3 values are the b that was mentioned on the previous slide.

Expand this concept…

$$(x+4)(x-5)(x-1)=0$$

Do we know the roots before graphing?

Graph it… did it touch the x-axis where you expected it to?

Go Deeper… Split it up!

$(x + 4) = 0$ $(x - 5) = 0$ $(x - 1) = 0$

If you graph all 3 of these where do the 3 lines touch?

Graph $(x + 4)(x - 5)(x - 1)$ at the same time.

Why does this happen?

How would it change if we were asked to solve:

$x(x + 4)(x - 5)(x - 1)(x + 2) = 0$? Why?

(If needed: Split it up and graph the factors individually)

Writing a Polynomial in Factored Form: $x^3 + 5x^2 + 6x$

- Hint: Find the GCF

Writing a Polynomial in Factored Form:

$$x^3 + 5x^2 + 6x$$

$x(x^2 + 5x + 6)$ → *Factor out GCF (Graph at this stage)*

$\boldsymbol{x(x+3)(x+2)}$ → Factor using method from before… what multiplies to c and adds to b

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How could we have used the roots of the original graph to help us factor?

Thinking ahead…
(more for next time than this time)

- *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.*
- Do the roots match the factored form?
- **Therefore,** $\boldsymbol{x = 0, x = -3 \ and \ x = -2.}$

<u>Using Zeros to Write Polynomial Functions</u>

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

For Example…

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

$f(x) = (x - a)(x - b)(x + c)$

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

Zeros at: 2, -1, 4

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

Zeros at: 2, -1, 4

$(x-2)(x+1)(x-4)$ ← at least get here today

$(x^2-x-2)(x-4)$

$\boldsymbol{\left(x^3-5x^2+2x+8\right)}$ ← this is the ultimate goal though

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.

Example: Identify all roots:

1.) If 4, -3, and -5i are roots?

2.) If 6, 4 + 3i are roots?

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.

Example: Identify all roots:

1.) If 4, -3, and -5i are roots? **5i is also a root**

2.) If 6, 4 + 3i are roots? **4 – 3i is also a root**

For Next Time

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