Bell Work

Tell me anything that you know about P(x).

$$P(x) = x^5 - x^4 - 3x^3 + 3x^2 - 4x + 4 = 0$$

From Last Time…

- Pg 157 #55, 59, 61, 67, 69, 75
- Pg 146 #48, 51

More so for discussion next time…

- Pg 164 #21, 31, 51, 69, 97

PRE-CALC TRIG

Day 16

2.5 Zeros of Polynomial Functions

- **Objective:** Use Fundamental Theorem of Algebra to determine number of solutions and then find the zeros.

The Fundamental Theorem of Algebra

- If f(x) is a polynomial of degree n where $n \geq 0$, then the equation $f(x) = 0$ has exactly n roots, including multiple and complex roots.

- In other words: Any n^{th} degree polynomial function has exactly n zeros

Bell Work Explained:

- What are the roots for the following equation?

$P(x) = x^5 - x^4 - 3x^3 + 3x^2 - 4x + 4 = 0$

There are 5 zeros (solutions) because the degree is 5.

Graph to find the real ones: 1 , 2, -2 (so 2 must be imaginary…)

How to find the imaginary:

- Step2: Since P(1)=0 we know it is a root (Remainder Thm) and therefore x-1 is a factor. Use synthetic division to factor out x-1.

$$x^5 - x^4 - 3x^3 + 3x^2 - 4x + 4$$

$$
\begin{array}{lcccccc}
1 & & 1 & 0 & -3 & 0 & -4 \\
\hline
 & 1 & 0 & -3 & 0 & -4 & 0 \\
2 & & 2 & 4 & 2 & 4 & \\
\hline
 & 1 & 2 & 1 & 2 & 0 & \\
-2 & -2 & 0 & -2 & & & \\
\hline
 & 1 & 0 & 1 & 0 & &
\end{array}
$$

Therefore, (x-1)(x-2)(x+2)$(x^2 + 1) = 0$ => $= (x-1)(x+2)(x-2)(x+i)(x-i)$ = 0

$\mathit{The\ roots\ are}\ 1, -2, 2, -i\ \mathit{and}\ i$

Find all Zeros

- $x^5 - x^4 - 7x^3 + 7x^2 - 18x + 18 = 0$

- $x^4 + 2x^3 - 4x^2 - 7x - 2 = 0$

For next time…

- Pg 176 #9, 19, 27, 31, 44, 71, 77, 113, 118

Additional Information

The Rational Zero Theorem;

If $f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots + a_1 x + a_0$ has integer coefficients, then every rational zero of f(x) has the following form:

$$\frac{p}{q} = \frac{\text{factor of constant term } a_0}{\text{factor of leading coefficent } a_n}$$

Conjugate Pairs

Let f(x) be a polynomial function that has real coefficients. If a+bi, where b isn't 0, is a zero of the function, the conjugate a-bi is also a zero of the function.