4.3 Factor Theorem

Warmup

Factor the following polynomials:

1) $x^3-2x^2+6x-12$

$x^2(x-2)+6(x-2) \rightarrow (x^2+6)(x-2)$

2) x^3-6x^2-x+30 grouping doesn't work

3) $(x^3+x^2-8x-12) \div (x+2)$

$$\begin{array}{r} x^2-x-6 \\ x+2 \overline{)\, x^3+x^2-8x-12} \\ -(x^3+2x^2) \\ \hline -x^2-8x \\ -(-x^2-2x) \\ \hline -6x-12 \\ -(-6x-12) \\ \hline 0 \end{array}$$

$$\begin{array}{c|cccc} & x^3 & x^2 & x & c \\ -2 & 1 & 1 & -8 & -12 \\ & \downarrow & -2 & 2 & 12 \\ \hline & 1 & -1 & -6 & 0 \end{array}$$

x^2-x-6

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Daily Agenda

Learning Target:

I can use the factor theorem to factor higher order polynomials.

Homework
4.3 WS

Assessments
4.1 to 4.4 Quiz 11/4
Unit 4 Test 11/14

The best way to cheer yourself up is to try to cheer somebody el
-Mark Twain

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4.3 Factor Theorem

Why do we need long/synthetic division?

(x-b) is a factor of P(x) if and only if P(b)=0

Look at the factors of the constant term

- Substitute for x
- If P(b)=0, then x is a zero
- Use division to "depress" the equation

and factor completely

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Factor Completely given a zero

$x^3-6x^2-x+30; \quad x=-2$

$$\begin{array}{c|cccc} & x^3 & x^2 & x & c \\ -2 & 1 & -6 & -1 & 30 \\ & \downarrow & -2 & 16 & -30 \\ \hline & 1 & -8 & 15 & 0 \end{array}$$

$(x+2)(x^2-8x+15)$

$(x+2)(x-3)(x-5)$

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Factor Completely and list all zeros

$x^3+x^2-8x-12$

$$\begin{array}{c|cccc} & x^3 & x^2 & x & c \\ 3 & 1 & 1 & -8 & -12 \\ & \downarrow & 3 & 12 & 12 \\ \hline & 1 & 4 & 4 & 0 \end{array}$$

$(x-3)(x^2+4x+4)$

Possible Zeros: $\pm 1, 12, 2, 6, 3, 4$

Factors: $(x-3)(x+2)(x+2)$

Zeros: $3, -2$

$$\begin{array}{c|cccc} & 1 & 1 & -8 & -12 \\ -2 & \downarrow & -2 & 2 & 12 \\ \hline & 1 & -1 & -6 & 0 \end{array}$$

$(x+2)(x^2-x-6)$

$(x+2)(x+2)(x-3)$

Zero: $x=-2$

$(x+2)=0$

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Factor Completely and list all zeros

$x^5-5x^4+10x^3-10x^2+5x-1$

Possible Zeros: ± 1

$$\begin{array}{c|cccccc} & x^5 & x^4 & x^3 & x^2 & x & c \\ 1 & 1 & -5 & 10 & -10 & 5 & -1 \\ & \downarrow & 1 & -4 & 6 & -4 & 1 \\ \hline & 1 & -4 & 6 & -4 & 1 & 0 \end{array}$$

$x^4-4x^3+6x^2-4x+1$

$$\begin{array}{c|cccc} 1 & 1 & -3 & 3 & -1 \\ & \downarrow & 1 & -2 & 1 \\ \hline & 1 & -2 & 1 & 0 \end{array}$$

x^3-3x^2+3x-1

$(x-1)^3(x^2-2x+1) \rightarrow (x-1)^3(x-1)(x-1)$

$\searrow (x-1)^5$

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