Wednesday 12/4/19

1. Grab Notes/Calculator
2. Take out HW/Calendar
3. Begin Warm-up
4. Rational Root Theorem Notes

Topic: Rational Root Theorem **Name:** _____

What am I learning today?

Warm-Up:

Prove the zeros of the polynomial with synthetic division. Then find the remaining zero(s) using the result.

1. $f(x) = 2x^3 - 3x^2 - 32x - 15;\ x = -\frac{1}{2}, x = 5$

2. $3x^3 - 3x^2 - 5x + 5;\ x = 1$

$(x-1)(3x^2-5)$

$2x+6=0$, $2x=-6$, $x=-3$

$3x^2-5=0$, $3x^2=5$, $x=\pm\sqrt{\frac{5}{3}}$

Vocabulary

Rational Root Theorem

The Rational Root Thm. provides a complete list of all possible rational roots of a polynomial equation.

To find all possible rational roots, do the following:

$$\pm\frac{C}{L} = \pm\frac{\text{factors of the constant term}}{\text{factors of the leading coefficient}}$$

PRR Possible Rational Roots.

Ex. 1: Find/list all the possible rational roots of the following polynomials.

a. $f(x) = 3x^3 - 3x^2 + 15x - 40$

C(40): 4, 10, 20, 2, 5, 8, 1, 40

L(3): 1, 3

PRR: $\pm 4, \pm\frac{4}{3}, \pm 10, \pm\frac{10}{3}, \pm 20, \pm\frac{20}{3}, \ldots$

b. $f(x) = -15x^4 + 3x^3 - 9x^2 - x + 24$

C(24): 1, 24, 2, 12, 4, 6, 8, 3

L(-15): 5, 3, 1, 15

PRR: $\pm\frac{1}{5}, \pm\frac{1}{3}, \pm 1, \pm\frac{1}{15}, \pm\frac{24}{5}, \pm 8, \pm 24, \pm\frac{8}{5}, \ldots$

Recall

Writing Zeros as Factors

Recall from a previous unit how we wrote zeros as factors so we could write a polynomial in factored form.

Ex. 2: Write the following zeros/roots/x-intercepts as a polynomial in factored form.

a. $x = \frac{2}{3}, x = -4, x = 3$

$3x = 2$, $3x-2=0$, $x=-4$, $x+4$, $x=3$, $x-3$

$f(x) = (3x-2)(x+4)(x-3)$

b. $x = 0, x = -\frac{5}{2}, x = -2, x = 1$

$2x = -5$, $2x+5=0$, $x=-2$, $x+2=0$, $x=1$, $x-1=0$

$f(x) = (x)(2x+5)(x+2)(x-1)$

Topic: Rational Root Theorem **Date:** _____

Steps

Finding All Zeros and Writing in Factored Form

Steps to find the zeros of a polynomial and use the zeros to write the polynomial in factored form:

1. Find/list all the possible rational roots ($\pm\frac{c}{L}$)
2. Use the calculator to find the rational roots (see steps below)
3. Prove the zeros from the calculator are zeros/roots using synthetic division.
4. Solve for any missing zeros (using the last line from synthetic division).
5. Use found zeros to write in factored form.

CALCULATOR STEPS:
1. Press [table] , select **Edit Function,** enter a functions and press [enter] .
2. Select **Table Start** and **Table Step** values, then hit CALC .

Example

C(15): 1,15,3,5
L(1): 1

Ex. 3: List all possible rational roots. Then use a calculator, synthetic division and factoring to find all zeros & write in factored form (no fractions).

$f(x) = x^3 - x^2 - 17x - 15$ (L, C)

PRR: $\pm1, \pm15, \pm3, \pm5$

Zeros: $x=-1, x=-3, x=5$

Factored Form: $(x+1)(x+3)(x-5)$

f(x) = $(x+1)(x+3)(x-5)$

-1 | 1 -1 -17 -15
↓ -1 2 15
-3 | 1 -2 -15 0
↓ -3 15
5 | 1 -5 0
↓ 5
1 0

Example

C(15): 5,3,1,15
L(2): 1,2

Ex. 4: List all possible rational roots. Then use a calculator, synthetic division and factoring to find all zeros & write in factored form (no fractions).

$f(x) = 2x^4 + 11x^3 + 13x^2 - 11x - 15$ (L, C)

PRR: $\pm5, \pm\frac{5}{2}, \pm3, \pm\frac{3}{2}, \pm1, \pm\frac{1}{2}, \pm15, \pm\frac{15}{2}$

Zeros: $x=1, x=-3, x=-1, x=-\frac{5}{2}$

Factored Form:

f(x) = $(x-1)(x+3)(x+1)(2x+5)$

1 | 2 11 13 -11 -15
↓ 2 13 26 15
-3 | 2 13 26 15 0
↓ -6 -21 -15
-1 | 2 7 5 0
↓ -2 -5
2 5 0

$2x+5=0$
$2x=-5$
$x=-\frac{5}{2}$

You Try

Ex. 5: List all possible rational roots. Then use a calculator, synthetic division and factoring to find all zeros & write in factored form (no fractions).

$f(x) = 5x^3 + 2x^2 - 45x - 18$

PRR:

Zeros: _____

Factored Form:

f(x) = _____