Warm Up

How many possible roots are there for the following polynomial, and what *could* they be?

3 roots

$y = 2x^3 - 5x^2 + 3x - 5$

$\pm 5, \pm 1, \pm \frac{1}{2}, \pm \frac{5}{2}$

$-\frac{5}{2}, \frac{5}{2}, -1, 1$

Objective: SWBAT solve polynomial functions using synthetic division, factoring, and the quadratic formula

Agenda:

$\div 3x^2 - 2$

$\div (x - a)$

- Warm Up
- Remark
- Review: Synthetic Division, Quadratic Formula
- Gallery Crawl
- Discussion
- Practice
- Reflection

Remark: Notation

In precalculus, we will use functions of the form:

$f(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x + a_0$

a_n is the lead coefficient, and a_0 is the constant term.

So for quadratics, $ax^2 + bx + c$ becomes $a_2 x^2 + a_1 x + a_0$

This is how most mathematicians talk about coefficients, and it makes some formulas easier to write.

Practice: Quadratic Formula $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x^2 - 3x = 4$

$x^2 - 7x = -12$

$8x = 2x^2 + 5$

$3x^2 = 5x - 4$

$-8x \quad -8x$

$0 = 2x^2 - 8x + 5$

$\frac{+8 \pm \sqrt{64 - 40}}{4}$

$x = 3.22, 0.77$

Practice: Synthetic Division

$(x^3 + 8x^2 + 19x + 13) \div (x + 3)$

-3	1	8	19	13
	-3	-15	-12
1	5	4	1

$x^2 + 5x + 4 + \frac{1}{x+3}$

$(2x^7 - 1) \div (x + 1)$

-1	2	0	0	0	0	0	0	-1
	-2	2	-2	2	-2	2	-2
2	-2	2	-2	2	-2	2	-3

$2x^6 - 2x^5 + 2x^4 - 2x^3 + 2x^2 - 2x + 2 - \frac{3}{x+1}$

Gallery Crawl

Take a marker and go to the different stations. At each station, make comments about how the problem is being solved using the "I notice..." "I wonder..." stems. (6 min)

Now go back to your desk and answer these questions in your notes: (3 min)

1. What patterns do you see in the problems being solved?
2. What do you think the steps are for solving higher-order polynomials?

Discussion: Steps for Solving Polynomials

1. Discuss how you would *solve* a higher-order polynomial with your partner.

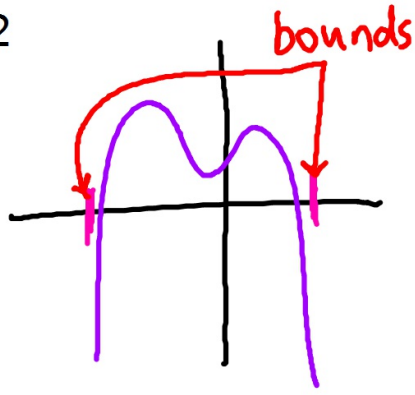
2. With the whole class, decide what the steps should be and write them on poster paper. *One* person will do the writing.

Notes: Solving Higher-Order Polynomials

1. Use the graph & rational root theorem to find what the roots might be
   (if the RRT gives choices outside the bounds of what the graph says is possible, throw them out)

2. Use synthetic division with those roots until the quotient (result) is quadratic

3. Use the quadratic formula to find the last 2



Practice Problem

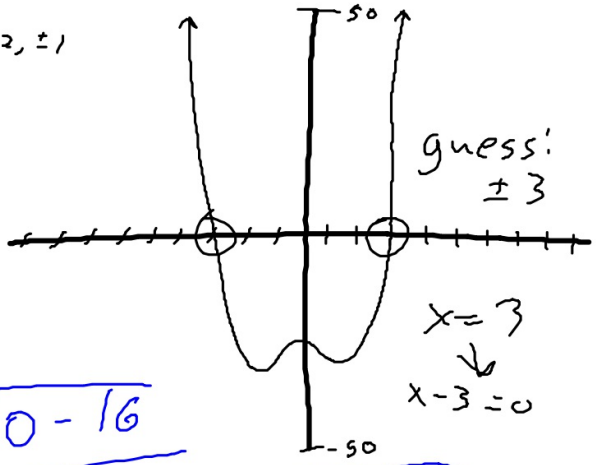
Solve: $f(x) = x^4 - 5x^2 - 36$

find all roots!

RRT: $\pm 36, \pm 18, \pm 12, \pm 9, \pm 6, \pm 3, \pm 2, \pm 1, \pm 4,$

3	1	0	−5	0	−36
		3	9	12	36
−3	1	3	4	12	0
		−3	0	−12	
	1	0	4	0	

$x^2 + 4$



$$\frac{0 \pm \sqrt{0-16}}{2} = \frac{\pm 4i}{2} = 2i, -2i, 3, -3$$

Practice

Algebra 2: pg. 322 #8-25 odd

Reflection

Why is the Rational Root Theorem relevant to today's lesson?