Warm-up

Thursday, March 5, 2015

1. Put the expression $2x^2 - 12x + 22$ in vertex form.

2. Solve the equation $2\sqrt{x+1} + 2 = 8$

3. Factor $2x^3 - 98x$ *Hint: GCF*

Objectives

Find the roots of higher order polynomials.

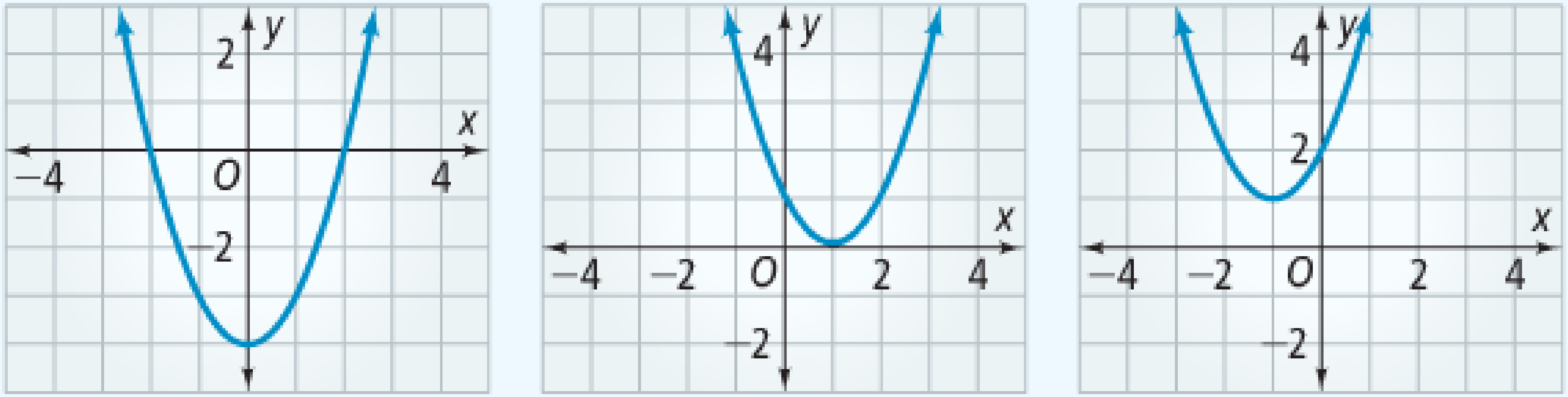
Find complex roots of higher order polynomials.

Homework

Packet Page 12-13; 1-3, 5-7 and 10

Essential Understanding The degree of a polynomial equation tells you how many roots the equation has.

It is easy to see graphically that every polynomial function of degree 1 has a single zero, the *x*-intercept. However, there appear to be three possibilities for polynomials of degree 2. They correspond to these three graphs:



$y = x^2 - 4$
Two real zeros

$y = x^2 - 2x + 1$
One real zero

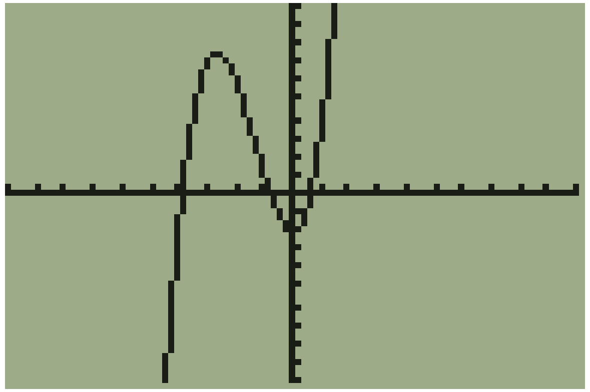
$y = x^2 + 2x + 2$
No real zeros

take note

Theorem The Fundamental Theorem of Algebra

If $P(x)$ is a polynomial of degree $n \geq 1$, then $P(x) = 0$ has exactly n roots, including multiple and complex roots.

So $p(x) = x^3 + 4x^2 - 2$ has **3 roots**



So $f(x) = x^4 + 3x^2 - 7$ has **4 roots**

So $g(x) = 7x^{102} + 43x^{27} - x$ has **102 roots**

Let's play how many roots?

Show me with your fingers…

$f(x) = x^2 + 2$

$f(x) = 7x^5 + 4x^4 + 3x - 3$

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

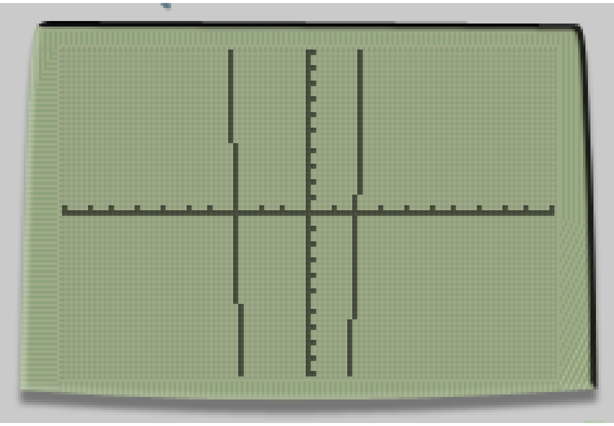
$f(x) = x^{23} + 4x^6 - 3$

So how do we find all these roots?

Find all the roots of $y = x^4 + x^3 - 2x^2 + 4x - 24$

First of all, how many roots are there going to be? 4

Thank you FTA!



Enter the equation into your calculator and graph.

How many roots/zeros do you see? 2

What are they? $x = -3$ and $x = 2$

So where are the other 2 roots? *IDK*

Finding the other roots

Since we know two of the roots, we can use synthetic division to factor them out of the original function. We will end up with a quadratic.

2	1	1	-2	4	-24
		2	6	8	24
-3	1	3	4	12	0
		-3	0	-12	
	1	0	4	0	

$$x^4 + x^3 - 2x^2 + 4x - 24$$

$$x^3 + 3x^2 + 4x + 12$$

$$x^2 + 4$$

Finding the other roots

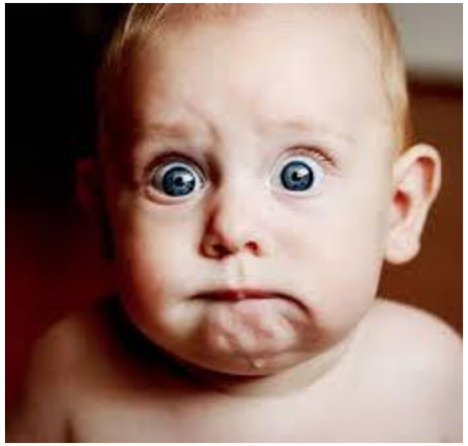
Now use quadratic formula to find the remaining two roots.

$$\boldsymbol{x^2 + 4}$$

$$\frac{-0 \pm \sqrt{0^2 - 4(1)(4)}}{2(1)} = \frac{\pm\sqrt{-16}}{2} = \frac{\pm 4i}{2} = \pm 2i$$

So the four roots are 2, -3, 2i and -2i

Yikes that's a lot of work!



What are all the zeros of $f(x) = x^4 + x^3 - 7x^2 - 9x - 18$

Graph it first.

This example is on the handout from today.

You do 1 and 2 on page 12 of your packet.

1. $x^4 - 8x^3 + 11x^2 + 40x - 80$

2. $4x^4 - x^3 - 12x^2 + 4x - 16$

Work on your homework.