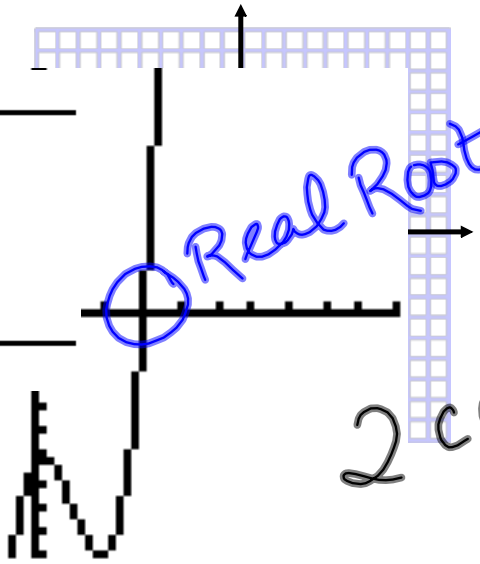
Warm Up:

Solve $2x^3 - 6x^2 + 2x - 6 = 0$ graphically.

X	Y_1
-2	-50
-1	-16
0	-6
1	-8
2	-10
3	0
4	34

X=4



1 Real Root @ $x = 3$

2 complex Roots

*Solving **Higher Degree Polynomials** Algebraically*

Remember the equation from the warm-up:

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

$2x^2(x-3) + 2(x-3) = 0$

$(x-3)(2x^2+2) = 0$

$(x-3)(2)(x^2+1) = 0$

$x-3=0 \quad 2=0 \quad x^2+1=0$

$x=3$

$\sqrt{x^2} = \sqrt{-1}$

$x = \pm i$

$\{3, i, -i\}$

What is the degree of that equation?

3 (highest exp)

So how many solutions should it technically have?

3

How can this be?

one Real
two imaginary

Solve the following algebraically (explain the different procedures):

4 terms: Factor by Grouping

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

$x^2(x-1) + 3(x-1) = 0$

$(x^2+3)(x-1) = 0$

$x^2+3=0 \quad x-1=0$

$-3 \quad -3 \qquad x=1$

$\sqrt{x^2} = \pm\sqrt{-3}$

$x = \pm\sqrt{3}\,i$

3 terms: GCF, then quad.

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

$x(x^2+2x-2) = 0$

$x=0 \qquad 1x^2+2x-2=0$

$x = \dfrac{-2 \pm \sqrt{4+8}}{2}$

$\sqrt{12}$
$\sqrt{4}\sqrt{3}$
$2\sqrt{3}$

$x = \dfrac{-2 \pm \sqrt{12}}{2}$

$x = -\dfrac{2}{2} \pm \dfrac{2\sqrt{3}}{2}$

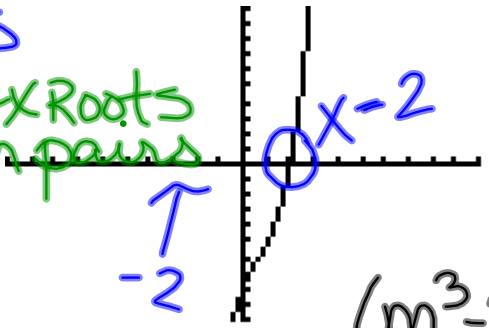
$x = -1 \pm \sqrt{3}$

Given $c(m) = m^3 - 2m^2 + 4m - 8$, the solution of $c(m) = 0$ is

1) ± 2
2) 2, only
3) $2i, 2$
4) $\pm 2i, 2$

3 Roots

Complex Roots come in pairs



$(m^3 - 2m^2) + (4m - 8)$

$m^2(m-2) + 4(m-2)$

$(m-2)(m^2+4)$

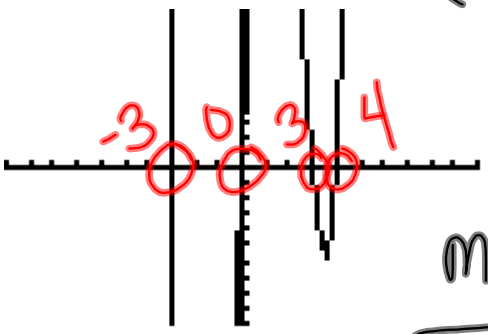
$m-2=0 \quad m^2+4=0$

$m=2 \quad \sqrt{m^2} = \sqrt{-4}$

$m = \pm 2i$

The zeros for $f(x) = x^4 - 4x^3 - 9x^2 + 36x$ are

1) $\{0, \pm 3, 4\}$
2) $\{0, 3, 4\}$
3) $\{0, \pm 3, -4\}$
4) $\{0, 3, -4\}$



More Practice:

$x^4 + 4x^3 + 4x^2 = -16x$

$8x^3 + 4x^2 - 18x - 9 = 0$

$x^3 - 3x^2 - 4x + 12 = 0$

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

Homework: p. 227 #1, 8, 9, 14, 20

Writing About Mathematics

1. Sharon said that if $f(x)$ is a polynomial function and $f(a) = 0$, then a is a root of the function. Do you agree with Sharon? Explain why or why not.

Developing Skills

In 3–18, find all roots of each given function by factoring or by using the quadratic formula.

8. $f(x) = -2x^3 + 6x^2 - x + 3$ **9.** $f(x) = x^4 - 5x^2 + 4$ **14.** $f(x) = x^5 - x^4 - 2x^3$

In 19–28: **a.** Find $f(a)$ for each given function. **b.** Is a a root of the function?

20. $f(x) = x^3 + 4x$, and $a = -2$