Your Name

Mrs. Theo

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Notes

Complex Zeros

Quadratic Formula

Day 2

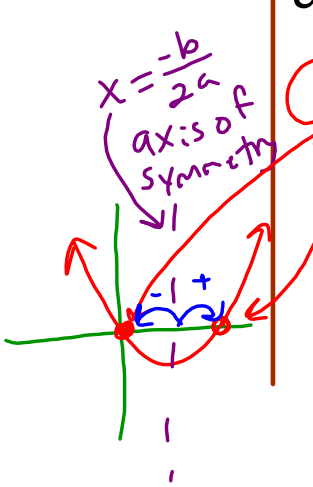
Quadratic Formula

When you can't factor or it would take a long time to find the factors, you can find the x-intercept solutions using

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

x = and x =

(x,0) and (x,0)



The $\pm \sqrt{(b^2 - 4ac)}/2a$ is how much to the left and right of the Axis of Symmetry you go to reach the x-intercept points! *Why?*

$ax^2 + bx + c = 0$

Discriminant D:

$b^2 - 4ac$ (The part under the root)

It Discriminates the type of solutions a Quadratic equations has

1 Rational Root

$b^2 - 4ac = 0$ There is just the -b/2a part, no ±

ex. $x^2 - 6x + 9$ D: $(-6)^2-4(1)(9)=36-36$ D = 0

a=1 b=-6 c=9 $(x-3)^2$

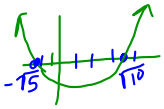
2 Rational Roots

$b^2 - 4ac$ = a perfect square

ex. $2x^2 - 6x + 4$ D: $(-6)^2-4(2)(4)$ $36-32=4$ D: 4

a=2 b=-6 c=4

2 Irrational Roots



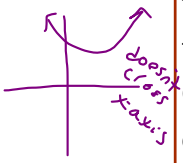
$b^2 - 4ac$ = not a perfect square

You will be left with a number under the radical

ex. $x^2 - 6x + 7$ D: $(-6)^2-4(1)(7)$ D: $36-28$ D: 8

a=1 b=-6 c=7

2 Complex Roots



$b^2 - 4ac < 0$ (its negative under √)

The solutions are complex conjugates with i

They come in pairs (Conjugate Zeros Theorem)

Graph will not show them.

ex. $x^2 + 16 = 0$ (+0x) ex. $x^2 - 6x + 10 = 0$

a=1 b=0 c=16

D: $0^2-4(1)(16)$

D: $0-64$

D: -64

Quad Formula

Real Roots

ex. $3x^2 - 7x - 8 = 0$ must = 0

a=3 b=-7 c=-8

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$x = \frac{-(-7) \pm \sqrt{(-7)^2-4(3)(-8)}}{2(3)}$$

$-7^2 = -1 \cdot 7 \cdot 7 = -49$

VS

$(-7)^2 = (-7)(-7) = 49$

$$x = \frac{7 \pm \sqrt{49+96}}{6}$$

$$x = \frac{7 \pm \sqrt{145}}{6}$$

$$x = \frac{7+\sqrt{145}}{6} \text{ and } x = \frac{7-\sqrt{145}}{6}$$

$$x = \frac{7+12.042}{6} \qquad x = \frac{7-12.042}{6}$$

$x = 3.174$ and $x = -0.840$

Quad Formula

Complex Roots

ex. $2m^2 + 1 = 2m$

$-2m \quad -2m$

$2m^2 - 2m + 1 = 0$

$a=2 \quad b=-2 \quad c=1$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$m = \frac{-(-2) \pm \sqrt{(-2)^2-4(2)(1)}}{2(2)}$$

$$m = \frac{2 \pm \sqrt{4-8}}{4}$$

$$m = \frac{2 \pm \sqrt{-4}}{4}$$

Discriminant is negative ⇒ 2 complex solutions

$\sqrt{-4} = \sqrt{4} \cdot \sqrt{-1}$

$2i$

$$m = \frac{2 \pm 2i}{4}$$

Separate

$$m = \frac{2}{4} \pm \frac{2i}{4}$$

$m = 0.5 \pm 0.5i$ and $m = 0.5 \mp 0.5i$

this is why we have conjugate pairs $\pm\sqrt{-\#}$

Quad Formula

Quad Form Polynomials

ex. $-2k^4 + 7k^2 = -9$

half of

$+9 \quad +9$

$-2k^4 + 7k^2 + 9 = 0$

$a=-2 \quad b=7 \quad c=9$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$k^2 = \frac{-(7) \pm \sqrt{(7)^2-4(-2)(9)}}{2(-2)}$$

$$k^2 = \frac{-7 \pm \sqrt{49+72}}{-4}$$

$$k^2 = \frac{-7 \pm \sqrt{121}}{-4}$$

Separate

$$k^2 = \frac{-7+11}{-4} \quad \text{and} \quad k^2 = \frac{-7-11}{-4}$$

$\sqrt{k^2} = \pm\sqrt{-1}$

$k = i, k = -i$

$\sqrt{k^2} = \pm\sqrt{4.5}$ yes decimal

$k = 2.121, k = -2.121$

Homework: Use the Discriminant to determine the type and amount of solutions. Then Use the quadratic formula to solve.

1. $u^2 - 49 = 0$
2. $s^2 - 5s - 36 = 0$
3. $c^2 - 7c = -3$
4. $a^2 - 9a + 22 = 0$
5. $2x^2 + 5x - 7 = 0$
6. $2p^2 + 5p + 4 = 0$
7. $3t^4 + 2t^2 - 3 = 0$
8. $n^6 - n^3 - 20 = 0$

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1. 2 Rational Solutions: u = 7 and u = -7
2. 2 Rational Solutions: s = -4 and s = 9
3. 2 Irrational Sol: $c = (7 \pm \sqrt{37})/2$

   c = 6.541 and c = 0.459
4. 2 Complex Solutions: $a = (9 \pm i\sqrt{7})2$

   $a = 4.5 + 0.5i\sqrt{7}$ and $a = 4.5 - 0.5i\sqrt{7}$
5. 2 Rational Solutions: x = -3.5 and x = 1
6. 2 Complex Solutions: $p = (-5 \pm i\sqrt{7})/4$

   $p = -1.25 + 0.661i$ and $p = -1.25 - 0.661i$
7. 2 Irrational and 2 Complex Solutions:

   $t^2 = (-2 \pm \sqrt{40})/6$

   t=0.849, t=-0.849, t=1.178i, t= -1.178i
8. 2 Rational and 4 Complex Solutions:

   t=1.710 and t=-1.587 and 4 imaginary solutions (we need to learn about the sum and difference of cubes for those)