

Quadratic equations

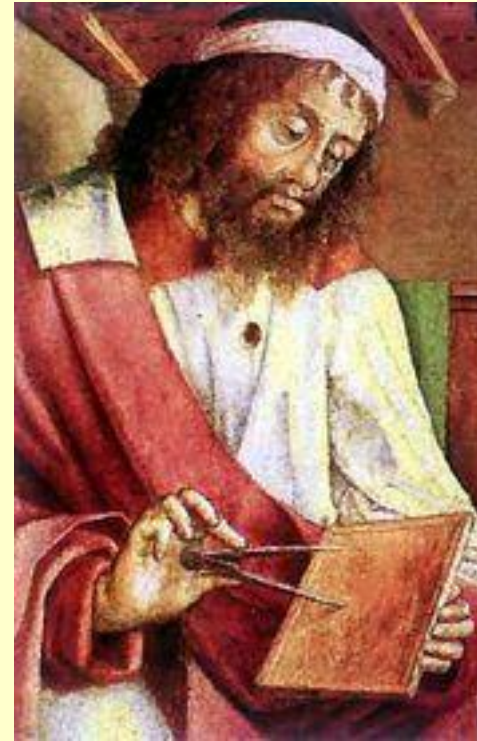
This presentation was created for students in the first year of the 4year course. The quadratic equations may be difficult to solve and it is necessary to understand the way of solving. This way is used also when solving the quadratic inequations or when designing graphs of quadratic functions. Shortly, it is a basic math skill. Parts of this presentation is also used for students in aprenticeship course. They will also use this way of solving and this presentation help them to understand.

History ...

- It is often said, the Babylonian were the first quadratic equations solvers (around 400 years b. c.). However, this is quite reduction, Babylonian did not know the equations in general.
- The algorithm for solving this type of problems by them. The whole Babylonian problems had the positive solutions.

...and more history...

- Euclid developed a geometrical method to determine the solution of the quadratic equations around 300 year b. c.. But, Euclid did not use a word equation or coefficients, his work was absolutely geometrical.



Quadratic equations

Quadratic equation is equation with an unknown x , which we can rearrange to the form:

$$ax^2 + bx + c = 0.$$

$$a, b, c \in R, a \neq 0$$

ax^2 – quadratic member

bx – linear member

c – constant member

The types of the quadratic equations

$ax^2 + bx = 0$... quadratic equation without an absolute member

$ax^2 + c = 0$... strictly quadratic equations

$ax^2 + bx + c = 0$... general quadratic equation

Solving the equation without an absolute member

Solve the equation with an unknown $x \in R$:

$$2x^2 - 18x = 0$$

$$2x(x - 9) = 0$$

$$\Leftrightarrow 2x = 0$$

$$\text{or } x - 9 = 0$$

The solvation is the numbers $\underline{x = 0}$ or $\underline{x = 9}$

The solvation of the strictly quadratic equations

Solve the equation with an unknown $x \in R$: $x^2 - 9 = 0$

The left side we split according to formula: $(x - 3) \cdot (x + 3) = 0$



$\Leftrightarrow x - 3 = 0$ *nebo* $x + 3 = 0$

The solvations are the numbers $x = 3$ or $x = -3$

The solution of the whole quadratic equation

➤ First we have to modify to the form of the general quadratic equation $ax^2 + bx + c = 0$.

We solve of this type a discriminant:

$$D = b^2 - 4.a.c.$$

- if $D > 0$... then $x_{12} = (-b \pm \sqrt{(D)}) / (2a)$... the result is the solutions x_1 and x_2
- if $D = 0$... then $x_{12} = (-b \pm \sqrt{(D)}) / (2a)$... the result is double solution x_{12}
- if $D < 0$... then the equation have no solution in a group of a real numbers.

For the practice ...

The solver of the quadratic equations

The calculator

The relations between the solutions and the coefficients of the quadratic equations

References and links

- <http://natura.baf.cz/natura/2001/7/20010705.html>
- <http://www.matweb.cz/kvadraticke-rovnice>
- <http://www.e-matematika.cz/stredni-skoly/jak-resit-kvadraticke-rovnice.pdf>
- <http://matematika-online-a.kvalitne.cz/kvadraticke-rovnice-a-nerovnice.htm>