

The Arabs: Renaissance of Number and Science

- Persian
- Studied math, astronomy, geography
- Scholar at Baghdad's House of Wisdom



Al-Khwarizmi (c. 680-750)

- Original treatise on arithmetic lost
- Algorism → algorithm
- Use of decimal system
- Synthesis, explanation, refinement

Al-Khwarizmi's Arithmetic

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0	1	2	3	4	5	6	7	8	9	10

- Method:
 - Multiplying denominators to find common ones
 - Express whole numbers as fractions to them
 - Add the two sets of fractions
 - Multiply two fractions ($N \times N$, $D \times D$)
 - Use division to convert into mixed fraction

Fractions

- *A Brief Account of the Methods of al-Jabr and of al-Muqabala*
- *al-Jabr*: transformations
- Knew of negative numbers, but did not recognize them

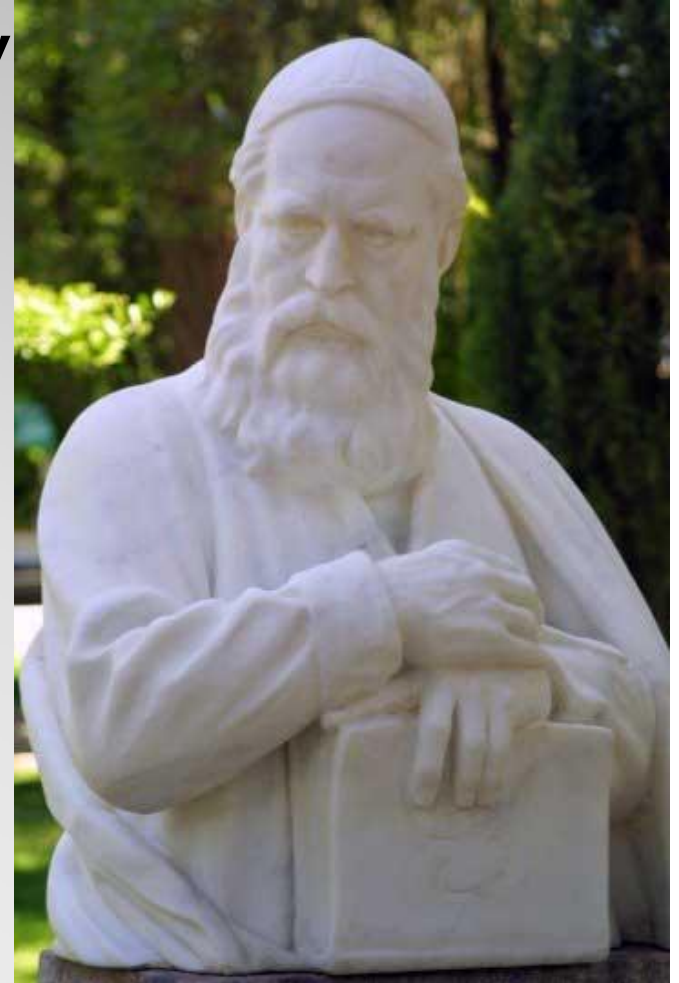


Al-Khwarizmi's Algebra

- 6 types of equations: 5 quadratic, 1 linear
 1. Squares are equal to roots: $x^2=8x$
 2. Squares are equal to a number: $x^2=4$
 3. Roots are equal to a number (linear): $8x=4$
 4. Squares & roots are equal to a number:
 $x^2+4x=12$
 5. Squares & numbers are equal to a number:
 $x^2+4=5x$
 6. Roots & numbers are equal to a square:
 $5x+6=x^2$

Al-Khwarizmi's Theory of Quadratic Equations

- Persian
- Polymath, mathematician, philosopher, astronomer, physician, poet, Sufi
- Court astronomer to Sultan Alp Arslan
- Lunar crater
- Made a calendar, errors only occurred once every 5000 years

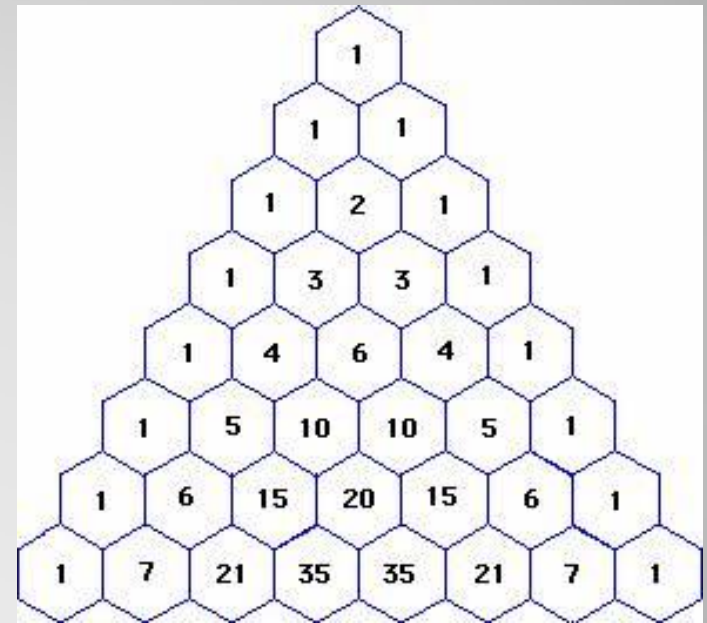


Omar Khayyam

- Formal definition of algebra: use of equations to find the unknown numbers by means of complete polynomials
- Recognized 25 types of equations
 - 14 new, used to solve cubic equations
 - Conic sections, both 2-D and 3-D

Omar Khayyam's Algebra

- Binomial theorem: the sum of 2 numbers is raised to a power
- Used Pascal's triangle (may have taken from Chinese, may have reinvented)



Omar Khayyam and the Binomial Theorem

- Translated works by Babylonians, Egyptians, Greeks, Indians, Chinese
 - Developed algebra and trigonometry
 - Laid foundations of analytical geometry
 - Basic ideas behind invention of logarithms
1. Invented & spread knowledge of the decimal system
 2. Fractions & integers require appropriate definitions
 3. Number systems are possible & interchangeable

The Arabs' Contribution

- <http://jahongirbandb.com/Blog/wp-content/uploads/2010/02/uzb-encounters-002.jpg>
- http://upload.wikimedia.org/wikipedia/commons/2/23/Image-Al-Kit%C4%81b_al-mu%E1%B8%ABta%E1%B9%A3ar_f%C4%AB_%E1%B8%A5is%C4%81b_al-%C4%9Fabr_wa-l-muq%C4%81bala.jpg
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Images / References