Overview.

HS — geometry
— trig
— alg
— calc

Timeline:

2000 BCE

300 — Euclid of Alexandria

0

190 — Heron of Alexandria

300 CE — Diophantus "

Constantine

400 — Hypatia "

500

Library of Alexandria Burn 642 Ruined

800 — al Khorizmi, al Jabr

1000

1200 — Fibonacci

Baghdad. 1494

1500

2000 CE
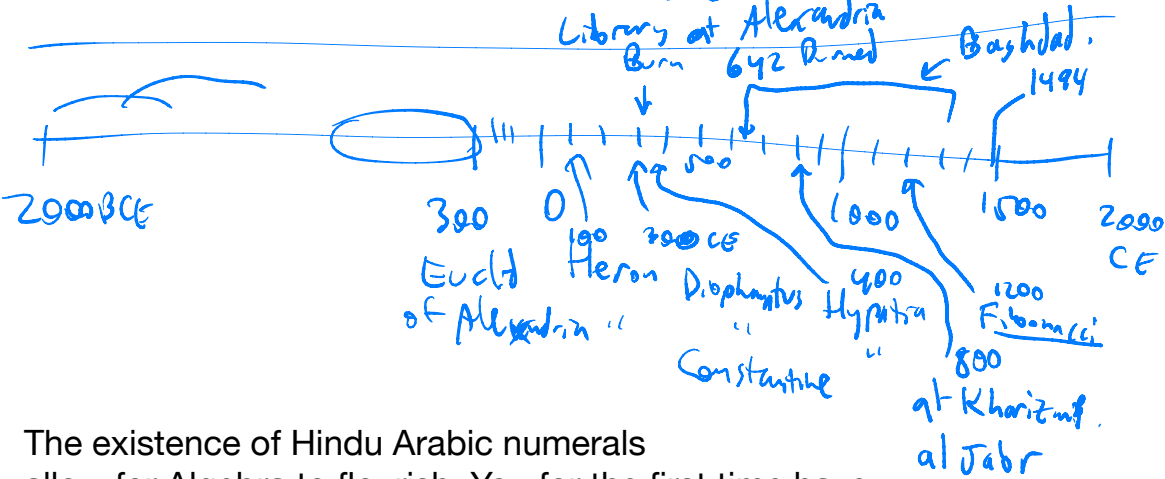
The existence of Hindu Arabic numerals allow for Algebra to flourish. You for the first time have access to a different set of symbols for numbers as opposed to unknown variables.

Summa de Arithmetica geo

1494 : Luca Pacioli : Summa di Arithmetica

gives methods to solve linear equations, quadratic equations.

$$ax + b = 0 \implies x = -b/a.$$

$$ax^2 + bx + c = 0 \implies x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

$$ax^2 + bx = c \qquad ax^2 + c = bx.$$

$$\square \quad \square \quad =$$

There is not One quadratic formula, but many, because they're using diagrams for squares and rectangles, and thinking of adding up areas

Negative numbers don't exist, negative areas don't make sense to them

Pacioli: cubic equations are probably as unsolvable as something like squaring the circle. (Note: he doesn't yet know that the latter really IS unsolvable.)

$$ax^3 + bx^2 + cx + d = 0, \quad x = \underline{\quad\quad}$$

1500   1520s   1600
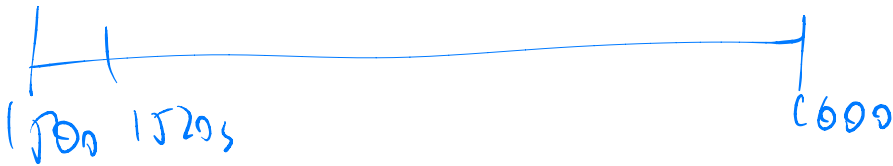
del Ferro: finds a method to solve "depressed" cubics $\left(b = 0\right)$,

Culture: mathematical duels = jobs

Withholding the information = tenure

On del Ferro's deathbed, he tells his method to: Fior

Fior goes and takes the jobs of lots of mathematicians by stumping them with depressed cubics

Fior eventually challenges Tartaglia (1530)

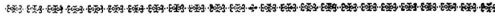Cardano learns the solution to the depressed cubic from Targalia

Ferrari (1535) figurte out how to solve ALL cubics, and Quartic equations too!

Around 1535: Cardano writes a book Ars Magna

qui-

CAPVT XI.

De Cubo & rebus æqualibus Numero.

SCIPIO Ferreus Bononiensis iam an-
nis ab hinc triginta fermè capitulum
hoc inuenit, tradidit verò Anthonio Ma-
riæ Florido Veneto, qui cùm in certamen
cum Nicolao Tartalea Brixellenſe aliquan-
do veniſſet, occaſionem dedit; vt Nicolaus
inuenerit & ipſe, qui cum nobis roganti-
bus tradidiſſet, ſuppreſſà demonſtratione,
freti hoc auxilio, demonſtrationem quæſiui-
mus, eámque in modos, quod difficillimum
fuit, redactam ſic ſubiiciemus.

DEMONSTRATIO.

Sit igitur exempli cauſà cubus g h, &
ſexcuplum lateris g h æquale 20. & ponam

By 1550, all of Europe knows how to solve cubic, and quartic equations

What degree eqns we can solve

$n \sim 2$
$n = 1$

2000 BCE   0   1500   1810   2000
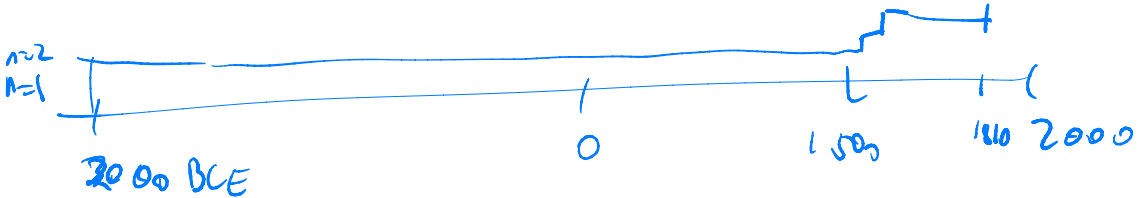
Next big target: solution to quintic equation???

1810: Ruffini + Abel general quintic equation DOES NOT EXIST

$$x^5 = 2. \qquad x = \sqrt[5]{2}$$

1830s Galois : explains exactly which quintics are or are not solvable