A very brief early history of Islam

(We'll come back to Indian mathematics from time to time, staying in rough chronological order.)

Founded by Muhammad ibn ʾAbdullah (c. 570 - 632AD) after receiving revelations c. 610AD in Mecca. He and his followers left Mecca for Medina in 622AD ("Hegira"), and returned as conquerors in 630 AD. By 632AD, most of the Arabian peninsula had converted to Islam and was unified politically. After his death the leadership of the "Ummah" passed to a series of Caliphs ("Successors to the messenger of God") which position became hereditary in the Umayyad family (661-750).

- moved the capital from Medina to Kufa (in current Iraq).
- they were overthrown in 750 by the Abbasid dynasty (750-1258) moved the capital to Baghdad
- one survivor of the Umayyad's escaped ~~Abd~~ al-Rahman and established a dynasty in Cordoba in Spain.

(By 750 Islamic forces had conquered most of the Iberian peninsula, North Africa inc. Egypt, Syria, Persian Empire, and parts of Northwest India, & parts of central Asia.)

Certain of the Abbasid Caliphs sponsored arts & sciences.

al-Mansur (754-777) had an Indian text on mathematical astronomy translated into Arabic (probably one of Brahmagupta's)

Haroun al-Rashid (786-809) the Caliph who appears in the 1001 Nights.

al-Mamun (813-833) Founded a "House of Wisdom" and recruited scholars and students, and commissioned translations into Arabic, especially from Greek & Hindu sources. [math, science, philosophy, religion]

Probably at the House of Wisdom was

Muhammad ibn Musa al-Kwarizmi [probably alive & active c. 830]

- tried to synthesize various Greek & Indian sources
- wrote a book "Hisab al-jabr w'al-mugabalah"
  i.e. "Book of the Calculation of Restoration & Reduction"
  → the origin of the word "algebra"
- most of it is believed to have been drawn from Brahmagupta's work, but with many practical problems drawn from commerce & division of inheritance

pp. 39-40 in the edition being used in this course.

Fifth Problem.

I have divided ten into two parts; I have then multiplied each of them by itself, and when I had added the products together, the sum was fifty-eight dirhems.

Computation : Suppose one of the two parts to be thing, and the other ten minus thing. Multiply ten minus thing by itself; it is a hundred and a square minus twenty things. Then multiply thing by thing; it is a square. Add both together. The sum is a hundred, plus two squares minus twenty things, which are equal to fifty-eight dirhems. Take now the twenty negative things from the hundred and the two squares, and add them to fifty-eight; then a hundred, plus two squares, are equal to fifty-eight dirhems and twenty things. Reduce this to one square, by taking the moiety of all you have. It is then: fifty dirhems and a square, which are equal to twenty-nine dirhems and ten things. Then reduce this, by taking twenty-nine from fifty; there remains twenty-one and a square, equal to ten things. Halve the number of the roots, it is five; multiply this by itself, it is twenty-five; take from this the twenty one which are connected with the square, the remainder is four. Extract the root, it is two. Subtract this from the moiety of the roots, namely, from five, there remains three. This is one of the portions; the other is seven.

$x \quad 10-x$

$x^2 + (10-x)^2 = 58$

Find x "thing".

$x^2 + 100 - 20x + x^2 = 58$

$2x^2 + 100 = 58 + 20x$

$x^2 + 50 = 29 + 10x$

$x^2 + 21 = 10x$

$x = 5 - \sqrt{25-21} = 5 - \sqrt{4} = 5 - 2 = 3$

$10 - x = 10 - 3 = 7$

Thabit ibn Qurra (826 - 901)

- polymath: wrote on politics, grammar, medicine, biology, engineering, astronomy, geometry, algebra, number theory
- translated many Greek works into Arabic (often with commentaries) (included works by Apollonius, Archimedes, Euclid, and Ptolemy)

- also wrote original works eg devised a formula for generating amicable pairs [integers which are the sums of each other's proper divisors]

$$u = 2^n(3\cdot 2^n - 1)(3\cdot 2^{n-1} - 1) \qquad v = 2^n(9\cdot 2^{2n-1} - 1)$$

These are amicable if $3\cdot 2^n - 1$, $3\cdot 2^{n-1} - 1$, $9\cdot 2^{2n-1} - 1$ are all prime. eg $n = 2$ you get $u = 220$ & $v = 284$.