# A couple of examples of work by other Islamic mathematicians

## Abu Kamil (c. 850 – c. 930 AD)

- wrote a commentary on al-Kwarizmi's *Algebra*
- first to regularly accept irrational numbers both as solutions and as coefficients in algebraic problems

## Problem 10 (of those he added to ~~the~~ his commentary)

The number 10 is divided by a certain number. If the divisor is increased by 3, then the quotient is decreased by $3\frac{3}{4}$. What is the divisor?

$$\frac{10}{x} - 3\frac{3}{4} = \frac{10}{x+3} \quad \text{is} \quad \frac{10}{x} - \frac{10}{x+3} - \frac{15}{4} = 0$$

$$\frac{10}{\cancel{x}}\cancel{x}(x+3) - \frac{10}{\cancel{x+3}}x\cancel{(x+3)} - \frac{15}{4}x(x+3) = 0$$

$$= \cancel{10x} + 30 - \cancel{10x} - \frac{15}{4}(x^2+3x)$$

$$= -\frac{15}{4}x^2 - \frac{45}{4}x + 30$$

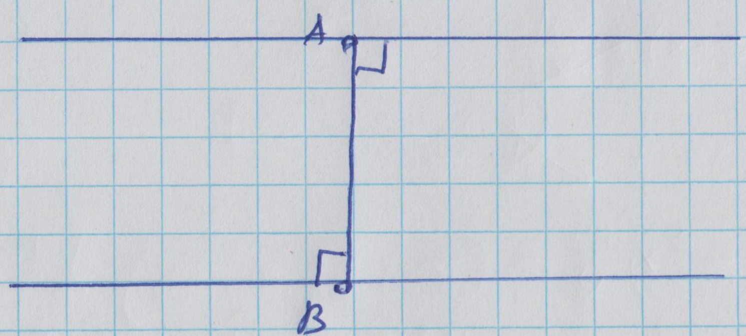
$$\iff 15x^2 + 45x - 120 = 0 \iff x^2 + 3x - 8 = 0$$

# Hasan Ibn al-Haitham ("Alhazen") (c. 965-1040)

Wrote on philosophy, theology, medicine, physics (especially optics), and mathematics.

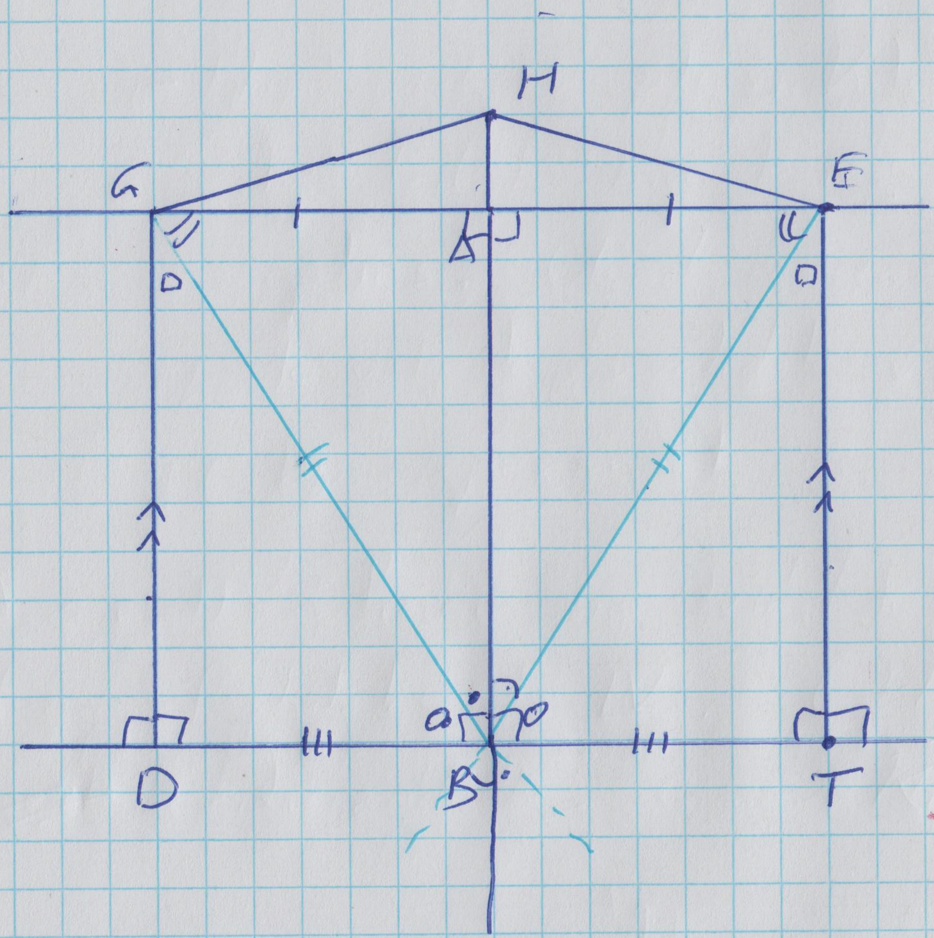
- His work on optics Kitab al-Manazir ("Book of Optics") has led to him being considered the father of modern optics. Used an early form of the scientific method to validate/invalidate various physical theories of optics by experiment.

As a mathematician he tried to prove Euclid's Parallel Postulate from Postulates I-IV. (His attempt was one these criticized by Omar Khayyam.)




Draw perpendiculars to AB at both A & B. Try to argue that these must be parallel to each other & no other line can be...

He plans to show that every perpendicular between the two perpendilars ~~[illegible]~~ to AB is the same length as AB.




Move along the perpendicular to A to the point E & then drop a perpendicular from E to T on the line perpendicular to B. Move the same distance (as from A to E) in the opposit direction to G (on the perpendicular ~~at~~ A) & drop a perpendicular to the perpendicular at B.

First, show $|ET| = |GD|$. Draw GB & EB.

$\Delta AGB \cong \Delta AEB$ (SAS), so $|GB| = |EB|$. Then also $|DB| = |BT|$, & it follows that $\Delta GDB \cong \Delta ETB$ (SAS) so $|GD| = |ET|$.

Suppos $|AB| \neq |ET|$. We'll assume that $|AB| < |ET|$. If you slide ET along BT so T ends up on B, then E ends at some point H on BA past A. Connect H to G & E.

But sliding further brings E to G, so the straight line EG is actually two lines EH & HG ... $\otimes$

What's wrong with this argument?

The main one is the assumption that the collection of points equidistant from a given straight line (and one side of it) is itself a straight line.

True in Euclidean geometry, but you need the Parallel Postulate to prove it.

... so al-Haitham's argument ultimately depends on what he's trying to prove.