What do you need a mathematician for?
Perspectives from the seventeenth century

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1. Introduction: What do you need a mathematician for?

When I suggested the title for my presentation in February, I did not foresee that the question "What do you need a mathematician for?" would, in a variation, be rather hotly debated later this year. The rapid development of artificial intelligence and its increasingly powerful tools, have really hit mathematics and the mathematical community this summer.

I give two examples for this:

(1) The Leiden Declaration on Artificial Intelligence and Mathematics, June 2026,
(2) The proof of one of the Millenium Prize Problems, September 2026.

(1) The Leiden Declaration on Artificial Intelligence and Mathematics:

In early June a group of 16 mathematicians, in consultation with colleagues and math organizations worldwide, published the Leiden Declaration on Artificial Intelligence and Mathematics. The declaration "calls for action to address the challenges posed by the use of artificial intelligence within mathematics research."

(2) The proof of one of the Millenium Prize Problems, in September 2026:

In 2000 the Clay Mathematics Institute in Cambridge, Massachusetts, established seven *Prize Problems* "in order to celebrate mathematics in the new millennium, […] with one million US dollars allocated to the solution of each problem." Naturally, these problems have drawn a lot of attention in the mathematics community. Recently, a solution for one of the problems, the Navier-Stokes equation, has triggered the discussion about the relationship between mathematics and AI, as well as the big AI players

I have mentioned these examples because they illustrate that the question "What do you need a mathematician for?" is very timely.

2. What are the early modern mathematical sciences?

In early modern Europe the term *mathematical sciences* was used to describe those fields of knowledge that depended on measure, number and weight – reflecting the much-quoted passage from the *Wisdom of Solomon* 11, 20: “but thou hast ordered all things in measure and number and weight”. This included astrology and architecture as well as arithmetic and astronomy. The *scientiae* or *disciplinae mathematicae* were generally subdivided into *mathematicae purae*, dealing with quantity, continuous and discrete as in geometry and arithmetic, and *mathematicae mixtae* or *mixed mathematics*, dealing not only with quantity but also with quality – for example astronomy, geography, optics, music, cosmography or architecture. It is important to note, that from the mid-sixteenth century onwards the *mathematicae purae* were taken to guarantee the absolute certainty and thereby dignity of knowledge produced in all the mathematical sciences, pure and mixed, and the *mathematicae mixtae* provided many examples for the utility of this unerring knowledge.

In the 17th century the mathematical sciences began to play a leading role in the hierarchy of scientific disciplines, and modes of explanation informed by them increasingly dominated many branches of the sciences and segments of society.

3. What might a mathematician be in the 17th century?

In the early modern period the word *mathematicus*, mathematician, would be used for a (pure) mathematician as well as for a practitioner of the mathematical sciences doing (mixed) mathematics: this covered a wide array of activities and practices. A mathematician in this sense is a member of a very broad and dynamic field, that is open and not academically controlled, and I’ll use the word in this broad sense in what follows.

4. What do you need a mathematician for?

The *Oratio de dignitate et utilitate Matheseos*, *Oration on the Dignity and the Usefulness of the Mathematical Sciences*, by Martinus Hortensius (Amsterdam 1634) reflects most of the standard arguments employed to legitimize the mathematical sciences. Therefore, it is an excellent example of its kind allowing an easy overview of an elaborate array of arguments from the classical Greek tradition to the then most recent developments in astronomy.

Hortensius and his contemporaries saw metaphysics, physics and mathematics as parts of theoretical philosophy, and in his *Oration* he flatly asserted that “among these mathematics excels by its certainty.”

Before he stresses that the mathematical sciences, “ought to be cultivated and honoured by us and their reputation enhanced, so that through them, aspiring to the knowledge of the stars

in the sky, we may watch more carefully that book of nature and we may read it more attentively".

He then takes up the issue of the usefulness and practical advantage of the mathematical sciences. As he puts it: "These [the mathematical sciences] we have shown to surpass the other sciences in the contemplation of things, by their certainty, their nobility of subject and their comfort and pleasing quality; so we will make clear that they confer the most noble benefits also upon men." In particular he discusses: practical arithmetic, geodesy, military architecture, mechanics and statics, music, optics, astronomy, geography and navigation. In the context of Amsterdam's reputation as a leading centre of trade, Hortensius pays particular attention to the advantages of practical arithmetic, geography and navigation. He argues that the mathematical sciences are essentially equal to prosperity and appeals to the authorities of Amsterdam to further promote the study of the mathematical sciences.

Hortensius' *Speech on the Dignity and Usefulness of the Mathematical Sciences* is imbued with allusions to and quotations from the classical authors. In this way he proved not only the dignity and nobility as well as the practical advantage and usefulness of the mathematical sciences, but also their antiquity and deeply rooted traditions. These three elements put together, made a convincing case for the mathematical sciences.

5. Conclusion

For the seventeenth century the very short answer, that mathematicians give to the question what you needed them for is: you need the mathematical sciences and mathematicians for everything. You just can't do without them. A core argument of early modern mathematicians is that mathematics matters, wherever you look.

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