

BOOK

Is God a Mathematician?

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SYNOPSIS/APPLICATION

Livio's book mines into the metaphysical question that has challenged thinking for centuries: why does the universe seem hardwired with for mathematics? While the title is a tad misleading – this book really doesn't touch on theological issues – it grapples with whether or not math is purely a human invention.

QUOTES ABOUT OUR MATHEMATICS AS HUMAN INVENTION

"In other words, to Newton, God was a mathematician (among other things), not just as a figure of speech, but almost literally – the Creator God brought into existence a physical world that was governed by mathematical laws."

"Tegmark argues that "our universe is not just described by mathematics – it is mathematics" [emphasis added]. His argument starts with the rather uncontroversial assumption that an external physical reality exists that is independent of human beings."

"Mathematics provides the solid scaffolding that holds together any theory of the universe."

"As Einstein once wondered: 'How is it possible that mathematics, a product of human thought that is independent of experience [the emphasis is mine], fits so excellently the objects of physical reality?'"

"Does mathematics have an existence that is entirely independent of the human mind? In other words, are we merely discovering mathematical verities, just as astronomers discover previously unknown galaxies? Or, is mathematics nothing but a human invention? If mathematics indeed exists in some abstract fairyland, what is the relation between this mystical world and physical reality? How does the human brain, with its known limitations, gain access to such an immutable world, outside of space and time?"

"If mathematics is entirely a human invention, is it truly universal? In other words, if extraterrestrial intelligent civilizations exist, would they invent the same mathematics? Carl Sagan (1934–96) used to think that the answer to the last question was in the affirmative. In his book *Cosmos*, when he discussed what type of signal an intelligent civilization would transmit into space, he said: "It is extremely unlikely that any natural physical process could transmit radio messages containing prime numbers only. If we received such a message we would deduce a civilization out there that was at least fond of prime numbers."

“The latest research in mathematics may refer to theorems that were published last year, or last week, but it may also use the formula for the surface area of a sphere proved by Archimedes around 250 BC! The nineteenth century knot model of the atom survived for barely two decades because new discoveries proved elements of the theory to be in error.”

“As mathematician and author Ian Stewart once put it, “There is a word in mathematics for previous results that are later changed – they are simply called mistakes.””

“Unlike the Ten Commandments, science was not handed to humankind on imposing tablets of stone. The history of science is the story of the rise and fall of numerous speculations, hypotheses, and models. Many seemingly clever ideas turned out to be false starts or led down blind alleys. Some theories that were taken to be ironclad at the time later dissolved when put to the fiery test of subsequent experiments and observations, only to become entirely obsolete.”

QUOTES ABOUT PYTHAGORAS

“Pythagoras (ca. 572–497 BC) may have been the first person who was both an influential natural philosopher and a charismatic spiritual philosopher – a scientist and a religious thinker. In fact, he is credited with introducing the words “philosophy,” meaning love of wisdom, and “mathematics” – the learned disciplines.”

“Pythagoras and the early Pythagoreans were neither mathematicians nor scientists in the strict sense of these terms. Rather, a metaphysical philosophy of the meaning of numbers lay at the heart of their doctrines. To the Pythagoreans, numbers were both living entities and universal principles, permeating everything from the heavens to human ethics.”

“The Pythagoreans were so enraptured by the dependency of geometrical figures, stellar constellations, and musical harmonies on numbers that numbers became both the building blocks from which the universe was constructed and the principles behind its existence. No wonder then that Pythagoras’s maxim was stated emphatically as “All things accord in number.”

“On the question of whether mathematics was discovered or invented, Pythagoras and the Pythagoreans had no doubt – mathematics was real, immutable, omnipresent, and more sublime than anything that could conceivably emerge from the feeble human mind. The Pythagoreans literally embedded the universe into mathematics. In fact, to the Pythagoreans, God was not a mathematician – mathematics was God!”

QUOTES ABOUT GALILEO

“Galileo managed to see the new star with his own eyes late in October 1604, and the following December and January he gave three public lectures on the subject to large audiences. Appealing to knowledge over superstition, Galileo showed that the absence of any apparent shift (parallax) in the new star’s position (against the background of the fixed stars) demonstrated that the new star had to be located beyond the lunar region. The significance of this observation was enormous. In the Aristotelian world, all changes in the heavens were restricted to this side of the Moon, while the far more distant sphere of the fixed stars was assumed to be inviolable and immune to change.”

“Turning his telescope to the Moon and examining in particular the terminator – the line dividing the dark and illuminated parts – Galileo found that this celestial body had a rough surface, with mountains, craters, and vast plains. He watched how bright points of light appeared in the side veiled in darkness, and how these pinpoints widened and spread just like the light of the rising sun catching on mountaintops. He even used the geometry of the illumination to determine the height of one mountain, which turned out to be more than four miles.”

“Until Galileo’s time, there was a clear distinction between the terrestrial and the celestial, the earthly and the heavenly. The difference was not just scientific or philosophical. A rich tapestry of mythology, religion, romantic poetry, and aesthetic sensibility had been woven around the perceived dissimilarity between heaven and Earth. Now Galileo was saying something that was considered quite inconceivable. Contrary to the Aristotelian doctrine, Galileo put the Earth and a heavenly body (the Moon) on very similar footing – both had solid, rugged surfaces, and both reflected light from the Sun.”

“The Assayer contains Galileo’s clearest and most powerful statement concerning the relation between mathematics and the cosmos.”

“Mind-boggling, isn’t it? Centuries before the question of why mathematics was so effective in explaining nature was even asked, Galileo thought he already knew the answer! To him, mathematics was simply the language of the universe. To understand the universe, he argued, one must speak this language. God is indeed a mathematician.”

“Galileo argued that by pursuing science using the language of mechanical equilibrium and mathematics, humans could understand the divine mind. Put differently, when a person finds a solution to a problem using proportional geometry, the insights and understanding gained are godlike.”

QUOTES OF FAITH

“I am inclined to think that the authority of Holy Scripture is intended to convince men of those truths which are necessary for their salvation, and which being far above man’s understanding cannot be made credible by any learning, or any other means than revelation by the Holy Spirit. But that the same God that has endowed us with senses, reason, and understanding, does not permit us to use them, and desires to acquaint us in any other way with such knowledge as we are in a position to acquire for ourselves by means of those faculties, that it seems to me I am not bound to believe, especially concerning those sciences about which the Holy Scripture contains only small fragments and varying conclusions; and this is precisely the case with astronomy, of which there is so little that the planets are not even all enumerated.”

“To be fair, the Pope found himself in a no-win situation. Any decision on his part, whether to ignore the issue and keep Galileo’s condemnation on the books, or to finally acknowledge the church’s error, was likely to be criticized. Still, at a time when there are attempts to introduce biblical creationism as an alternative “scientific” theory (under the thinly veiled title of “intelligent design”), it is good to remember that Galileo already fought this battle almost four hundred years ago – and won!”

“Descartes wondered, if everything we perceive as reality could in fact be only a dream, how are we to know that even the Earth and the sky are not some “delusions of dreams” installed in our senses by some “malicious demon of infinite power”? Or, as Woody Allen once put it: “What if everything is an illusion and nothing exists? In that case, I definitely overpaid for my carpet.” For Descartes, this deluge of troubling doubts eventually produced what has become his most memorable argument: Cogito ergo sum (I am thinking, therefore I exist).”

“Descartes started with the almost trivial fact that, just as the map of Manhattan shows, a pair of numbers on the plane can determine the position of a point unambiguously (e.g., point A in figure 25a). He then used this fact to develop a powerful theory of curves – analytical geometry. In Descartes’ honor, the pair of intersecting straight lines that give us the reference system is known as a Cartesian coordinate system. Traditionally, the horizontal line is labeled the “x axis,” the vertical line the “y axis,” and the point of intersection is known as the “origin.”