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MATHEMATICAL EDUCATION IN EARLY CHRISTIAN AUTHORS*

Arithmetic, geometry, astronomy, and harmonics – the four subjects of what later came to be known as quadrivium – were first perceived as kindred (ἀδελφεά) by a Pythagorean mathematician Archytas of Tarentum (47 B 1 DK).[1] These subjects quickly bridged the gap between professional and non-professional education and became a subject of heated debates over the usefulness of such studies. Some, like Protagoras, argued that certain sophists "maltreat the young" by forcing the mathematical studies onto them (Plat. *Prot.* 318 d–e).[2] Others took the middle ground: they acknowledged certain benefits that come along with mathematical education, but advised against dwelling on these subjects for too long. According to Xenophon, Socrates thought it wise to limit the study of mathematics to what is practically applicable, like knowing the principles of land measurement, while more fundamental studies, like the study of complicated geometrical figures, were quite useless, according to him. On top of that, Socrates considered these subjects extremely demanding to learn, which makes them "enough to occupy a lifetime, to the complete exclusion of many other useful studies" (Xen. *Mem.* 4. 7. 2–3).[3]

Quite common was the view that μαθήματα should serve as a part of preparatory studies leading to the actual goal of an educational curriculum, be it rhetoric, philosophy, dialectics, or, in Christian authors, the study of the Scripture. Thus, Isocrates, responding to the claims that there is nothing in mathematical studies "but empty talk and hair-spitting; for none of these disciplines has any useful application either to private

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[1] Huffman 2005, 64.

[2] He is alluding to a Sophist Hippias of Elis. Another person, who is known to have been teaching mathematics around the same time is a Pythagorean Theodore of Cyrene (Plat. *Theaet.* 145 a).

[3] Translations of Isocrates here and further are from Marchant 1923, 349.

or to public affairs" (Isoc. *Ant.* 262),[4] argued that these studies "do not injure but, on the contrary, benefit" the students (*ibid*. 261) by sharpening their mind and preparing it for further, more useful and important studies (*ibid*. 265). Academic Xenocrates said "to someone who had never learnt music, geometry, or astronomy, but nevertheless wished to attend his lectures: 'Go your ways, for you offer philosophy nothing to lay hold of' " (D.L. 4. 10).[5]

Plato's educational philosophy is unparallel in its influence on both pagan and Christian tradition. The education of the guardians in the *Republic*, though never implemented in practice,[6] served as a reference point for many authors writing on education. Where mathematics is concerned, Plato's curriculum famously included ten years of rigorous mathematical studies that served as προπαιδεύματα to the ultimate study goal, i.e. dialectics (*Resp.* 521 c, 532 b–c).

According to Plato, studying mathematics brings various benefits: first, arithmetic and geometry are useful when it comes to the conduct of war (522 d–e, 526 d), while astronomy is serviceable to agriculture, navigation and again, to the martial art (527 d); second, mathematical studies make one quicker in other studies (526 b) to the point that "there will be an immeasurable difference between the student who has been imbued with geometry and the one who has not" (527 c);[7] third, μαθήματα help in "acquiring sobriety and righteousness together with wisdom" (591 b–c). Still, the ultimate aim of mathematical studies is, in Plato's eyes, the knowledge of the Good (*Resp*. 526 d–e, 530 e, 531 c, 532 c). Mathematics familiarizes one with 'unqualified beings', i.e. facts that always remain true and are independent of external factors. Thus, arithmetic "strongly directs the soul upward and compels it to discourse about pure numbers, never acquiescing if anyone proffers to it in the discussion numbers attached to visible and tangible body" (525 d). Moreover, it is "indispensable for us, since it plainly compels the soul to employ pure thought with a view to truth itself" (526 b). Geometry

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[4] Tr. Norlin 1929.

[5] Tr. Hicks 1925, 385.

[6] There is no evidence to suggest that this curriculum was implemented even at the Academy itself. In fact, the educational practices of the Academy remain shrouded in mystery. See Krämer, 5. V. contra: Cherniss 1945, 66–67 on mathematical education at the Academy. For the theory that the subject that was actually taught at the Academy was metaphysics, see Zeller [5]1921, 416–117; Burnet 1914, 220–221; Natorp 1921, 434–435; Field 1948, 30–48.

[7] Translations of Plato here and further are from Shorey 1935.

is "the knowledge of that which always is, and not of something which at some time comes into being and passes away" (527 b). In general, mathematical studies "purify and kindle afresh <...> an organ or instrument of knowledge in every soul" (527 d–e). This way, to Plato, the study of mathematics becomes truly irreplaceable, because no other subject is able to draw the mind πρὸς οὐσίαν (523 a).[8]

Plato's student Philip of Opus authored a treatise called the *Epinomis,* where he further expands on these ideas.[9] According to him, the number was given to us by god in order to save us (*Epin*. 976 e: θεὸν δ' αὐτὸν μᾶλλον ἤ τινα τύχην ἡγοῦμαι δόντα ἡμῖν σῴζειν ἡμᾶς). Those who cannot count, can never attain wisdom, and, as a consequence, virtue (977 c–d). The *Epinomis*, while retaining the anagogical function of mathematics, opens up new possibilities for the theological one as well (978 a–b):

> <...> ἀριθμὸν <...> ἀγαθῶν ὡς πάντων αἴτιον, ὅτι δὲ κακῶν οὐδενός, εὖ τοῦτο γνωστέον, ὃ καὶ τάχα γένοιτ' ἄν. ἀλλ' ἡ σχεδὸν ἀλόγιστός τε καὶ ἄτακτος ἀσχήμων τε καὶ ἄρρυθμος ἀνάρμοστός τε φορά, καὶ πάνθ' ὁπόσα κακοῦ κεκοινώνηκέν τινος, ἐπιλέλειπται παντὸς ἀριθμοῦ, καὶ δεῖ τοῦθ' οὕτω διανοεῖσθαι τὸν μέλλοντα εὐδαίμονα τελευτήσειν· καὶ τό γε δὴ δίκαιόν τε καὶ ἀγαθὸν καὶ καλὸν καὶ πάντα τὰ τοιαῦτα οὐδείς ποτε μὴ γιγνώσκων, ἀληθοῦς δόξης ἐπιλαβόμενος, διαριθμήσεται πρὸς τὸ ἑαυτόν τε καὶ ἕτερον πεῖσαι τὸ παράπαν.
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> <...> number <...> is the cause of all good things; and that it is the cause of no evil thing is a point that must be well understood, as it may be quickly enough. Nay, the motion that we may call unreasoned and unordered, lacking shape and rhythm and harmony, and everything that has a share of some evil, is deficient in number altogether; and in this light must the matter be regarded by him who means to end his life in happiness. And no one who does not know the just, the good, the honorable and all the rest of such qualities, with a hold on true opinion, will number them off so as fully to persuade both himself and his neighbor.[10]

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[8] On Platonic 'unqualified beings' in mathematics and on the benefits of studying mathematics in general, see Burneyat 2000, 1–81.

[9] The identity of the author was a subject of debate already in Antiquity. The dialogue was read as a continuation of Plato's *Laws* and many believed in Plato's authorship of the text, including Aristophanes of Byzantium, Thrasyllus of Mendes, Nicomachus and Iamblichus. Clement of Alexandria also mentions Plato as the author of the *Epinomis* (*Strom*. 1. 25).

[10] Tr. Lamb 1927.

This outlook was adopted by Philo of Alexandria and some Christian authors: mathematicals are a godsend, they bring order and equality, while the works of the devil are deprived of number.[11]

In this paper, I will look at how early Christian authors adopted the pagan attitudes towards studying mathematics, what arguments they used when writing about mathematical education, and whether there is evidence of actual educational practice among early Christians. The education in question is the so-called "liberal education", i.e. post-school non-specialized education in *artes liberales* (or their Greek counterpart, ἐγκύκλια). This education was intended for free well-to-do citizens, aiming to introduce them to a more or less set number of subjects (usually these subjects were grammar, rhetoric, dialectics, arithmetic, geometry, astronomy, and harmonics, i.e. mathematical theory of music).[12] The overview of the state of Christian education during the first centuries CE is provided by Henri Marrou in his classic *Histoire de l'éducation dans l'Antiquité*. Still, when it comes to mathematical education, he does not go into much detail, only mentioning the fact that mathematical disciplines were a part of a curriculum at a Christian School of Alexandria when it was headed by Origen.[13] Ilsetraut Hadot in her *Arts libéraux et philosophie dans la pensée antique* touches upon the way Philo, Clement and Origen all view ἐγκύκλιος παιδεία as προπαιδεύματα to the study of the Scripture, but she tends to exaggerate Platonic influences, while disregarding all other factors when it comes to mathematical education.[14] A more recent survey by Alain Bernard et al., while providing a great general overview of different kinds of mathematical education in Antiquity up to the fifth century CE, completely forgoes Christian authors.[15]

There is one Jewish author that we must pay attention to, before turning to the Christian writers. Philo of Alexandria had an enormous influence on some Christian authors, such as Clement and Origen.[16] We know that Philo had first-hand experience in following a liberal arts curriculum.

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[11] See for example Cass. *Inst.* 2 intr. 3, where he states that "the Lord, maker of things, arranged the universe by number, weight and measure" while "the evil works of the devil are not defined by weight, measure and number, since the result of injustice is always the opposite of justice".

[12] On ἐγκύκλιος παιδεία see Rechenauer 1994, 1160–1185; Kühnert 1961; Fuchs 1962. For mathematical education in Greek and Roman Antiquity see Bernard et al. 2014, 27–53.

[13] Marrou 1964, 469.

[14] Hadot 1984, 282–289.

[15] Bernard et al. 2014, 38–51.

[16] Van den Hoek 1997, 59–87; Runia 1993; id. 1995; van den Hoek 1988.

In an autobiographical account, he recalls having studied grammar, geometry and harmonics (*Congr.* 74–76). In *Som*. 1. 205 he describes post-school education as the one consisting of the study of poets and history, arithmetic, geometry, harmonics, rhetoric and philosophy. Philo's writing reveals certain knowledge of mathematics, that he also expected from his readers. Oftentimes, he turns to arithmology when elucidating the text of the Scripture.[17]

Much like Plato, Philo views μαθήματα, along with the subjects of trivium, as a stepping stone on the way to the aim of the curriculum. For Plato it is dialectics, for Philo μαθήματα are handmaidens of philosophy, which in its turn is handmaiden of wisdom, i.e. the knowledge of all divine and human things (*Congr.* 79). Reflecting on the benefits of mathematical education, Philo seems to place the greatest emphasis on the virtues that derive from it. According to Philo, "all encyclical learning reproduces in itself and imitates genuine virtue" (*Quaest. in Gen*. 3. 21).[18] People "who are instructed have many more opportunities of prayer than those who are destitute of teachers, and those who are well initiated in encyclical accomplishments have more opportunities than those who are unmusical and illiterate, inasmuch as they from their childhood almost have been imbued with all the lessons of virtue, and temperance, and all kinds of excellence" (*Mut.* 229). Each mathematical subject has potential to turn the reader's soul to virtue: certainty and freedom from deception derive from arithmetic and geometry, as they both deal with proportions and calculations (*Som*. 205), therefore geometry is meant to implant an admiration of justice (*Congr*. 16). In its turn, harmonics "will guide what was previously discordant to concord" (*Congr*. 16) by healing "whatever in us is deficient in rhythm or in moderation, or in harmony, by giving us rhythm, and moderation, and harmony, by means of a polished system of music" (*Cher*. 105).

To Philo it was obvious that μαθήματα deal with the nature of number itself, which is "the most useful of all things" (*Op.* 60). He was a firm believer that God created this world according to certain mathematical laws, arranging it "in perfect order, both as to the proportions of its numbers, and the harmony of its periods" (*Op.* 78). In *Who Is the Heir of Divine Things* Philo, commenting on the creation of the world, portrays God as using different categories of equality: number, magnitude, power, measure, weight and proportion (141–156). This way God "made every

[17] On arithmology in Philo see Arndt 1967, Berchman 2013, Moehring 1995, Robbins 1931.

[18] Translations of Philo here and further are from Yonge 1993.

single existing thing perfection, the Creator employing all numbers and all the ideas which tend to perfection" (156). Equality is opposed by inequality, which is "the parent of two wars, foreign and civil war, as on the other hand equality is the parent of peace" (162).[19]

In Philo's time, Alexandria was a vibrant and bustling city, home to many religious groups. One of them was young Christian community. According to Eusebius, a certain Christian "school of sacred words" was thriving there at that time (*HE* 5. 10. 1). This school supposedly met the needs of the followers of Christian doctrine to provide them with the necessary guidance leading up to their conversion. Still, the origins of the school are unclear. Allegedly, the school was founded by Mark the Evangelist in the middle of the first century (*HE* 5. 10). There is, however, a gap left by Eusebius between Mark and the next head of the school, Pantenus, a converted Stoic philosopher (d. 210/212), who in his turn was succeeded by Clement of Alexandria (159–215). Thus, the actual existence of the school as an institution before the time of Clement is debated, along with the type and the content of education provided there.[20]

At that time, many Christians felt aversion to pagan education as it inevitably introduced students to false deities. This led to much opposition towards the pagan learning among the Christians. "What use is there in knowing the causes of the manner of the sun's motion, for example, and the rest of the heavenly bodies, or in having studied the theorems of geometry or logic, and each of the other branches of study? – for these are of no service in the discharge of duties, and the Hellenic philosophy is human wisdom, for it is incapable of teaching the truth" – are the words of Clement's imaginary opponent (*Strom.* 6. 11).[21] This opinion was shared not just by the poorly educated: Irenaeus and Tertullian thought that pagan philosophy was the source of heresies (Iren. *Adv. haer*. 2. 14; Tert. *De praescr. haer*. 7); Tertullian thought that a Christian should not work as a teacher in a pagan school (*De idol*. 10).

Clement was trying to defend secular learning, appealing to its many benefits.[22] In line with the Platonic tradition, where liberal studies are perceived as a gateway to dialectics, Clement views them as preparation

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[19] Cf. 47 B 3 DK: According to Archytas, the invention of counting put an end to discord (στάσις) and increased concord (ὁμόνοια).

[20] Van den Hoek 1997, 59–87; van den Broek 1995, 39–47; Scholten 1995, 16–37.

[21] Wilson 1882, 357. Translations of Clement here and further are from Wilson, unless stated otherwise.

[22] On the term ἐγκύκλιος παιδεία in Clement see Camelot 1931, 41–44.

to the study of Christian theology and to the exegesis (1. 5). These studies "exercise the mind, rouse the intelligence, and beget an inquiring shrewdness" (*Strom.* 1. 5), "in such studies, therefore, the soul is purged from sensible things, and is excited, so as to be able to see truth distinctly" (*Strom.* 1. 6). Even though secular education is not a must for a believer – one can attain virtues without having received education – but informed faith is still better, because education, first, speeds up the way to virtue, and second, helps one interpret difficult places in the Scripture that are incomprehensible without the knowledge of secular subjects (1. 6, 6. 10). Furthermore, the Gnostic[23] should not shy away from dialectics and even from pagan philosophy. On the contrary, he is to use this knowledge as a defense against sophists (1. 6, 6. 10) and heretics (6. 10).[24] A truly learned person "brings everything to bear on the truth; so that, from geometry, and music, and grammar, and philosophy itself, culling what is useful, he guards the faith against assault" (1. 9). To a teacher providing education to catechumens (especially when they were Greek), Clement advised "not to abstain from erudition, like irrational animals; but he must collect as many aids as possible for his hearers. But he must by no means linger over these studies, except solely for the advantage accruing from them; so that, on grasping and obtaining this, he may be able to take his departure home to the true philosophy, which is a strong cable for the soul, providing security from everything" (6. 11).

So, what exactly was, according to Clement, the place of mathematics in the education of a Christian and to what goal these studies were beneficial? Much like Philo, Clement turns to arithmology and uses number symbolism for the Biblical exegesis (6. 11).[25] But there is more to mathematics than arithmology. Influenced by Plato both directly and through Philo, Clement views quadrivium as preparation for dialectics. He stresses the potential of mathematics to teach students to ascent to the world of being. This ability, in his eyes, will make one see through the lies

[23] The Clement's Gnostic is "an ideal Christian who has been educated properly" (Glenn 2017, 8). Other interpretations of this term can be found in Ferguson 1976, 79; Kovacs 2001, 5.

[24] On the other hand, dialectic and rhetoric, the way they are exploited by the Sophists, have nothing to do with the truth (*Strom.* 1. 39. 87; 2. 7). See Camelot 1931, 53–58. Cf. Plat. *Philebus* 16 d – 17 a, where number helps distinguishing the dialectic and the eristic methods of discussion.

[25] Oftentimes he also uses Philonic allegories to support the argument in favor of liberal education (see the Hagar analogy in *Strom*. 1. 30–32, cf. Phil. *Congr.* passim; the Jacob analogy in *Strom*. 1. 31, cf. Phil. *Sacrif.* 2).

of sophists and heretics, while also allowing them access to unqualified truths. Through geometry (6. 10) and arithmetic (11. 1) Abraham (and the Gnostic) arrives at the knowledge of God himself (*Strom*. 6. 10):

> For to him (i.e. the Gnostic) knowledge (γνῶσις) is the principal thing. Consequently, therefore, he applies to the subjects that are a training for knowledge, taking from each branch of study its contribution to the truth. Prosecuting, then, the proportion of harmonies in music; and in arithmetic noting the increasing and decreasing of numbers, and their relations to one another, and how the most of things fall under some proportion of numbers (τὰ πλεῖστα ἀναλογίᾳ τινὶ ἀριθμῶν ὑποπέπτωκεν); studying geometry, which deals with οὐσία itself (οὐσίαν αὐτὴν ἐφ' ἑαυτῆς θεωρῶν), he perceives a continuous distance, and an immutable essence which is different from these bodies (ἐθιζόμενος συνεχές τι διάστημα νοεῖν καὶ οὐσίαν ἀμετάβλητον, ἑτέραν τῶνδε τῶν σωμάτων οὖσαν). And by astronomy, again, raised from the earth in his mind, he is elevated along with heaven, and will revolve with its revolution studying ever divine things, and their harmony with each other; from which Abraham starting, ascended to the knowledge of Him who created them. Further, the Gnostic will avail himself of dialectics, fixing on the distinction of genera into species, and will master the distinction of existences, till he come to what are primary and simple.[26]

Mathematics helps to ascend to the knowledge of God not just because of its anagogical function and its potential for developing abstract thinking. God himself is closely connected with mathematical categories of number, measure and weight. In fact, when discussing *Deut.* 25, 13–15, Philo and Clement both refer to God as to "weight, and measure, and number of all things".[27]

Phil. *Somn.* 2. 192–194:[28]

> <...> ἐπειδὴ τυφλὸν καὶ ἄγονον καλῶν ἀφροσύνη, ὑφ' ἧς ἀναπεισθέντες τινὲς μετρεῖν καὶ σταθμᾶσθαι καὶ ἀριθμεῖν πάντα καθ' αὑτοὺς ἠξίωσαν· 193. Γομόρρα <γὰρ> μεταληφθέν ἐστι μέτρον. Μωυσῆς δὲ

[26] Tr. Wilson 1882, 349–350 with modifications.

[27] Here Clement is quoting from Philo, which was noted by van Winden 1978, 208–209. Note, however, that his quotation of Philo contains a mistake (Μωυσῆς δὲ στάθμην καὶ ἀριθμὸν τῶν ὅλων <...> instead of Μωυσῆς δὲ στάθμην καὶ μέτρον καὶ ἀριθμὸν τῶν ὅλων <...>).

[28] Tr. Yonge 1993 with modifications.

στάθμην καὶ μέτρον καὶ ἀριθμὸν τῶν ὅλων ὑπέλαβεν εἶναι τὸν θεόν, ἀλλ᾽ οὐ τὸν ἀνθρώπινον νοῦν. δηλοῖ δὲ διὰ τούτων φάσκων· "οὐκ ἔσται ἐν μαρσίππῳ σου στάθμιον καὶ στάθμιον, μέγα ἢ μικρόν· οὐκ ἔσται ἐν τῇ οἰκίᾳ σου <μέτρον καὶ μέτρον>, μέγα ἢ μικρόν· στάθμιον ἀληθινὸν καὶ οἰκίᾳ σου <μέτρον καὶ μέτρον>, μέγα ἢ μικρόν· στάθμιον ἀληθινὸν καὶ δίκαιον ἔσται σοι". ἀληθὲς δὲ καὶ δίκαιον μέτρον τὸ τὸν μόνον δίκαιον θεὸν ὑπολαβεῖν πάντα μετρεῖν καὶ σταθμᾶσθαι καὶ ἀριθμοῖς καὶ πέρασι καὶ ὅροις τὴν τῶν ὅλων περιγράψαι φύσιν, ἄδικον δὲ καὶ ψευδὲς τὸ νομίσαι κατὰ τὸν ἀνθρώπινον νοῦν ταῦτα συμβαίνειν.

<...> folly is a thing which is blind, and also barren of all good things; though, nevertheless, some people have been so greatly influenced by it as to measure, and weigh, and count everything with reference to themselves alone. 193. Gomorrah, being interpreted, means 'measure'; but Moses conceived that God was weight, and measure, and number of all things, not the human mind. He explains it saying: "There shall not be in thy sack one weight, and another weight, a great and a small; there shall not be in thy house one measure, and another measure, a great and a small; thy weight shall be a true and just one" (*Deut*. 25, 13–15). But a true and just measure is, to conceive that it is the only just God alone who measures and weighs everything, and who has circumscribed the nature of the universe with numbers, and limits, and proportions. But it is unjust and false to imagine that these things are regulated in accordance with the human mind.

Clem. *Protr.* 6. 69. 1–4:[29]

Τίς οὖν ὁ βασιλεὺς τῶν πάντων; Θεὸς τῆς τῶν ὄντων ἀληθείας τὸ μέτρον. Ὥσπερ οὖν τῷ μέτρῳ καταληπτὰ τὰ μετρούμενα, οὑτωσὶ δὲ καὶ τῷ νοῆσαι τὸν θεὸν μετρεῖται καὶ καταλαμβάνεται ἡ ἀλήθεια. Ὁ δὲ ἱερὸς ὄντως Μωυσῆς "οὐκ ἔσται", φησίν, "ἐν τῷ μαρσίππῳ σου στάθμιον καὶ στάθμιον μέγα ἢ μικρόν, οὐδὲ ἔσται ἐν τῇ οἰκίᾳ σου μέτρον μέγα ἢ μικρόν, ἀλλ᾽ ἢ στάθμιον ἀληθινὸν καὶ δίκαιον ἔσται σοι", στάθμιον καὶ μέτρον καὶ ἀριθμὸν τῶν ὅλων ὑπολαμβάνων τὸν θεόν· τὰ μὲν γὰρ ἄδικα καὶ ἄνισα εἴδωλα οἴκοι ἐν τῷ μαρσίππῳ καὶ ἐν τῇ ὡς ἔπος εἰπεῖν ῥυπώσῃ ψυχῇ κατακέκρυπται· τὸ δὲ μόνον δίκαιον μέτρον, ὁ μόνος ὄντως θεός, ἴσος ἀεὶ κατὰ τὰ αὐτὰ καὶ ὡσαύτως ἔχων, μετρεῖ τε πάντα καὶ σταθμᾶται, οἱονεὶ τρυτάνῃ τῇ δικαιοσύνῃ τὴν τῶν ὅλων ἀρρεπῶς περιλαμβάνων καὶ ἀνέχων φύσιν.

[29] Translation is mine.

> Who, then, is the king of all? God, who is the measure of the truth of all existing things. As, then, the things that are to be measured are attained by the measure, so also the truth is measured and comprehended by apprehending the God. And the truly holy Moses said: "There shall not be in thy sack one weight, and another weight, a great and a small; there shall not be in thy house one measure, and another measure, a great and a small; thy weight shall be a true and just one" (*Deut*. 25, 13–15), conceiving the God to be weight, and measure, and number of all things. For the unjust and unrighteous idols are hid at home in the bag, and, so to speak, in the polluted soul. But the only just measure is the only true God, always just, continuing the self-same; who measures all things, and weighs them by righteousness as though with a balance, encompassing and sustaining universal nature without leaning to either side.

Despite the benefits that come with studying mathematics, it is not clear whether any of it was taught at the catechetical school of Alexandria when it was headed by Clement. The fact that it was later taught under his successor, Origen, might be an indicator that Origen was following an already established curriculum, but there is no direct evidence to support this claim.

According to Eusebius, Origen was educated in liberal arts, well-read in Plato, and studied the writings of Numenius, Cronius, Apollophanes, Longinus, Moderatus and Nicomachus (*HE* 6. 19. 8). In *Against Celsus* 3. 49, probably feeling the same need as Clement to defend secular education, he expresses an opinion that education is the way to virtue and no hindrance to the knowledge of God. In his *Letter to Gregory* (1), Origen advices him to study, among other things, geometry, music and astronomy, and take from them "what will serve to explain the Sacred Scripture". Similar to Clement, he sees liberal arts as preparatory to philosophy, while philosophy itself is preparatory to Christianity.

As a teacher, he chose different curricula for his students based on their abilities: those with superior intelligence were instructed in "geometry, arithmetic and other preparatory studies, and then advanced to the systems of the philosophers" (Euseb. *HE* 6. 18. 3).

In around 231, Origen left Alexandria and took up permanent residence in Caesarea, where he established a Christian school. His teachings at this school are documented in an *Oration and Panegyric Addressed to Origen*, written by one of his students.[30] His students followed a demanding

[30] The *Oration* was transmitted under the name of Gregory Thaumaturgus in *Vaticanus Graecus* 386, but the attribution was called into question by Nautin 1977, 83–85.

curriculum, consisting of logic, physics, geometry, astronomy, ethics, Greek philosophy, Jewish and Christian texts. The study of mathematics is described this way (*Oration* 8):[31]

> Τί δεῖ λέγειν τὰ τῶν ἱερῶν μαθημάτων, γεωμετρίαν μὲν τὴν πᾶσι φίλην καὶ ἀναμφισβήτητον, καὶ ἀστρονομίαν τὴν μετεωροπόρον; ἃ δὴ ἕκαστα ταῖς ψυχαῖς ἡμῶν ἐνετυποῦτο, διδάσκων, ἢ ἀναμιμνήσκων, ἢ οὐκ οἶδ' ὅ τι χρὴ λέγειν· τὴν μὲν ὡς ὑποβάθραν πάντων ἁπλῶς ποιησάμενος οὖσαν ἄσειστον, τὴν γεωμετρίαν, καὶ κρηπιδά τινα ἀσφαλῆ· ἀγάγων δὲ καὶ μέχρι τῶν ἀνωτάτω διὰ τῆς ἀστρονομίας, ὡσπερ διὰ κλίμακός τινος οὐρανομήκους, ἑκατέρου τοῦ μαθήματος, βατὸν ἡμῖν τὸν οὐρανὸν παρασκευάσας.
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> And what is there to say about sacred mathematics (τὰ τῶν ἱερῶν μαθημάτων), i.e. geometry, pleasant to all and undisputed, and astronomy, traveling through the air? These studies he carved onto our souls, teaching us, or recalling them to our mind, or doing something which I cannot describe. But geometry he considered the unmovable pedestal and the unshakable foundation of all, and with these sciences he lifted us towards the utmost heights, as if with a sky-high ladder, making the heavens accessible to us.[32]

Here we come across the same reasons to study mathematics: (1) mathematics is "undisputed", i.e. it helps one to ascend to the knowledge of unqualified truths; (2) mathematics is described as "sacred". Much like Clement before him, referring to the creation, Origen refers to God creating all things by number and measure (*De prin*. 4. 35). Therefore, studying mathematics is a means of both understanding God's creation and ascending to the knowledge of the God himself.

Around the same time, the followers of Theodotus the Cobbler (fl. late second century) were also known for studying mathematics. As heretics, they are criticized by Eusebius, because "being of the earth and speaking of the earth, they are ignorant of him who comes from above, they abandon the holy Scriptures and devote themselves to geometry. Euclid is laboriously studied by some of them (Εὐκλείδης γοῦν παρά τισιν αὐτῶν φιλοπόνως γεωμετρεῖται)" (Euseb. *HE* 5. 28. 14).[33] Given the brevity of

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[31] Translation is mine.

[32] Cf. Nicomachus also comparing these sciences to ladders (κλίμαξι) leading from perceptible and opineable to intelligible and knowable, and from corporeal to those more akin to our souls (*Intr*. 1. 3. 6).

[33] Translation is mine.

this fragment, it is difficult to tell what exactly their reasons for studying geometry were, but I would suggest that they, "being of the earth", used geometry as a means for understanding God's creation.

Anatolius, bishop of Laodicea (early third century – 283) was well versed in various mathematical disciplines (Euseb. *HE* 7. 32. 6). He authored *Introduction to Arithmetic* in ten books. The surviving fragments belong to the opening part of the book and cover the topics of what mathematics is, what its parts are, and what the famous discoveries in the field of mathematics were. Among the reasons for studying mathematics he mentions the fact that nothing can be understood without prior knowledge of mathematics. Mathematics gives access not only to the incorporeal and intelligible, but to the corporeal and sensible as well (*Patrologia Graeca* 10. 231–236). Moreover, Anatolius made important contributions to the so-called *computus paschalis* by inventing a 19-year Paschal cycle.[34]

Thus, there were some important intrinsic reasons that connected mathematics to the God himself that could encourage mathematical studies among Christians and, as we have seen, it was indeed studied by some of them in the second and the third centuries CE. It was not simply the ability of mathematics to exercise the mind, and not just the Platonic anagogical function of mathematics that allows one to access unqualified truths, that encouraged mathematical education, but, more importantly, it was the fact that God himself was connected with mathematical categories of number, measure and weight, which made room for theological interpretations of mathematics.

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[34] McCarthy 1995, 285–320.

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When mathematical sciences started their advancement into non-professional education, it became necessary to explain why these sciences should be studied by those who are not going to become professional mathematicians. The ancients found various arguments in favor of studying mathematical sciences. For example, there were arguments of an utilitarian nature: the benefits of mathematics were seen in its application in trade, navigation, managing one's estate, etc. There were also those who prioritized the benefits of mathematics for the development of intelligence: mathematics is useful because it exercises the mind. According to others, the main benefit of studying mathematics is that it promotes the acquisition of various virtues (for example, justice and moderation), and also serves as a preparation for the study of dialectics (and later, Holy Scripture).

This argument was borrowed in one form or another by Christian authors from pagans. The article traces how Philo of Alexandria and the following Christian authors (namely, Clement and Origen) justify the need to study mathematics, how their argumentation correlates with the ancient pagan tradition, and also what conclusions about the practice of teaching mathematical disciplines and their content follow from their testimonies. The article shows that, according to the views of the above-mentioned authors, there were important internal reasons linking mathematics with the concept of God, which could encourage the study of mathematics among Christians. It was not just about the ability of mathematics to exercise the mind, or about the important role of mathematics in gaining access to the unconditional truths of the Platonic tradition, but, more importantly, God himself is connected with the mathematical categories of numbers, measures and weights, which made theological interpretations of mathematics possible.

С появлением математических наук возникла потребность в объяснении, зачем эти науки следует изучать тем, кто не собирается становиться профессиональным математиком. Древние находили разные аргументы в пользу

изучения математических наук. Например, существовали доводы утилитарного характера: польза от математики виделась в ее применении в торговле, навигации, управлении своим имением и т. п. Существовали и те, кто во главу угла ставил пользу математики для развития интеллекта: математика полезна, поскольку она упражняет ум. Согласно другим, главная польза от занятий математикой заключается в том, что она способствует приобретению разных добродетелей (например, справедливости и умеренности), а также служит подготовкой к изучению диалектики (а позднее – Священного писания).

Эта аргументация была в том или ином виде заимствована христианскими авторами у язычников. В статье прослеживается, как Филон Александрийский и следующие за ним христианские авторы (Климент, Ориген) обосновывают необходимость изучения математики, как их аргументация соотносится с античной языческой традицией, а также какие из их свидетельств позволяют сделать выводы о практике преподавания математических дисциплин и об их содержании. В статье показано, что, согласно представлениям вышеназванных авторов, существовали важные внутренние причины, связывавшие математику с концепцией Бога, которые могли поощрять изучение математики среди христиан. Речь идет не просто о способность математики упражнять ум, или о важной роли математики для получения доступа к безусловным истинам платоновской традиции, но, что более важно, сам Бог оказывается связан с математическими категориями числа, меры и веса, что делало возможными теологические интерпретации математики.

CONSPECTUS

Статьи сопровождаются резюме на русском и английском языке
Summary in Russian and English