



The Archimedes Standards: A Better Standard

What Makes the Archimedes Standards Different?

The *Archimedes Standards* were drafted by Jonathan Gregg, professor of mathematics education at Hillsdale College. It builds upon the best practices of the past and the present, drawing upon insights from national and international sources. Excellent mathematical practices abroad (such as those in Singapore and South Korea) and within the United States (such as Florida's 2021 standards) informed the crafting of the standards. The *Archimedes Standards'* Expert Committee worked with Professor Gregg, who also served as Project Director for the *Archimedes Standards*, to substantially revise the first draft of *Archimedes Standards*.

The *Archimedes Standards* possess several distinct virtues.

Content-Rich Knowledge

The *Archimedes Standards* provide a content-rich summary of required mathematical knowledge, with equal standards for every student, so as to restore a culture of high expectations. In the PreK-Grade 8 grade bands, the standards are grade-level-appropriate and build a strong framework for students' math proficiency to grow grade-by-grade. Though the recommended scope and sequence is relatively inflexible in these grades, such rigidity is essential to ensuring a solid foundation for all students. At the high school level, however, the standards divide into course sequences – Algebra I, Geometry, Algebra II, Pre-Calculus, Calculus, and Statistics – rather than grade bands. Schools may teach these six courses in whatever sequence they think appropriate, and may even divide instruction within grades. Such a combination of specific instruction for PreK-Grade 8 and maximum flexibility throughout high school, will best equip students for mathematical fluency and success.

Algebra I: Grade 8 or Grade 9

Many education reformers have argued strongly that Algebra I needs to be taught in Grade 8 rather than Grade 9 to ensure that students have enough instruction time in high school to be properly prepared for undergraduate mathematics.¹⁵ While a proper set of standards should allow students to take Algebra I in Grade 8, not every student will be ready for such a pace. The *Archimedes Standards'* middle school sequence therefore allows for both regular and accelerated instruction. While the standards schedule Algebra I for Grade 9, schools can consolidate the Grade 6-8 material into two grades, allowing students to proceed to Algebra I a year early in Grade 8. The specific details of such a consolidation will vary from school to school, but middle school math teachers will see that the standards facilitate accelerated instruction.

This flexible approach to Algebra I exemplifies how the *Archimedes Standards* aim for both achievement and accessibility. To prescribe Algebra I for either Grade 8 or Grade 9 would be too narrow; leaving open the opportunity for students to take it in either grade ensures that all students will receive the best possible mathematics education.

Calculus and Statistics

The *Archimedes Standards* were designed to provide rigorous math education for all students rather than encouraging schools to skim hastily toward advanced placement classes. However, at the end of such a robust progression through mathematics, many high school students will be prepared to take advanced placement courses, and thus the Calculus and Statistics standards are approximately equivalent in content and rigor to AP Calculus BC and AP Statistics. While many schools will not require these courses, good standards are available for the schools that offer them.

Clear Format

The *Archimedes Standards* emphasize clarity far more than rival mathematics standards. We have eliminated the tangle of skills and crosswalks and concentrated on facts to learn, presented in a simple list. The *Archimedes Standards'* straightforward structure makes it easy for teachers to use and easy for parents to hold teachers accountable for how well they teach mathematics. We expect the states and school districts to modify the sequence we offer—but they can do so knowing with absolute clarity what is the total mathematics education we believe they should provide.

Depoliticized

The *Archimedes Standards* removes the lower standards imposed by the Common Core State Standards for Mathematics (CCSSM), which provide a vague outline of content knowledge, it lack rigor, and were rushed into public use without sufficient testing and evaluation. It rejects the growing urge by ideologically extreme education theorists and administrators to subordinate mathematics instruction to politicized instruction and the discriminatory and counterproductive ideology of so-called “diversity, equity, and inclusion” (DEI). No ideologies permeate the problems and tasks, no ethnomathematics guides the pedagogies, and no tangential applications have been inserted that politicize. Mathematics is a discipline that is free of cultural bias, universally true, and accessible to all, which can and should provide unifying principles that Americans of all backgrounds, cultures, and political affiliations can rally behind.

Mental Mathematics

The *Archimedes Standards* are committed to encouraging students to practice mental math in order to develop number sense and number flexibility. While mathematics is fundamentally a creative endeavor that cannot be reduced to a set of memorizable processes, math instruction cannot be divorced from the art of memory. Memorizing facts, processes, and formulas is useful for daily life, equipping students with the tools to quickly and efficiently solve practical problems at home, at work, and at play. Mental math also greatly facilitates the ability to engage in higher-level mathematics,

providing a solid foundation from which to explore advanced concepts. Practically speaking, a true preparation for undergraduate and professional mathematics requires early memorization, which should remain central to math instruction.

Throughout the K-6 sequence, each grade level includes several Mental Mathematics standards, each of which specify mathematical knowledge that teachers should encourage students to commit to memory. Individual districts, schools, and teachers should choose the specific methods of doing so (flashcards, games, etc.), but every classroom should develop a culture of mental math that helps make mathematical reasoning second nature for students.

History of Mathematics

The *Archimedes Standards* restores History of Mathematics to state standards. Mathematics instruction can be enriched by the history of mathematical discovery, by helping both teachers and students to learn how we came to know what we know about the mathematical world. The History of Mathematics standards have been crafted to include stories and themes that complement the math being taught at each specific grade level. In Grade 5, for example, Brahmagupta's discovery of negative numbers accompanies classroom instruction on negative numbers. Stories like this can spark student interest and help them participate in the process of guided reinvention as they investigate the origins of mathematical concepts.

The *Archimedes Standards* incorporate these sections in moderation: not all schools and teachers will have the classroom time to incorporate these sections, and they easily be reduced or even eliminated. Still, for states, districts, and schools that do adopt them, these sections can provide an instructive and stimulating access point for students to encounter the narrative side of math.

Mathematical Practices

The *Archimedes Standards'* emphasis on content-rich knowledge contrasts with pedagogical approaches, such as "inquiry-based learning." While not bad in and of themselves, such pedagogies too often encourage teachers to replace robust instruction in content with hollow instruction in "skills." Yet the *Archimedes Standards* do not mandate or forbid specific instructional methods. As a result, teachers may use the standards to choose freely from appropriate content-focused pedagogies that will promote student learning. State education departments, likewise, are equally free to provide pedagogy guides for teachers.

Centering mathematical content, however, does not mean ignoring the specific skills that students should learn at various levels, skills which are included in the Mathematical Practices section for each grade. We provide six core practices, repeated in each grade band, which are associated with a variety of pedagogical techniques, so that teachers can employ the particular instructional methods that they see fit. Skills instruction does have an appropriate time and place in math teaching and learning, and the Mathematical Practices section provides a helpful guide to teachers without diminishing the primary task of teaching content.

Interdisciplinary Integration

While remaining centered around content-rich math instruction, the *Archimedes Standards* have an interdisciplinary ambition that complements instruction in science, social studies, and English language arts. This integrated, liberal-arts approach to learning helps students to make connections between different academic subjects, providing a well-rounded approach to mathematics. As such, the *Archimedes Standards* complement the two previous model standards drafted by the National Association of Scholars (NAS) and Freedom in Education (FiE), *The Franklin Standards* (science) and *American Birthright* (social studies) as well as future model standards for English language arts. But more broadly, such an integrated approach will help students to see how math overlaps with other disciplines and extends into our daily lives.

Broad Appeal and Flexibility

The *Archimedes Standards* have been designed to appeal to a broad majority of Americans. In addition to being depoliticized, they are flexible, so states and school districts can alter the sequence as they see fit. States and school districts can create equally rigorous standards by abbreviating some topics, expanding others, or adjusting the course sequences. States and school districts that adjust the course sequence can make age-appropriate adjustment to the learning standards. The *Archimedes Standards* should provide a broadly acceptable model for mathematics standards.

Teacher Freedom

The *Archimedes Standards* does not provide an entire curriculum. Teachers are free to teach each topic as they see fit, to add new topics, to incorporate independent lesson plans and sequences, and to unite items from these learning standards into thematic units. They also are free to reorganize the sequence in which they teach these topics, as well as to review material from earlier grades in any course of instruction.

Teacher Education

The content-rich *Archimedes Standards* makes clear what teachers should be expected to know, and what state education departments can expect of teachers. The *Archimedes Standards* outlines what teachers should learn, whether in college, graduate school, or professional development. It also helps teachers to arrange content so that it builds coherently over several years, and to know what is appropriate for each grade level.

Reliable Assessment

The *Archimedes Standards*' intensive content standards facilitate reliable assessment, whether by national companies such as the Educational Testing Service (ETS), state-level testing, or tests by school districts and individual teachers. Its content standards provide enough material to make it easy both for teachers and for large organizations such as ETS to create tests that accurately assess student knowledge.

Mathematics For All Americans

Some educators argue that schools should limit content instruction, even though a large body of scholarship has shown their arguments are misguided. Content standards that focus on “skills” and abbreviate content especially harm the education of disadvantaged students, and thereby foster an unequal society. When disadvantaged students receive intensive content instruction, they learn eagerly and well. The *Archimedes Standards* offers comprehensive content knowledge to ensure that America’s schools fulfill the promise of equal educational opportunities for everyone.