

Exhibit M9.9: National Policies Regarding the Use of Technology in Advanced Mathematics Instruction and Assessment

Reported by National Research Coordinators

Country	Description of National Policies for Technology Use in Advanced Mathematics Instruction	Description of National Policies for Technology Use in Advanced Mathematics Assessment
France	The policy focuses on using tools such as calculators equipped with Computer Algebra Systems (CAS) in problem solving to focus students on reasoning and strategy rather than technical calculations.	ICT tools are allowed for in-class assessments to assess students' capacity to use technological aids in the process of problem solving. For national examinations, students may use off-line graphing calculators.
Italy	Curriculum guidelines emphasize providing opportunities for students to become familiar with ICT tools and their methodological value; they are not treated as a substitute for all mental calculations.	Same
Lebanon	No policy	No policy
Norway	Digital skills in advanced mathematics involve using digital tools for comprehensive computations and visualization. This means retrieving, processing, and presenting mathematical information in electronic form. It also means evaluating the suitability, possibilities, and limitations of the digital tool.	Every examination in mathematics is now divided into two parts. The first part (3 hours) is solved by pen and paper only; no technological aids are allowed. The second part (2 hours) not only allows the use of some digital tools, but requires that they are applied, such as dynamic geometry programs. It is specifically stated that students in the second part of the exam shall have sophisticated electronic aids available, as long as they cannot use them to communicate.
Portugal	Some subjects (such as normal and binomial distributions) are always taught with graphing calculators.	Some advanced mathematics examinations require the use of a graphing calculator.
Russian Federation	The program has no direct references to the use of electronic devices in advanced mathematics courses. However, the requirements for students' attainment in the subject area "Mathematics and Informatics" include expected learning outcomes for ICT, such as using a computer to construct mathematical models of the proposed situation, conduct experiments, and conduct statistical analysis of data.	No policy. However, during the compulsory state exam in mathematics at Grade 11, students are not allowed to use any calculators or computers. The use of these technological aids in classroom tests depends on the teacher.
Slovenia	Technology is required to be used in teaching and learning. Students are required to demonstrate use of standard and specific software for mathematics. Calculators are not specifically required or described, but teachers and students should use as many devices as possible. In practice, schools require students to have their own calculator capable of symbolic calculations in two lines but not for drawing graphs.	The curriculum does not define the use of calculators for assessments, but on the Matura examination, for all subjects, non-programmable calculators which cannot be connected to the Internet may be used.
Sweden	Digital media and tools are addressed in several curriculum statements as problem solving tools. Mathematics 4 has one additional explicit notion of technology in the description of core content—algebraic and graphical methods for determining integrals with and without digital tools, including estimates of magnitudes and probability distributions.	The grading criteria are very similar for all courses and contain only one statement explicitly referring to technology. Students should be able to solve problems with and without digital tools.
United States	Policies vary by state, but most advanced mathematics courses require graphing calculators and other tools (such as spreadsheets or statistical packages) strategically when solving mathematics problems. Both AP Calculus and IB Mathematics require the use of a graphing calculator to help solve problems, experiment, interpret results, and support conclusions.	Policies vary by state, but some programs (such as AP and IB) have their own specifications about what kinds of calculators are permissible.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS Advanced 2015