Exhibit M1.1: Structural Characteristics of the Advanced Mathematics Programs (Tracks)

Reported by National Research Coordinators

Country	Description of How the Programs (Tracks) Fit into the Overall Curriculum	Number of Years Students are Taught in These Programs (Tracks)	Number of Hours of Advanced Mathematics Instruction per Year	Criteria for Admission to These Programs (Tracks)	Prerequisites for Admission to These Programs (Tracks)
France	Secondary schooling spans Grades 6–12. At the end of Grade 9 students choose either a vocational program or the general program. Students attending the general program choose among four tracks at the end of Grade 10–technological, literary, economic and social, or scientific. Students choosing the scientific track choose either the engineering sciences or the life and Earth sciences emphasis at Grade 11. At Grade 12, these students additionally choose a specialization among four–life and Earth sciences, mathematics, physics and chemistry, or computational sciences.	2 years	173	Students' skills and attitudes towards science, their grades in mathematics and science, and teachers' and principals' opinions and reports all contribute.	Completion of Grade 10
Italy	Secondary education can last 5 years and is given in three types of schools–lyceums, technical schools, and vocational schools. The students assessed by TIMSS Advanced 2015 were in Grade 13 and completed an advanced mathematics course or an advanced mathematics and physics course. Most of these students were in general schools with scientific focus on mathematics and physics (Liceo Scientifico), in general schools with a focus on science, mathematics and physics (Liceo Scientifico opzione Scienze Applicate), or in technical institutes and receiving full-time vocational training.	5 years	132	Completion of lower secondary education (Scuola secondaria di I grado), Grades 6–8, and success on the national examination at the end of Grade 8.	No prerequisites
Lebanon	The curriculum in Lebanon is spiral in nature so mathematical concepts are introduced in Grade 1 and accumulate until Grade 12. Participation is a prerequisite for the university specialized studies in mathematics or related studies.	6 years	250	Students must obtain a grade of 12 out of 20 or higher in mathematics in Grade 11.	Since the system is spiral, students are prepared from Grade 1 on to take the courses in advanced mathematics.
Norway	The Norwegian students assessed by TIMSS Advanced 2015 completed 10 years of compulsory education followed by 3 years of upper-secondary education. Upper-secondary education is not compulsory. However, all students have the right to an upper-secondary education. Almost the entire cohort enters this level, approximately half of them in an academic track, the other half in vocational programs. All students in the academic track must take some mathematics in Grades 11 and 12. Those who want to specialize in mathematics choose the most theoretical courses offered. The last two of these are called "Mathematics R1" and "Mathematics R2," normally taken in Grades 12 and 13, respectively. The Norwegian students assessed in advanced mathematics by TIMSS Advanced 2015 took the R2 course in their final year of secondary education.	2 years	140	Students must successfully complete a theoretical mathematics course in Grade 11.	In Grade 11 students can choose between two courses. The most theoretical one of these is a prerequisite for the R1 course. The R1 course is a prerequisite for the R2 course.
Portugal	Upper-secondary schooling is a 3-year program (Grades 10–12) and is compulsory for all students. Depending on the program in the upper-secondary academic track, students may take either 3 years of advanced mathematics (Matemática A for Sciences and Technology or Socio-Economic programs) or 2 years of Matemática B (Arts programs) with 2 years of Mathematics for the Social Sciences (Languages and Humanities programs). Only students enrolled in advanced mathematics (Matemática A) were assessed in TIMSS Advanced 2015.	3 years	146	Completion of lower secondary education. In upper-secondary education, students can choose a secondary education study program according to their academic and/or professional interests.	No prerequisites

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

Exhibit M1.1: Structural Characteristics of the Advanced Mathematics Programs (Tracks) (Continued)

Country	Description of How the Programs (Tracks) Fit into the Overall Curriculum	Number of Years Students are Taught in These Programs (Tracks)	Number of Hours of Advanced Mathematics Instruction per Year	Criteria for Admission to These Programs (Tracks)	Prerequisites for Admission to These Programs (Tracks)
Russian Federation The TIMSS Advanced 2015 mathematics students assessed in the Russian Federation include both the Profile and Intensive streams of students. However, results also are provided separately for the students in the Intensive stream because this is the group of students assessed in TIMSS Advanced 1995 and TIMSS Advanced 2008. The results for the Intensive stream students are designated Russian Federation 6hr+.	Since 2012, for their final two years of secondary school students in Grade 10 are divided into three streams that include different amounts of mathematics courses: Basic–3 hours per week; Profile–4.5 hours per week; and Intensive–6 or more hours per week. The courses also vary in depth of content and attainment requirements. Grade 11 students in both the Profile and Intensive streams participated in TIMSS Advanced 2015. The students in the Profile and Intensive streams study in lyceums, gymnasiums, special schools for mathematics and physics tracks, and general secondary schools with different streams at the upper-secondary level. In Grade 11 they have mastered the general mathematics courses in Grades 1–9 before moving on to more advanced courses in Grades 10 and 11. In some cases, advanced coursework in mathematics is available for these students in Grades 7–9, so Profile and Intensive stream classes may consist of students who have done advanced work in mathematics in previous courses. Students who successfully complete Profile and Intensive programs of mathematics study meet the requirements for admission to universities that require a sufficiently deep knowledge of mathematics.	2 years	158 (Profile) 210 (Intensive)	Successful completion of basic education (Grades 1–9), successfully passing the state mathematics examination at Grade 9, and possibly an interview, oral or written mathematics test or examination, organized by the student's school.	No prerequisites
Slovenia	Secondary education consists of two types of programs: general gymnasia; and vocational or technically oriented programs. Only the general gymnasia program offers students the possibility of admission to university studies. All general gymnasia students study the same mathematics course during their 4-year program.	4 years	105	Completion of elementary schooling.	No prerequisites

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Exhibit M1.1: Structural Characteristics of the Advanced Mathematics Programs (Tracks) (Continued)

Country	Description of How the Programs (Tracks) Fit into the Overall Curriculum	Number of Years Students are Taught in These Programs (Tracks)	Number of Hours of Advanced Mathematics Instruction per Year	Criteria for Admission to These Programs (Tracks)	Prerequisites for Admission to These Programs (Tracks)
Sweden	Upper-secondary education starts at Grade 10 and is divided into 18 national 3-year programs. There are 12 vocational programs and 6 programs preparing for studies at the university level. In Swedish upper-secondary schools, mathematics is taught in consecutive courses at 5 levels–Mathematics 1, 2, 3, 4, and 5–and in one specialized course. In addition, courses at the first 2 levels are taught in 3 tracks with one track for vocational programs, one for social science and economics programs, and one for science and technology programs. The third level has 2 tracks (no track for vocational programs) and there is only one track in levels 4 and 5. The vast majority of students studying mathematics at level 4 or above are found in the science and technology programs. For the science program, most students study Mathematics 4. It is compulsory for the vast majority of students. For students in the technology program, Mathematics 4 is compulsory in one track of the program and optional for students within the other tracks, but it is chosen by many students. Students who participated in TIMSS Advanced 2015 in advanced mathematics completed either Mathematics 1–4 (400 credits) or Mathematics 1–3, and were about to complete Mathematics 4. Some of the students who completed Mathematics 4 completed or were taking Mathematics 5 (100 credits) and/or a mathematics specialized course. These students studied in either the natural science program or technology program at Grade 12.	3 years	Varying, but approximately 150 on average	Completion of 9-year compulsory school with passing grades in Swedish, English, mathematics, biology, physics, chemistry, and at least six other subjects.	No prerequisites
United States	The mathematics programs/tracks vary by state and district. All students begin studying mathematics in elementary school with a focus on basic arithmetic and learning about objects they encounter in the environment. In middle school, students study basic algebra and concepts of variables, integers and polynomials. Some students take more advanced algebra in middle school. In high school, most students start taking focused courses such as higher level algebra, geometry, and pre-calculus. After completing those secondary mathematics requirements students can begin studying advanced mathematics (calculus/statistics) courses. The year during which students begin studying advanced courses varies, but generally it is in grade 11 and 12. In advanced mathematics, there are two main programs that are used across many states: College Board's Advanced Placement (AP) Program and the International Baccalaureate's (IB) Diploma Programme. The AP Calculus program includes two calculus courses, AP Calculus AB and AP Calculus BC, for students to choose between. Each course is independent and designed to be taught for one full academic year. AP Calculus BC is an accelerated version of the AB course that also covers additional topics. IB Mathematics is a two-year comprehensive program that also offers two courses, Standard Level (SL) and High Level (HL), for students to choose between. Each course is independent and has a two year duration. The TIMSS Advanced mathematics sample includes Grade 12 students who have taken an advanced mathematics course (AP, IB, or another advanced mathematics course specific to their state/district) in Grade 12 or in a prior grade.	Varies by school and by course	Varies by school and by course	Varies by district and school	Varies by school and by course

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