**Summary: A Case for a High School Acceleration Pathway for Next Generation Learning Standards for Mathematics**

**Long Island Consortium for Acceleration**

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* The Common Core Learning Standards for Mathematics (CC) as well as the Next Generation Learning Standards for Mathematics (NG) are of significantly higher rigor than the former 2005 standards.In fact, 71% of 2005 Integrated Algebra standards are included in the content for grades 3-8. The shift to CC and NG exposes all our students to a higher level of mathematics in the elementary and middle grades.
* The Common Core and Next Generation (CC/NG) Grade 8 coursework is comprised of roughly 65% former Integrated Algebra topics, 23% former Geometry topics and 12% new content. As a result, CC/NG Algebra 1 is correspondingly more advanced and includes concepts previously taught in Algebra 2 and beyond.
* Topics now taught in 6, 7, 8 are foundational for success in high school mathematics, as well as on the ACT, SAT, in college, carreer, and for basic mathematical literacy for life.
* Longitudinal studies indicate that entering students in an accelerated pathway who are not properly prepared has significant negative long term consequences.
* Technology has eliminated many jobs while changing and creating others, especially those involving mathematical and conceptual reasoning skills. One characteristic of a fast growing segment of jobs is that the employee needs to be able to solve unstructured problems while working with others in teams. At the same time, migration and immigration rates around the world bring diversity to schools and neighborhoods. This growth in interactions and information sharing from around the world means there is much to process, communicate, analyze and respond to in the everyday, across all settings. For a great majority of jobs, conceptual reasoning and technical writing skills are integral parts of the daily routine.
* To keep up with a changing world, we need a different approach to teaching and learning that focus on student’s ability to learn from peers and through technology, and their flexibility as a learner in a dynamic learning environment. Students need to be engaged in dialogue and learning experiences that allow complex topics and ideas to be explored from many angles and perspectives. They also need to learn how to think and solve problems for which there is no one solution—and learn mathematical skills along the way. NYS Math Standards require students to have deep conceptual understanding, fluency, and the ability to apply what they have learned to model contextual situations. The Standards for Mathematical Practice require that students work collaboratively to problem solve. Implementing this new level of rigor takes much more instructional time and a shift in the way we teach mathematics.
* Many districts are focusing on how many students “pass” the Regent’s exams, often sacrificing mastery for acceleration. The quality of the mathematics instruction is much more important than the speed in which students learn mathematics. We need to re-think our instructional priorities and the pathways we offer for students to access advanced mathematics.
* Pathways to AP Calculus and other advanced mathematics courses that require less curricular compacing and offer a later decision point have been developed in New York, California, and Massachusetts. Several districts are now offering a pathway to Calculus that does not compact or omit any coursework in middle school, and offers students access to Calculus directly after Algebra 2.

**Equity of Access to Advanced Mathematics**

One of the goals of mathematics acceleration is to offer access to advanced mathematics to students in high school. But, longitudinal studies show that when students are accelerated before they have demonstrated readiness, their performance and achievement decline over time. This practice often discourages students from pursuing advanced mathematics, the opposite of the desired effect.

If districts are going to offer multiple pathways, such as an advanced pathway and a regular pathway, they should offer multiple opportunities for students to enter and exit the pathways, with multiple decision points, and clear, well communicated criteria for movement into and out of the pathways.

If districts are going to offer one heterogeneous pathway for all students, that pathway should offer a smooth transition to advanced mathematics that does not skip any foundational content and allows ample time for students to master the mathematical skills and develop the necessary collaboration and communication skills that are also required for college and career.

Regardless of which philosophy the district espouses, multiple pathways or algebra for all, the educational goal should be mastery, not merely “passing”.

**The Pathways**

**Best Pathway to Advanced Mathematics**:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **6** | **7** | **8** | **A1** | **G** | **A2** | **AP Stat****Pre-Calc****AP Calc** |

Note: Culminating 12th year course can be AP Statistics, Pre-Calculus or other college credit bearing course. Districts may also offer AP Calculus if extra time is available in the schedule (double period). A menu of options should be available for all students.

**Best Pathway to AP Calculus**:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **6H** | **7H** | **8H** | **A1 H** | **GH+** | **A2H+** | **AP Calc****AB or BC** |

Note: Culminating 12th year course can be AP Calculus AB or BC, AP Statistics, or other college credit bearing course. Menu of options should be available for all students.

*Advantages of Honors Pathway to Calculus: multiple entry points and exit points relieves pressure for students to be accelerated at any one point but instead, when they have demonstrated readiness, all foundational standards are addressed at each grade level, utilizes ability grouping to allow strong students to flourish, significantly less compacting of content standards than the traditional middle school acceleration pathways, allows time for true mastery of standards needed for success in mathematics, allows time for students to develop the Standards for Mathematical Practices.*

**Secondary Compacting Schedule**

The following standards have been added to Geometry and Algebra 2 to allow access to AP Calculus. There is an assumption that students have mastered the foundational standards at each grade level. A rubric has been developed to help teachers communicate expectations of the Honors Plus pathway

**Geometry Honors Plus**

A2-F.FT.2 Apply concepts of the unit circle in the coordinate plane to calculate the values of the six trigonometric functions given angles in radian measure.

(+)-F.TF.7 Solve trigonometric equations:

* + analytically with inverse functions and interpret solutions in terms of the context.

 (+)-G.SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles.

(+)-G.GMD.2 Give an informal argument using Cavalieri’s principle for the formulas for the volume of a sphere and other solid figures.

Other Plus Standards? Subject to local math department review

**Algebra 2 Honors Plus**

(+)-N.CN.9 State the Fundamental Theorem of Algebra and use it to find roots of polynomials.

(+)-A.APR.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

(+)-F.IF.7d Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available.

(+)-F.BF.5c Apply the properties of logarithms to rewrite logarithmic expressions in equivalent forms and solve logarithmic equations.

(+)-F.TF.7 Solve trigonometric equations:

* + graphically with technology and interpret solutions in terms of the context.

Other Plus Standards? Subject to local math department review

**AP Calculus AB or BC**

Vertical articulation conversations must be had to clarify expectations at each level.

Rubric Template: The following rubric can be used as a platform for conversation as stakeholders collaborate on the articulation of performance indicators and assessment thresholds/

**The Selection Criteria and Rubric:**

Assuming that students have access to multiple pathways that offer homogeneous grouping, we can generally think of kids as performing in three different categories:

1. Student is clearly placed at a level that is below the level that is appropriate for them
2. Student is clearly placed at the level that is generally appropriate for them
3. Student is clearly placed at a level that is above the appropriate level for them

But there are always students for whom it is not so clear. For these students, there is a rubric.

**Mathematics Placement Rubric**

The following rubric can be used as part of the decision making process, to communicate to students and their parents the expectations for placement in any particular pathway.

|  |  |  |
| --- | --- | --- |
| **Student Performance on*****both* State Test and****Current Course Grade** | **Students in Regular Pathway** | **Students in Advanced Pathway** |
| ***EXAMPLE:*** *97-100* | *Move Up* | *Stay* |
|  | *Evaluate with Rubric:* *score average of 3 to move up* | *Stay* |
|  | *Stay* | *Evaluate with Rubric:**Score average of 2 to stay* |
|  | *RTI Protocols* | *Move Down* |
|  |
| **Performances** | **1 Does Not Meet Expectations** | **2 Working Towards Expectations** | **3 Meets Expectations** | **4 Exceeds Expectations** |
| **Academics:** |  |  |  |  |
| **Common Assessments** NYS 3-8 Assessment, Regents Exam, Local Benchmark Exams | ***EXAMPLE****: Level 1 & 2 on NYS 3-8 State Assessment.* *Level 1 & 2 on Regents Exam* | *Lower level 3 on NYS 3-8 State Assessment.* *Level 3 on Regents exam* | *Higher Level 3 on NYS 3-8 State Assessment.* *Level 4 on Regents exam* | *Level 4 on NYS 3-8 State Assessment.* *Level 5 on Regents exam* |
| **Class Average** Performance Trends |  |  |  |  |
| **Behavioral:** |  |  |  |  |
| **Perseverance and Resourcefulness**MP1 : Make sense of problems and persevere in solving themMP5: Use appropriate tools strategically |  |  |  |  |
| **Mathematical Reasoning and Communication**MP3: Construct viable arguments and critique the reasoning of othersMP6: Attend to precision | ***EXAMPLE:*** *Does not communicate effectively orally or in writing. Does not contribute much when working in groups, or overpowers the conversation and/or exhibits bullying behavior. Produces sloppy/inaccurate work*. |  |  |  |
| **Overall Average** | **1 Does Not Meet Expectations** | **2 Working Towards Expectations** | **3 Meets Expectations** | **4 Exceeds Expectations** |