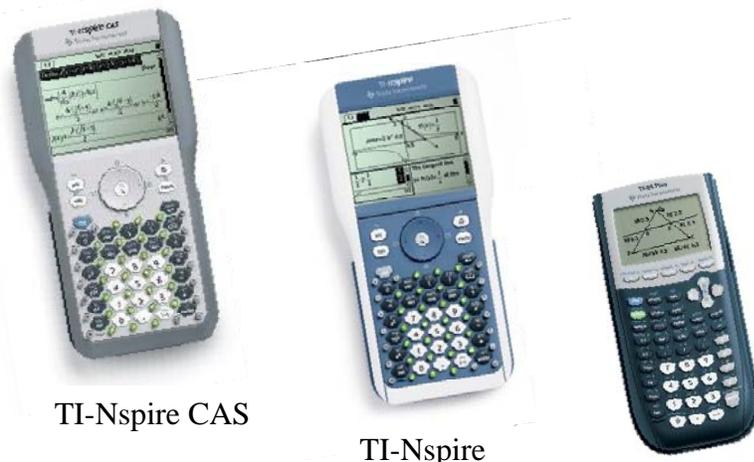


## **TI-Nspire Calculator Proposal**

**Glenbrook School Board Meeting  
Monday, May 11<sup>th</sup>, 2009**



TI-Nspire CAS

TI-Nspire

TI-84 Plus

- I. ADVANTAGES OF THE NEW TI-NSPIRE CALCULATOR**
  - II. TI-NSPIRE & TI-NSPIRE CAS**
  - III. ADVANTAGES OF THE COMPUTER ALGEBRA SYSTEM (CAS)**
  - IV. IMPLEMENTATION PLANS: GBN / GBS**
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### **I. ADVANTAGES OF THE NEW NSPIRE CALCULATOR**

The new Texas Instruments TI-Nspire calculator offers students all the current features of the TI-84 graphing calculator plus much more. The calculator is designed to function more like a computer than a calculator with file structures and drop-down menus similar to conventional computers. The quality of the resolution is greatly improved and the memory is more than ten times larger. The calculator even has a multi-directional wheel for navigating the screen and dragging objects.

The calculator operating system is easily upgradeable and students can download the newest version for free (via a USB link to computer with Internet connection). The ability to upgrade the operating system is intended to extend the life and usefulness of the calculator through high school, college, and beyond.

The ability to save files is pedagogically powerful. Students can save work and reference it at any point in the future. Teachers can pick up an idea from the day before and have students right where they were the day before simply by opening the saved file.

The TI-Nspire is a multi-faceted device. It includes a dynamic geometry system (for drawing figures, making measurements, visually displaying the effect of change and discerning geometric properties), a notes application for students to write text, a spreadsheet application, a statistics software package, and many more applications in addition to what is offered currently through the TI-84 calculator. Texas Instruments has partnered with the top software companies for each of these programs and designed a calculator version of the software.

The Nspire calculator also has a software version with all the functionality of the calculator that is sold separately. At this time the product is not sold as a site license, but rather is sold on a per user basis for approximately \$80. However, Texas Instruments is considering providing the Glenbrooks the software for teachers and students at no cost. Computers are not allowed in standardized testing.

Users of the TI-Nspire benefit from a split screen feature that allows multiple representations of the same problem (e.g., graph and equation, stat list and stat plot, etc.) to be viewed simultaneously. Graphs and

transformations are much more readily explored as students can grab a graph, manipulate it by sliding/stretching, and immediately see how the equation changes. Changes in one screen simultaneously generate changes in others (change a graph equation and table/graph update with new graph, drag a geometric figure and immediately update table with various measurements). When students can see a problem visually and symbolically side by side they can better grasp the principles behind them.

The Nspire calculator comes with an interchangeable TI-84 faceplate. When this is attached to the front of the calculator it operates and looks just like a TI-84. This provides flexibility during the transition.

The calculator has “pretty-print” which allows students to see mathematical notation in the same way they see it in class or in the textbook. This is true for entry and output.

The new calculator gives teachers the power to prevent students from storing information from a test or quiz. Furthermore, access to notes, programs, and other files on the calculator can be locked by the teacher during assessments.

Many activities are being written for the Nspire calculator. Some are written by Texas Instruments and posted on their TI Online Activities Exchange while others are designed by teachers and publishers. These are easily downloaded by the teacher and can be adapted for their classroom. Some math text publishers are integrating the TI-Nspire into their latest texts. The design of the calculator makes it easy to share files among teachers or with students. Students will be able to download applications and customize their calculator for specific courses year after year.

## **II. TI-NSPIRE & TI-NSPIRE CAS**

There are two versions of the TI-Nspire calculator. The Nspire and the Nspire CAS, which contains an additional capability called a Computer Algebra System (CAS).

*Note:* The TI-Nspire CAS is allowed on many standardized tests including the SAT and Advanced Placement. However, while the Nspire calculator is allowed on the ACT, the Nspire CAS is not currently permitted.

Glenbrook North is planning on adopting and thoughtfully phasing in the Nspire calculator, which is the preferred calculator by the North mathematics department at this time. Classroom sets of the TI-Nspire CAS will be utilized.

Glenbrook South is planning on adopting and thoughtfully phasing in the Nspire CAS calculator, which supports their curriculum development. The TI-Nspire CAS includes all the features of the Nspire (although it does not have the interchangeable TI-84 faceplate) plus it can solve, factor, symbolically manipulate expressions, etc.

### **History of CAS at GBS**

- GBS began using CAS on computers in the early 1990's. Over time, about five classroom sets of CAS have been acquired. The department began using CAS with the AP calculus classes three years ago. For the last two years GBS teachers piloted the Nspire CAS calculator (at no cost to students or district) in Advanced Algebra, Precalculus with Statistics, and the Precalculus & Discrete Mathematics courses.
- Six GBS math faculty members have written journal articles about CAS for national publications. The department as a whole decided to pursue this calculator change and use it as a primary tool for improving math learning at all levels of the curriculum.

### III. ADVANTAGES OF THE COMPUTER ALGEBRA SYSTEM (CAS)

The following outlines some advantages of CAS in the classroom.

1. Strategic use of CAS facilitates the learning of sound mathematics. CAS will:
  - Help in solving problems that involve algebraic manipulation
  - Generate patterns for student exploration and understanding that might not be easily generated without CAS; these include purely algebraic or arithmetic patterns and also connections between the algebraic symbolism and some general graphic interfaces
  - Provide a platform to support algebraic language and notation
  - Relieve drudgery of calculation when objective is higher order
  - Make higher-level concepts accessible to learners who otherwise would not be able to access them due to limited skill
  
2. Reputable U.S. curriculum developers are now including CAS as part of their math curriculum. (University of Chicago School Mathematics Project, Education Development Center and NSF curricula, CORE Communications, Key Curriculum, Pearson’s new CME Project series of texts) Three new University of Chicago texts that incorporate the Nspire CAS calculator have been adopted for use at GBS for the 2009-10 school year (Advanced Algebra 363, Precalculus with Statistics 463, Precalculus with Discrete Mathematics 563).

### IV. IMPLEMENTATION PLANS

#### A. Glenbrook North (TI-Nspire)

Required for 2009-10	Required for 2010-11	Required for 2011-12
<i>All incoming freshmen to buy TI-Nspire (all students at Northbrook Junior High have already purchased this past year)</i>	<i>All incoming freshmen to buy and any transfer student who was not here as a freshman.</i>	<i>All incoming freshmen to buy and any transfer student who was not at GBN previously.</i>

- Each year, the freshmen class will enter using the TI-Nspire.
- Each of the GBN feeder schools were told of this change last year at articulation. The current 8<sup>th</sup> grade class has been encouraged to purchase the TI-Nspire. Northbrook Junior High School sold the Nspire in their bookstore this year and will continue to do so subsequent years.
- Many of the 8<sup>th</sup> grade teachers from the feeder schools will be attending the TI-Nspire Summer Institute to be held at GBN in June. It is our hope that all of our feeder schools will begin using the Nspire technology in 8<sup>th</sup> and prior to 8<sup>th</sup> grade.
- The Nspire calculator would sell for approximately \$139. This is only \$7.50 more than the currently required TI-84 that sells for \$131.50.
- The GBN Math Instructional Supervisor has been a T<sup>3</sup> (Teachers Teaching with Technology) instructor since 1992. The GBN math department has a 30-student set of Nspires that were given to the department when Robin Levine-Wissing wrote four Nspire lessons/activities for the TI Nspire Teacher Activity Exchange. Four of the GBN math department teachers have been involved in writing Nspire lessons and presenting workshops at the T<sup>3</sup> International Conference.

## B. Glenbrook South (TI-Nspire CAS)

Required for 2009-10	Required for 2010-11	Required for 2011-12
Algebra Studies & Algebra Team Algebra / Geometry / Adv. Algebra Geom. Hon / Adv. Algebra Hon	<i>All courses from previous year &amp;</i> Geometry Studies & Team Precalculus with Statistics Precalculus Honors	<i>All courses from previous year &amp;</i> Algebra II Studies & Team Precalculus with Discrete Math Calculus courses

*\*table does not include Algebra III Studies, Decision Making with Data, and AP Statistics which will require the calculator in 2012-'13.*

- For the 2009-10 school year, the following percentages of students will be in a math course that requires the Nspire CAS calculator.

Freshman Class of 2013	100%	635 students purchase new Nspire CAS
Sophomore Class of 2012	62%	375 students purchase new / borrow loaner
Junior Class of 2011	21%	128 students purchase new / borrow loaner
Senior Class of 2010	2%	11 students purchase new / borrow loaner

- This plan maximizes instructional benefit of the TI-Nspire CAS as soon as possible while preventing current students from having to purchase the new calculator. Current students in a course where Nspire CAS is required would have the option not to purchase a new calculator but borrow a school-issued Nspire CAS calculator. All incoming freshmen would have to purchase the new calculator (unless free/reduced). The plan is based by math course (as opposed to year in school) with the goal of avoiding students with different calculators in the same course. This way instructional time will not be lost by having to teaching two different calculators in the same class. Most math classes have two or more years in school represented. There are a considerable number of sophomores in courses requiring the TI-Nspire CAS in 2009-10 because they are in a course with freshmen.
- By moving ahead with a course like Advanced Algebra in 09-10 nearly all teachers will have a course with the Nspire CAS next year. This is helpful in planning professional development activities and training as all teachers will have a stake in further training. This timeline puts the whole math department into a common situation with a common purpose. This will foster collaboration and help strengthen curricular and training initiatives. Furthermore, teachers are eager to reap the benefits of the new calculator in the regular sequence with texts that incorporate the Nspire CAS into the curriculum.
- The current cost of the TI-84 calculators is \$131.50. The Nspire CAS will be sold at the Bookstore for \$141.11 (\$159.00 online through Texas Instruments). The Nspire CAS calculator is not available in stores and can only be purchased online if not purchased at the Bookstore.
- Next year's sophomores and juniors (Class of '11 and '12) will be encouraged to purchase the new Nspire CAS calculator if they are in one of the courses where the new calculator is to be implemented. To defer some of the cost to parents, the school will allow students to sell back their used TI-84 calculators. A fair market price (\$45) will be paid for used 84's in good condition. Buyback will go through the Bookstore and separate GBS accounts will be designated to fund this initiative. Students will only be allowed to sell back a maximum of one TI-84 calculator. They will only be allowed to sell it back after the Prairie State testing is done in April of the junior year. Many students will opt to keep their TI-84 for additional ACT tests taken the following summer and during senior year. Bookstore staff will be trained in how to ascertain that the calculator is in good condition. A \$45 credit will be applied to the family's Bookstore account when the TI-84 is sold back to the school. This buyback program will in effect reduce the purchase price of the new calculator. This program will be in effect for three years and would not apply to the Class of 2013 or future classes.
- There is no penalty for current students who opt to not purchase the new calculator. A loaner will be made available by GBS and the student will not be at any disadvantage. Such a student would not be eligible for participation in the buyback program since a new calculator was not purchased.

- About 1 out of 4 GBS students got their TI-84 from a sibling (according to departmental survey). Many 8<sup>th</sup> grade students do not purchase a TI-84 and the Nspire CAS required of incoming freshmen will be their first major calculator purchase.
- Department and school funds (as well as support from Texas Instruments) will be used to create a supply of “loaner” CAS calculators for use at GBS (special situations/low-income students). Title I funds could be used to acquire calculators for Free/Reduced students and for some loaners. TI will provide GBS with approximately 100 loaner Nspire CAS calculators for one year. Glenbrook South and North will also receive one free calculator for every sixteen that are purchased.

### C. Professional Development – GBN & GBS

The last two summers many teachers from both Glenbrook North and South have participated in intensive full week sessions offered for educators from the area. The training in summer '07 was at North and was at South in the summer '08. Yet another group of Glenbrook teachers will be participating this summer in the training and it is being held once again at North. Teachers from the Glenbrooks and districts throughout the state send teachers for training at these institutes.

Additional intensive training will take place at both schools in the fall. Professional Development for the teachers will continue in the fall with Robin Levine-Wissing, Phil Gartner and other teachers leading the sessions. Texas Instruments will also offer training with their associates at no charge (for both schools). TI's online resources, Atomic Learning, and others have also made learning the calculator online convenient.

### D. Impact/Communication with Sender Schools

The Glenbrooks have remained in contact with our sender schools regarding our movement to the Nspire and Nspire CAS calculators. As the table below shows, at this point in time, it has very little impact on sender schools as they do not have a consistent calculator requirement. Only Northbrook Junior High requires graphing calculators and they will require the TI-Nspire, which is consistent with GBN.

Sender School	Calculator Information
Field	Students are required to have a scientific calculator starting in 6 <sup>th</sup> grade. TI-83's are available in classroom as needed. Field is acquiring Nspire CAS calculators for class sets. Because school splits they would not have students buy a calculator not used at their high school.
Maple	Students are required to use a TI-34 scientific calculator beginning in 6 <sup>th</sup> grade. Class sets of TI-84's are available as needed in classroom.
Springman and Attea	No graphing calculator required, but some students do purchase TI-84. There are sets of 84's in each classroom to hand out as needed.
Northbrook	All 8 <sup>th</sup> graders purchase the Nspire but it is being used as an 84 at this point. Some teachers will receive training at GBN this summer on using Nspire technology.
Wood Oaks	There are class sets of TI-83's. Current Algebra students purchased Nspire for home use.

## V. FREQUENTLY ASKED QUESTIONS

### A. Glenbrook North

1. How will the situation be handled when freshmen with the Nspire are mixed with older students with the TI-84 from the previous year? How will lessons be handled in these classes?

*Geometry 163 is a class that has more freshmen than sophomore students. Teachers will have department TI-Nspires that a sophomore student can use during the class period. We anticipate that some sophomores might purchase the Nspire and perhaps give their 83/84 to a younger sibling. This will only be a situation for next year as the following year any freshmen/sophomore classes will all have the Nspire.*

*Algebra 163 G is almost all freshmen. If there is a sophomore in the class(there might only be a total of 4 in the dept)we can furnish a loaner for units taught that are Nspire intensive. This would be the case for Algebra Team as well.*

*Freshmen in Advanced Algebra 263 will use the TI-84 keypad side of the Nspire in Advanced Algebra. This course is predominantly sophomores and some juniors; for the next two years the course will not rely on the Nspire capabilities until all three grade levels have them. Advanced Algebra/Trig 273 Honors has freshmen and sophomores. Teachers in this course will bring in dept. Nspires for in class lessons when appropriate for all students to use the Nspire. This will only need to be done for one year as all students in this course will have the Nspires the following year.*

2. What other schools are using this calculator or planning to use it soon?

*Several schools in the area are exploring the use of this calculator and some have been piloting its use. New Trier has been using the Nspire and Nspire CAS calculators in select classes. They are considering adopting the calculator. Schools such as Plainfield and Walter Payton Prep have moved entirely to the new Nspire CAS calculator and their students are using them now.*

3. When was the last time GBN / GBS called for a significant change in calculator requirements?

*It has been over ten years that students have been using the TI-83 and TI-84 family of calculators. When the new TI-84 came out with improved features, we still allowed students to use the old 83 because it was comparable in design and use. The TI-Nspire has a keypad which is used when the teacher wants the students to use it in TI-84 mode. Students with the 84 keypad on the Nspire and students with a TI-84 have the exact same capabilities.*

*The TI-84 line of calculators will eventually become out-dated and be phased-out. TI has not made any improvements to this calculator for years as all their research and development has gone into their newer line of products like the Nspire calculator. At some point in the future it is expected Texas Instruments will discontinue the manufacture of new TI-84 calculators.*

## **B. Glenbrook South**

1. Won't students get rusty with their TI-84 for the ACT if they have been using the Nspire CAS all year?

*This was not an issue with students in the pilot classes who used Nspire CAS all year but those students had used the TI-84 for years before switching to the new calculator. As the years pass, students will not be familiar with the TI-84 (unless used in middle school). The TI-84 is learned very quickly. Students will have the option of borrowing the calculator at GBS (for the junior year) and teachers with juniors will work with the TI-84 instead of the Nspire as needed in the months leading up to the ACT test.*

2. What other schools are using this calculator or planning to use it soon?

*Several schools in the area are exploring the use of this calculator and some have been piloting its use. New Trier has been using the Nspire and Nspire CAS calculators in select classes. They are considering adopting the calculator. Schools such as Plainfield and Walter Payton Prep have moved entirely to the new Nspire CAS calculator and their students are using them now.*

3. How have GBS students responded to the calculators in the several Precalculus classes that have used them the past two years? Have ACT scores been affected?

*While some students struggled with learning the new calculator at first, by the end of September students were very comfortable and liked the calculator. When students moved from a pilot class back to the regular calculator for 2008-09 many missed the Nspire CAS. Teachers who have taught with it do not want to ever go back to the old TI-84 calculator. ACT scores were neither significantly helped nor hurt by use of the calculator based on juniors in the pilot classes for 2007-08. We value our students' performance on the ACT and will work hard to ensure that this change is a positive one in that respect.*

4. Does CAS cause basic skills to erode?

*No. When used correctly, the use of this new calculator should enhance instruction and improve conceptual understanding. Research has found that the group with CAS performs better on conceptual tests while performing just as well as the control group on "skills" tests. It should be noted that many of the questions for math on the ACT are quite conceptual in nature. Very few questions are a matter of just basic skills.*

*Teachers will recognize that there are basic skills for which students still need to use paper and pencil. Teachers recognize the importance of assessments where calculators are prohibited or where explanation/work must supplement answers. Not only is this good pedagogy, but this prepares students for tests where the Nspire CAS is not allowed (such as the ACT).*

*Teachers will be trained in the strategic instruction and assessment in a CAS environment. There will be much collaboration in the first years as course teams implement this new tool and adjust instruction and assessments accordingly.*

5. Might ACT change their calculator policy in the next few years and begin to allow these calculators?

*We will lobby ACT to conduct some research wherein students take an advisory ACT test using Nspire CAS. Our hope is that the ACT policy will eventually change but it may take a few years. It is also possible that the officials at ACT could decide to ban calculators all together since none of the questions require the use of a calculator. Some other mathematics tests have gone that direction to deal with the issue of calculators (some State math contests, American Invitational Mathematics Exam).*

*CAS calculators are allowed on the Advanced Placement math/science exams and on the SAT. They are allowed for various math contests. In time, testing entities like the ACT tend to catch up, and ACT officials are currently reviewing classrooms using CAS and attending CAS sessions at conferences. Glenbrook impacted the original use of the TI-82 graphing calculator on the ACT in 1990; it is possible that we could again initiate a change in ACT calculator policy.*