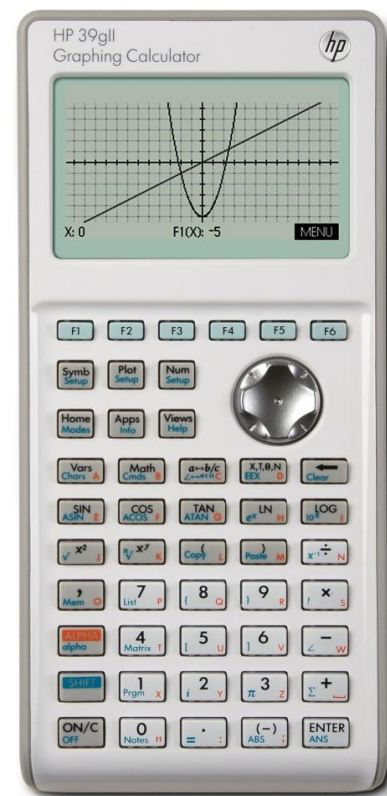# The HP GC in Education Newsletter

July 2013

Issue 3

Welcome to Issue 3 of the HP GC in Education Newsletter. Boxed and complete versions of HP Prime were sent out mid-June to the support community in Europe. Now we can all start to develop ideas for students to take advantage of the amazing potential of this new machine. In this issue you'll find an example activity making use of the advanced graphing app on HP Prime, more discussion on the issue of use in exams, two teachers giving their views on graphing calculators in the department and in the classroom plus news and views as we all look forward to HP Prime and its little sister the HP39gII supporting students develop their mathematical understanding.

HP Prime News and Views

The education system in England is changing fast. A new national curriculum for mathematics has just been launched. Now students before the age of 16 will need to learn about mechanics; projectiles, forces and so on. Mathematical modeling is now a requirement. Proof is clearly present. The intention is to raise the bar in terms of mathematical expectations. The government inspection agency, Ofsted, has published a report condemning the routine drill and practice methods that have often been seen in maths classrooms.
It would seem that HP's timing is spot on. Students need to develop their understanding through exploration and problem solving. They need tools that understand mathematics and speak its language in a flexible and dynamic way. There has been a long heritage of excellent products from software like Cabri Geometre and Autograph, to handhelds like the HP50g and TI-nspire. But, now there is a handheld device that works the way young people are used to (app based and touch interface) and which covers all of mathematics in one machine (exact mathematics in a computer algebra system and approximate mathematics with units in a calculation home screen). Teachers can show their students work on the classroom screen through wireless connectivity and the classroom is equipped for real mathematical dialogue …. HP Prime has arrived!
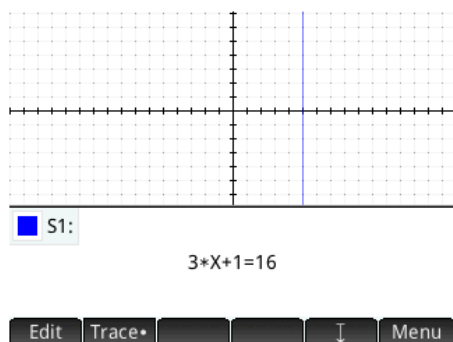
Contents:

Sometimes True, Always True, Never True

A Mathematical Exploration for the HP Prime

If we look at the statement $3x + 1 = 16$ we can say immediately that this is true only when $x = 5$. Compare that to the statement $2x + 3x = 5x$. That is true for any value of x. It doesn't matter what x is, 2 times a number plus 3 times the same number is always the same as five times that number. Now compare with the statement $\sin(x) = 2$. There is no value of x where $\sin(x) = 2$ because the values of $\sin(x)$ are always between negative and positive one.

So:

- $3x + 1 = 16$ is sometimes true … in fact true in one instance $x = 5$

- $2x + 3x = 5x$ is always true … it is true for all x

- $\sin(x) = 2$ is never true.

S1:
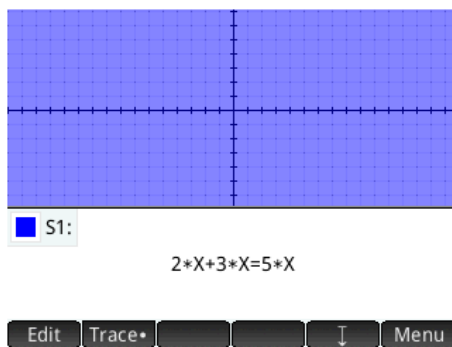
3*X+1=16

Edit | Trace• | | | ↕ | Menu

See what happens when we type these statements into the Advanced Graphing App in HP Prime.

1. Click Apps
2. Select Advanced Graphing
3. Type the statement into the line for S1
4. Click Plot
5. Press Menu then Defn (you can drag the graph into a more suitable position if you like)
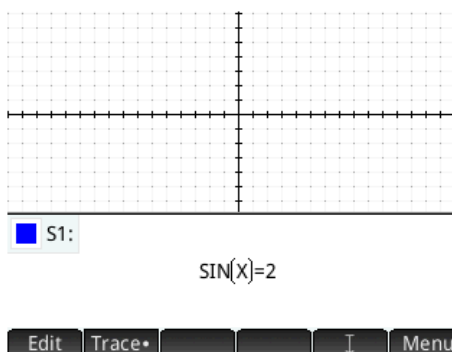6. Click Symb to edit the statement, press backspace to

delete, then type the next statement and continue as before.

The graph for $3x + 1 = 16$ is a graph of $x = 5$. These two statements are the same. The solution is $x = 5$

S1:

2*X+3*X=5*X

Edit | Trace• | | | ↕ | Menu

The graph of $2x + 3x = 5x$ is everything. It is always true.

The graph of $\sin(x) = 2$ is nothing. It is never true.

S1:

SIN(X)=2

Edit | Trace• | | | ↕ | Menu

Mathematically we are very interested in situations of the first two types. An equation which is always true is called an **identity**. Essentially the statements are identical. Equations which are sometimes true have **solutions** and we are interested to know which equations have solutions and how many they might have. In both cases we can take the statement and manipulate the algebra to see if we can find statements which are solutions or are identical.
For $3x + 1 = 16$ the solution is $x = 5$

But $2x + 3x = 5x$ is always true so it is an identity. We write it: $2x + 3x \equiv 5x$

Note: Just because the screen shows all, some or none shaded does not prove that these are the only outcomes, just in the range that the screen is showing. You could zoom out (press the – key a few times, which is more convincing, but you cannot see an infinite range!) Nonetheless this gives a very good visual indication.

The full downloadable activity sheet is available on the support web site (see below). This page sets out the idea. Please send feedback on this activity and also your own activities to take advantage of the unique features of HP Prime.

A CAS View from the Netherlands
Roosmarij Vanhommerig

In our education system there are four different math courses. They differ greatly and are designed to prepare students for their future studies.

Maths A prepares students for studies in such fields as economics and health. Maths C is designed for the social sciences focussing on probability and statistics. Maths B is for students who will be going on to the exact sciences and they will cover a lot of hardcore maths. Maths D is a supplement to maths B …it is for the real fanatics and it is a JOY to teach.

I do believe being able to solve equations algebraically is a skill worth learning. It takes a systematic way of thinking, it takes accuracy and requires dealing with a certain level of abstraction. But it is not for everyone, let's be clear on that too! In my opinion, there should be a distinction between the maths courses here. Future engineers and mathematicians will benefit from the experience of being able to solve equations algebraically, since they will encounter lots of abstract thinking and programming in their future. Also, these are the students that enjoy doing rigorous mathematics! In my Maths B classes I find that they are used to plotting graphs on their calculator but when I show them basic graph forms and

how to do translations and transformations, they love it! They love being able to figure out how stuff works, the challenges of algebraic problem solving and abstract thinking. They are as you would want future scientists to be.

In courses A and C they struggle with grasping the abstraction needed to do algebra. Give them any realistic situation and their common sense will kick in, but adding an x distracts them somehow. I am convinced that there are students who despite willpower and best efforts, are not able to do algebra. These are the students that would greatly benefit from a calculator with CAS, as it will allow them to solve problems they would otherwise be unable to do. Problems they do not need to do algebraically, given their future path. I think CAS could help these students to gain a better understanding of mathematics, a general understanding of the possibilities math offers.

But what use is it to know the steps to the salsa if you don't have any sense of rhythm or the passion that is associated with the dance? What good is to go through the motions, learn the mechanics, without understanding? Our children might as well be machines, if they do not get a chance to understand what is the heart and soul of mathematics.

See:
http://www.themathszone.com/?p=496 for the full debate.

Early Days in Developing Graphical Calculator Use Across a Secondary Maths Department.
Lynette Bromfield, Buller's Wood School, Bromley, UK.

As a department we are all trying out short activities – maybe one or two lessons – to get students (and teachers!) familiar with the technology. We have had some problems – e.g. an upgrade of our network has meant that the interactive calculator no longer works (this needs addressing) plus more mathematical issues like: How do you input the equation of a circle without resorting to rearranging it and taking both the positive and negative square roots? Staff are finding (as you would expect) that their confidence grows as they use the technology more. My plan is to centralize the resources/ideas used so far and to share them (and teachers' experiences) at a future department meeting to try to increase the use of the GC across the whole department. I have also surveyed students about their reaction to using the technology both to engage their interest and to promote more independent learning but the results are not yet analyzed.
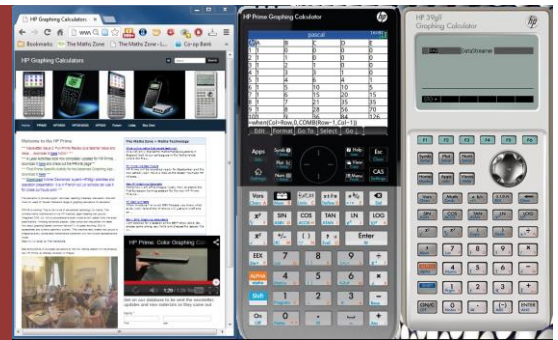
Editors Notes
1. Network management often means software needs to be reinstalled, but students can always work with the handhelds!
2. A circle is not a function, so on the HP39gII it has to be graphed in two parts. On HP Prime the advanced graphing app allows any relationship between x and y to be graphed.

Calculators, StreamSmart and a full range of support materials …
←
HP Prime at the MEI Conference, Keele University, June 2013

HP Prime, HP39gII, the hpgraphingcalc.org web site and the YouTube Prime teaser…   →

HP Prime at the MEI Conference

Chris Olley

Mathematics in Enterprise and Industry is a long established UK organisation for promoting innovative approaches to mathematics teaching. A most exciting innovation is a module they have accredited as part of the A Level examination in mathematics, where a CAS enabled handheld is allowed in the exam. The first group of students completed the exam this summer. At present the support materials for students only engage with the TI-nspire CAS. However, now that HP Prime is here, students will have an interesting choice. It was good for me to see how easily the materials could be translated to work with HP Prime. These versions are available on the hpgraphingcalc.org web site. Teachers were very impressed with the look and feel of HP Prime. However, hearing about the low cost wireless connectivity brings the device alive. This will really change the way graphing calculators are seen as classroom tools. Schools are buying iPads and then wondering what to do with them. In maths, the software is poor, so "not a lot" is the answer. Instead maths departments can look for a specialist device and HP Prime is clearly generating some excitement.

A View On Exam Use from OCR

At the MEI conference I talked with the Oxford and Cambridge Examinations maths team. It is important to say that there is no approval process for calculator use in exams in England. The ultimate responsibility for checking that your device meets the rules is with the candidate. This is very different to most other countries. However, their view was that the exam mode on HP Prime was an acceptable way for candidates to be sure. They said that TI's press-to-test system had been accepted and this set a good precedent. They did not think that the existence of a CAS in HP Prime was a problem at all, since the exam mode allowed it to be disabled. I was very encouraged by this view.
We know that in England the decision normally rests within each school with the exam secretary and the head of maths, so I hope they too will be encouraged by this way of thinking.

So, to follow up, here is a view from a head of maths …

Is your graphing calculator permissible in public exams?

Linda Earnshaw
Magdalen College School, Oxford, UK

There is no definitive answer to this. Some schools ban all graphics calculators from the exam hall to avoid this question.
The problems lie with retrievable data within the calculator, symbolic algebraic manipulation and possible communication with the internet and other machines. As technology advances it is becoming increasingly difficult to monitor the changes and ensure that all calculators in exam halls are within the regulations.
HP have designed their new calculator the HP Prime with this in mind. They have not compromised on functionality of the calculator (it is way ahead of many of its competitors) but would not be permitted in an exam hall as it is normally. However, the calculator can be disabled quickly and easily so that it is within the JCQ regulations. In fact exam boards could issue an electronic file that does the disabling if they want to ensure this. Also invigilators in the exam hall are able to see easily that HP Prime calculators are in exam mode.
Surely this is the way forward.

Prime Links
The GT Springer Interview at Cemetetch:
http://bit.ly/11z2dWc

GTs activity set for HP Prime from the Prague training:
http://bit.ly/11z3TPi

Calc-Bank Comparison shows Prime is fastest:
http://bit.ly/146jqlI