MATHEMATICS ON POCKET PC'S

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Introduction

Pocket computing technology currently appears to be the next wave in any time-any location technology. Students will soon have possession of this technology and many groups are looking into its use in education. Therefore, it is important to know what mathematics software available for use in education.

We are part of the Numina Project http://aa.uncwil.edu/numina/ at UNCW who have been testing and using technology in science and mathematics classrooms for well over a decade. We have in the past several years secured internal and external support for the development of a digital library - http://turing.bear.uncw.edu/ilumina/homePage.xml, associated with the National Science Digital Library (NSDL), and for the investigation of uses of handheld and pocket PCs in the classroom.

Within the limited space allowed for this article, we can only provide some highlights of what mathematical software is currently available on Pocket PCs but not provide an assessment of these packages. The importance of this paper lies in the fact that it is very difficult to locate such resources through the usual Internet searches. Thus, this is one of the few, if not the only, listing of such software for mathematics. Below are links to various sites mentioned in this talk delivered at the 2002 ICTCM in Orlando, FL, USA. Many of the descriptions were adapted from those provided at the sites. Sample Snapshots are provided at the end of this paper.

Graphing Utilities and Calculators

RDCalc http://ravend.com/ An inexpensive graphing calculator with lots of hidden features, including regression, periodic tables, and unit conversions. The interface is similar to the standard graphing calculator.

GraphData This utility was written as a tool for plotting and analysis of data captured from Pocket Excel. Linear, exponential, power law and inverse relations can be fitted to the data. This program can be found in the iLumina Digital Library and further information can be found at people.uncw.edu/hermanr.

AutoGraph http://www.developerone.com/pocketpc/autograph/ Pocket AutoGraph makes it simple to quickly create graphs from the data in your Pocket Excel spreadsheets on your Pocket PC.

Gnuplot on WinCE http://www.rainer-keuchel.de/wince/gnuplot-ce.html

MRI Graphing Calculator - http://www.mathresources.com/

Ptab - http://www.z4soft.com/ PTab is a fully functional spreadsheet for a variety of handheld devices with the features of common desktop spreadsheets and can be used with existing Excel files.

Software with CAS Capabilities

Euclid - http://www.poliplus.com/ Euclid is an interactive mathematics visualization environment for dynamic geometry in which users can draw shapes and transform them while measuring important geometric relations. It needs Jeode JVM and currently only works on specific machines.

Formulae 1 http://www.poliplus.com/ F1 is a CAS that can perform mathematical calculations from simple algebra to complex calculus both numerically and symbolic. It needs Jeode JVM and currently only works on specific machines.

Geometer's Sketchpad Build mathematical models by drawing with the stylus and then explore their properties dynamically by transforming their components. This was specifically made for the Cassiopeia and appears that the hardware is no longer available. http://www.casio.com/accessories/product.cfm?product=1742

MapleV for the Cassiopeia This is a stripped down kernel of MapleV. It is powerful and in black and white. This was specifically made for the Cassiopeia and it appears that the hardware is no longer available for newer products.
http://www.casio.co.jp/edu_e/product/new_products/hpc_edu/detail/maple.html

Math Xpander http://www.saltire.com/xpander.html Created in the laboratories at Hewlett Packard Math Xpander supports graphic, symbolic, and numeric computations.

Maxima on WinCE http://www.rainer-keuchel.de/wince/maxima-ce.html (This is a WinCE Version by General Paranoyaxc Software http://www.rainer-keuchel.de.) Maxima is a Common Lisp implementation of MIT's Macsyma system for computer based algebra. [There is a free desktop version as well: This and more can be found at http://www.ma.utexas.edu/users/wfs/maxima.html.)

Data Acquisition

Data Harvest DATAQ System http://www.data-harvest.co.uk/ This system works on handhelds and pocket PCs with a variety of probes and can use many of the Vernier probes. The software has been recently upgraded and Flash Logger (below) can be used on PPCs. There is a desktop version of the software as well.

Flash Logger http://www.flashlogger.com/ The EasySense Flash card logger slips solidly into the Compact Flash expansion slot of your Pocket PC to form a completely integrated probe solution. This is also a product of Data Harvest. [See above.]

Miscellaneous Packages

LaTeX on WinCE http://www.rainer-keuchel.de/wince/texce.html Standard LaTeX editing and viewing through a dvi-previewer is possible on handheld and pocket devices.

Frequency Tuner http://www.frequencytuner.solcon.nl/ This is a program that can measure the frequency of a sound and convert it to a note.

HASA 2.1 http://www.equatesystems.com/pocketpc/ HASA is a handheld audio frequency spectrum analyzer for the Pocket PC. Frequency components of sounds picked up by the built-in microphone are shown in real-time.

Pocket Hyperchem http://www.hyper.com/ Pocket HyperChem is an integrated and flexible molecular modeling product for researchers, educators, and students, presenting molecular mechanics and semi-empirical quantum mechanics calculations. This software demonstrates the capabilities of what can be done on handheld devices that a decade ago could only be done on large machines - visualizing and analyzing molecular dynamics

Pocket Oscillator http://www.equatesystems.com/pocketpc/ In Pocket Oscillator audio signals can be generated and manipulated in a Pocket PC 2002 environment.

Other Platforms

Most of the above software runs on Pocket PCs. In some case there is software for the Handheld PC technology, but much is now being developed for the Pocket PC 2002 operating system. Another technology that is available is the Palm Pilot, as it is less expensive, though limited in memory and usage. A review of some of this software and the use of the HP CAS systems on graphing calculators can be found in the November 2002 issue of *Mathematics Teacher*. However, there is also mathematics software available for these machines. Furthermore, Linux is available for handheld computing on several handheld devices.

Finally, many of the old DOS favorites can be run on Pocket PCs by installing PocketDOS. However, there are limitations to the DOS version and graphic driver support.

PocketDOS http://www.pocketdos.com/ PocketDOS is based on an IBM PC/XT emulator for Windows CE which emulates a PC with an 80186 processor, 1Mb of RAM, a CGA-compatible display. PocketDOS is able to provide the same level of application compatibility as the original IBM PC/XT, while still allowing the H/PC or P/PC user access to all of the features and applications of the Windows CE operating system.

Linux/Unix Some places to look for embedded Linux OS are http://www.linuxda.com/ for Palm III. The NetBSD Operating System is a fully functional Open Source UNIX-like operating system. http://www.netbsd.org/ However, at this time it appears that there Linux OS are restricted to certain platforms.

Palm Pilot There are several programs for doing mathematics on Palm Pilots. However, there appears to be quite a bit more for devices running the PPC 2002 OS.

Development Tools

There are many tools that can be used to develop applications for Pocket PCs. One can program using embedded Visual C+ + or embedded Visual Basic. Microsoft is supposedly phasing out embedded programming in favor of the new .NET technology. These technologies are also important in software development for mobile phones.

MS Embedded Visual Tools This free environment coupled with appropriate SDKs (Microsoft development packages) allows users to program in embedded Visual C++ or embedded Visual Basic to create stand alone applications that run on pocket and handheld computers. http://www.microsoft.com/mobile/downloads/emvt30.asp

NS Basic http://www.nsbasic.com/ On October 30, 2002 the NS Basic Corporation announced the immediate availability of NS Basic/CE 4.0, a development tool for all commercial Windows CE and Pocket PC devices, including those from HP, Compaq, Casio and others.

Visual Studio .NET http://msdn.microsoft.com/vstudio/ This next wave of programming includes embedded programming, which is also important in mobile phones systems, and is combining the embedded environment into that for standard PC operating systems.

Another approach is to use Macromedia Flash. At the time of the presentation there was a Flash 5 plug-in for Pocket PCs. In early 2003 there will be an upgrade to Flash MX. This will allow users to write Flash applications that can be used on both desktops and pocket computers.

Flash Math http://www.friendsofed.com/fmc/downloads/ Examples of creative uses of Macromedia Flash using simple mathematics routines.

Macromedia Flash Player for PPC Macromedia Flash 5.0 files can be viewed on systems with Pocket PC 2002.
http://www.macromedia.com/software/flashplayer/pocketpc/download/

Flash Differential Equations Tools http://www.math.wsu.edu/idea/Flash/ See the IDEAS Project page for these tools for creating Flash models for mathematics classes.

Finally, one can develop web-based applications for the classroom. An example of this is a Web-based response system:

Numina II SRS http://aa.uncwil.edu/numina/srs/ This is a Web-based student response system that uses a combination of wireless networks, handheld computers, and a data projector to allow students to submit responses to questions posed by an instructor. The instructor poses a question in a multiple-choice, true/false, yes/no, or opinion-based format and directs students to a Web site that generates a form on their computer screens through which they submit their responses.

The Future

As with any technology these days, Pocket PCs could be short lived. The costs are coming down, but there are other technologies on the horizon, which will also need some scrutiny as to their use in mathematics education. No matter what form of technology surfaces, we will always need to be prepared for the day when our students show up to class with them or IT staff dream up for us to promote.

MS Tablet http://www.microsoft.com/windowsxp/tabletpc/ At the time of this conference Microsoft was pushing its new Tablet device. Due to the hype, we should keep an eye on this device as a replacement for laptops in the classroom vs the smaller handheld devices.

OQO http://www.oqo.com/ This is marketed as the world's first ultra-personal computer. It runs XP and has a 10 GB drive as well as other amazing features.

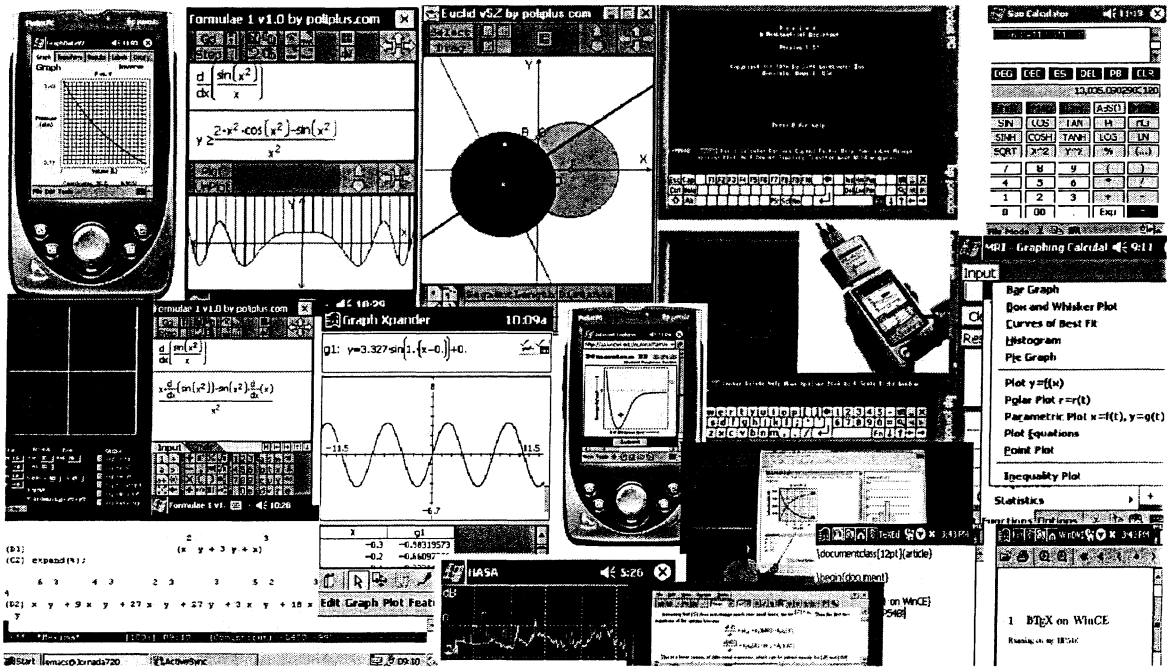

Figure 1 Collage of Snapshots of Some Mentioned PPC Software