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Head back to school this year with HP's line up of calculators, perfect for any grade. See the different types that help your students tackle even the toughest problems with speed and ease.

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Your articles



» **[Announcing the HP 39gs Graphing Calculator Classroom Kit for middle grades](#)**

Now there is a solution that provides teachers with the tools and training to engage and motivate middle school students in math. This kit integrates technology with team activities to facilitate enhanced learning.



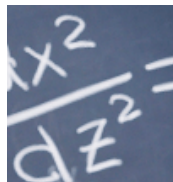
» **[Using the HP 40gs in Advanced Placement Calculus](#)**

In this article we will use the HP 40gs calculator to solve Advanced Placement Calculus problems. See how difficult calculations are made easy with HP calculators and these step by step instructions.



» **[RPN Tip #8](#)**

In this month's RPN tip you'll learn to solve a linear interpolation problem. Use the RPN problem solving guidelines to accurately get the price of a certain quantity of something when you only know its price at another quantity.



» **[The technical corner](#)**

Learn the technical operations behind adding numbers in a calculator in this month's technical corner.

Upcoming HP Calculator events

Event	Dates - Location
WIPTTE	October 15-16 - Westville, IN

**Volume 8
September 2008**

Welcome to the eighth edition of the HP Solve newsletter. Learn calculation concepts, get advice to help you succeed in the office or the classroom, and be the first to find out about new HP calculating solutions and special offers.

[Download PDF version](#) of newsletter articles.

Featured Calculator



» **[HP 40gs Graphing Calculator](#)**

Another calculator that's perfect for the classroom, the HP 40gs is September's calculator of the month. With 750 built-in functions and powerful applications, this calculator is perfect for back to school.

[Learn more »](#)

HP Calculator Blog

Check out Wing Kin Cheung's blog, "The Calculating World with Wing and You."

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HP calculators for back to school

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By: Susan Twombly

Smart answers to tough problems for pupils large and small

If you're the parent of a grade schooler or a near graduate or you're preparing to teach a class of your own, you should know that HP has a full line of financial, scientific and graphing calculators that can help start the school year with a stroke of genius. So, before your student gets stumped, see what HP has in store to help them tackle the toughest problems with speed and ease.

For students

College: Figure these into your future



The new **HP 20b Business Consultant** financial calculator is ideal for students *and* professionals. Its modern design, intuitive layout and new high-speed CPU makes it stylish, fast and easy to learn and use. It features a large, two-line display accommodating up to 12 digits and a choice of time-saving Reverse Polish Notation (RPN),¹ hierarchical or traditional chain algebraic data entry.

The **HP 50g Graphing Calculator** is a powerful, flexible calculator designed for math, science and engineering applications. Students can confidently tackle problems with 2.5MB total memory² and use the available SD card slot³ to transfer data and expand memory. They can view calculations on a large, high-contrast display, choose between data-entry modes (RPN, algebraic and textbook) and work efficiently with a large equation library and 2300+ built-in functions.

High school and middle school: Solve more simply



A great graphing tool for math and science, the **HP 39gs Graphing Calculator** is simple to use and displays answers on its large, screen in symbolic, numeric and graphing views. Students and teachers can save their work as documents and share them wirelessly to get all students on the same page at once.

The **HP 40gs Graphing Calculator** is compatible with the HP 39gs, plus it has a full Computer Algebra System (CAS) to perform symbolic operations. The interactive CAS editor lets you write expressions as they appear in textbooks. The editor also keeps track of all expressions entered and gives you 1-button access to them.

Middle school and elementary school: Start smart



The simple-to-use **HP 10s Scientific Calculator** can go with students as their challenges grow. Its large easy-to-read two-line, 10-character LCD display makes viewing entries, results, menus and prompts easy. Runs on a standard battery or solar power.

For teachers



The **HP 39gs Graphing Calculator Classroom Kit for Middle Grades** provides teachers with the tools and training to engage and motivate middle-school students. This all-in-one kit includes calculators, carrying case, training, teaching tools and a three-day teacher workshop. Provides important tools to succeed in algebra and helps prepare students for 8th-grade state assessments.

HP StreamSmart 400 is a four-port data collector that helps math and science students visualize experiment results in real time. Just plug it into the HP 39gs or 40gs calculator and a probe or sensor and start streaming data at up to 5,700 samples per second.

HP StreamSmart is part of the new **HP Mobile Calculating Lab** solution for middle and high school math and science classes. It also includes an HP 39gs or 40gs graphing calculator, a variety of Fourier scientific sensors and probes, calculator presentation software and classroom instruction materials.

The sensors capture physical data – like temperature, light or sound. Then, StreamSmart translates the probe signals into numerical data and displays it graphically on the calculator screen at speeds up to 5,700 samples per second. Students can better visualize concepts and their impact on the real world, such as industrial run-off into a water supply.

Multiply the reasons

Whether you parent pupils or teach them, you can count on the power, speed and reliability of HP calculators and educational tools to help your star students quickly plow through the toughest problems. Add some to your back-to-school list today!

Click here for more information about the [HP Calculators](#).

- (1) Reverse Polish Notation (RPN) is an efficient data-entry system that can significantly reduce keystrokes..
- (2) 350KB RAM and 700KB Flash ROM available to the user. A PC with an Internet connection is required for downloads.
- (3) Secure digital (SD) card must be purchased separately.
- (4) Flash ROM memory is for system upgrades only and not available to the user.
- (5) Rate based on one port in use. Rates may vary based on number and type of sensor.

Feature calculator of the month: HP 40gs Graphing Calculator

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The 40gs is the part of HP's Graphing Calculator series that is ideal for the classroom. This smart calculator can create and store custom applets with 256KB RAM memory and can easily share data and connect to PCs. The HP 39gs can tackle any tough problem with over 750 built-in functions and powerful HP solvers and applications. You can communicate data wirelessly to other 40gs calculators with its built-in two-way infrared port. The 40gs graphing tool is also equipped with Computer Algebra System (CAS) which makes it perfect for advanced math problems. HP quality and reliability shines in the 40gs with the unique HP click-and-rotate keys and HP quality and award winning support. The HP 40gs is a comprehensive classroom tool that is perfect for all.

Click [here](#) for more information about the HP 40gs Graphing Calculator.

RPN Tip #8

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Solving the Linear Interpolation Problem

A teacher needs to estimate the cost of 135 text books for a budget that is due immediately. The only available price list has the price for 100 books at \$17.50 ea. and 250 books at \$11.70 ea. The estimate is made by linear interpolating the price list for the 135 quantity. The first step is to set up the math.

Quantity	Price	The relative position of the 135 quantity between 250 and 100 is determined and then the respective position between the two prices is linearly calculated using the values shown in figure 1.
A = 250	C = \$11.70	
⋮	⋮	$F = \frac{(E-B)(C-D)}{A-B} + D \quad (1)$
E = 135	F = ?	
⋮	⋮	The optimum RPN calculation using the five inputs to get a single output is to order the calculations to avoid re-entering the inputs.
B = 100	D = \$17.50	

Fig. 1 – Book price list values.

Volume four of *HP Solve* described the concept of making a stack diagram for RPN problem solving. The time to sketch a stack diagram is justified by the guidelines of optimum RPN problem solving listed below, especially #2,

RPN Problem Solving Guidelines

1. Use minimum keystrokes and stack operations for optimum problem efficiency and accuracy.
2. Enter numeric data only once to reduce entry errors.
3. Maximize the use of the unshifted stack operator (depends on model) $R\uparrow$ or $R\downarrow$ to reduce keystrokes.
4. Minimize the number of divisions for optimal accuracy.
5. Avoid recalculating input data values for optimal accuracy.

Equation (1) may be solved using the 16 stack operation steps shown below. ~ is don't care, \uparrow is ENTER.

Step	1	2	3	4	5	6	7	8	9	10
T	~	~	~	~	~	~	~	D=17.5	D=17.5	D=17.5
Z	~	~	~	D=17.5	D=17.5	~	D=17.5	E-B	E-B	D=17.5
Y	~	D=17.5	D=17.5	E=135	E=135	D=17.5	E-B	B=100	A=250	E-B
X	D=17.5	D=17.5	E=135	E=135	B=100	E-B	B=100	A=250	B=100	A-B
press	D=17.5	\uparrow	E=135	\uparrow	B=100	-	LASTX	A=250	$X\leftrightarrow Y$	-

Step	11	12	13	14	15	16	Answer
T	D=17.5	D=17.5	D=17.5	D=17.5	D=17.5	D=17.5	
Z	D=17.5	D=17.5	$\frac{E-B}{A-B}$	D=17.5	D=17.5	D=17.5	
Y	D=17.5	$\frac{E-B}{A-B}$	C=11.7	$\frac{E-B}{A-B}$	D=17.5	D=17.5	F
X	$\frac{E-B}{A-B}$	$\underline{C=11.7}$	D=17.5	$\underline{C-D}$	$\frac{(E-B)(C-D)}{A-B}$	$\frac{(E-B)(C-D)}{A-B} + D$	F = \$ 16.15
press	\div	$\underline{C=11.7}$	$R\uparrow$	=	\times	+	

Click here to learn more about [RPN](#).

Announcing the HP 39gs Graphing Calculator Classroom Kit for Middle Grades

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Easy to use and powerful, HP Calculators for grades 6-8 are designed to perform above expectations for math and science students on all levels. These reliable calculators are equipped with easy-to-use problem solving tools, flexible connectivity & customizing options, plus award-winning HP support.

Our HP 39gs Graphing Calculator Classroom Kit is a unique solution that provides teachers with the tools and training to engage and motivate middle school students in mathematics. We believe that successful integration of technology into the mathematics classroom is enhanced when it is undertaken as a group or team effort, a belief that is reinforced by independent studies, so we designed the Classroom Kit to help middle

school teachers establish a mathematics leadership team on campus. The Classroom Kit features a three-day professional development workshop and supporting curricula to help ensure the successful integration of the HP 39gs Graphing Calculator into math classes.

The HP 39gs Graphing Calculator is the heart of the HP Graphing Calculator Classroom Kit, and this all-in-one kit includes calculators, carrying case, classroom-ready teaching materials, and a 3-day teacher workshop. The HP 39gs Graphing Calculator was designed by teachers for classroom use and to align with NCTM (National Council of Teachers of Mathematics) Standards. Importantly, and uniquely, the HP 39gs has dedicated keys for symbolic, graphic and numeric views.

The Classroom Kit allows teachers to save time in their digital classroom. Using our kit and included calculator emulator software, the teacher can project a virtual calculator during the lesson so students can follow along easily. Plus, teachers can use HP Aplets, either that they've written or downloaded from numerous free resources online. Teachers can set up powerful examples beforehand, saved with common names to ease retention, and then send them to students wirelessly! By utilizing this powerful feature, and given the ability to collect or create these aplets beforehand, teachers save precious class time, and are secure in the knowledge that students will quickly get on the same page, ready to learn.

Visit www.hp.com/go/calceducation for more information

Using the HP 40gs in Advanced Placement Calculus

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In this article, we examine a question similar to those posed for the last few years in the Advanced Placement Calculus Examination's Free Response Section. In these questions, it is noted that a graphing calculator is required for some of the problems or parts of problems. For our purposes, we will use the HP 40gs with its Computer Algebra System (CAS).

Let $f(x) = x \sin(\pi x)$ and let R be the region contained by the graphs of $y=f(x)$ and $y=x$ from $x=0.5$ to $x=2.5$.

- Show that the line $y=x$ is tangent to $f(x)$ at $x=0.5$.
- Find the area of R
- The region R is the base of a solid. For this solid, each cross section perpendicular to the x-axis is a square. Find the volume of the solid.

To answer part a), it is necessary to show that two conditions are met when $x=0.5$. First, $f(0.5)=0.5$; that is, both graphs contain the point $(0.5, 0.5)$. Second, the derivative of $f(x)$ has a value of 1.

We start by defining $f(x) = x \sin(\pi x)$ on the HP 40gs, just as the written problem indicates (Figure 1).



Figure 1: define $f(x)$.

After pressing ENTER to define f , you can use $f(x)$ in commands. For instance, you can evaluate $f(0.5)$ by simply typing it in. Notice that $f(0.5)=0.5$, as required.

For the second condition, we type the expression shown in Figure 2 and evaluate the result to see the derivative $\sin(\pi x) + \pi x \cos(\pi x)$. You can either evaluate this expression by inspection at $x=0.5$ or use the Where command as in Figure 3. The required result is shown in Figure 4.



Figure 2: find $f'(x)$

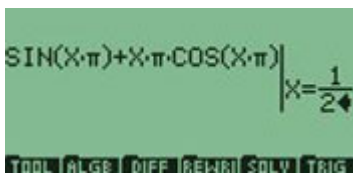


Figure 3: evaluate $f'(0.5)$



Figure 4: $f'(0.5)=1$

Having shown that both $y=f(x)$ and $y=x$ contain the point $(0.5, 0.5)$ and that the slope of the tangent to $y=f(x)$ at $x=0.5$ is 1, it is clear that $y=x$ is indeed tangent to $y=f(x)$ at $x=0.5$. Of course, they are also tangent at $x=2.5$, etc.

For part b), we evaluate the integral $\int_{0.5}^{2.5} x - x \sin(\pi x) dx$.

Figure 5 shows the integral on the HP 40gs. The intermediate results depend on multiple CAS settings, but the final result (shown in Figure 6) is the same: the area of R is 3.

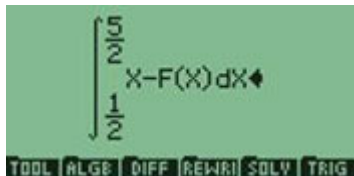


Figure 5.

Although integration by parts is no longer a topic tested by the AP Calculus exams, it may still be a topic of interest for you and your students. In this case, finding the antiderivative of $f(x)$ provides an example of this technique.

The HP 40gs provides two commands to illustrate the technique. We start with a common formulation of the technique:

$$\int u \frac{dv}{dx} = uv - \int v \frac{du}{dx}$$

Once the student has identified an appropriate u and dv/dx , the IBP command can be used. This command has the following syntax: $\text{IBP}(u \cdot dv/dx, v)$ and it returns $u \cdot v$ AND $-v \cdot du/dx$. Invoking the integral command INTVX on the result will complete the technique.

Figure 7 shows the IBP command with $\frac{dv}{dx} = x$, $v = \frac{x^2}{2}$, and $u = x \sin(\pi x)$.

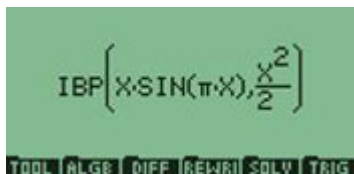


Figure 7.

Figure 8 shows the result.

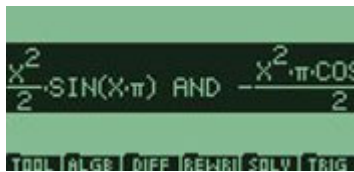


Figure 8.

In Figure 9, the integral command is invoked on the result from Figure 8.

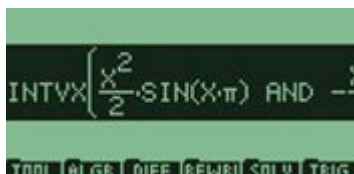


Figure 9.

The final result is shown in Figure 10.

$$\frac{X \cdot \pi \cdot \cos(X \cdot \pi) - \sin(X \cdot \pi)}{\pi^2}$$

Figure 10.

In part c), we set up and evaluate the integral representing the volume of a solid whose cross sections are squares.

Figure 11 shows the integral as entered in the CAS of the HP 40gs.

$$\int_{\frac{1}{2}}^{\frac{5}{2}} (X - F(X))^2 dX$$

Figure 11.

Evaluation of the integral will return a number of intermediate results, depending on your CAS settings. Figure 12 shows one such intermediate result.

$$\frac{31 \cdot \pi^2 - 30}{4 \cdot \pi^2}$$

Figure 12.

Figure 13 shows the final numerical approximation.

$$6.99009112268$$

Figure 13.

The HP 40gs saves a copy of each expression you enter and the result. Press the SYMB key to see the history of expressions and results, as shown in Figure 14.

```

: IBP(X*SIN(T*X), X^2/2
X^2/2*SIN(X*PI)AND-(X^
: INTVX(X^2/2*SIN(X*PI
X^2*SIN(X*PI)/2-(2*X/PI
: X^2*SIN(X*PI)/2-(2*X
-((X*PI*COS(X*PI)-SIN(X
: J(1/2, 5/2, (X-F(X))^
ECHO VIEW INFO COPY CLEAR

```

Figure 14.

From here, you can insert any expression or result into the current expression – or replace the current expression!

As illustrated by the problems in this article, the HP 40gs is a great tool for Calculus instruction. The CAS has plenty of tools for topics within and even beyond the AP syllabus. Its interactive editor makes it easy to

operate on results, letting you work step by step. And the active history lets you go back and reuse any previous result, saving you time.

The Technical Corner

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How does my calculator add two numbers?

HP calculators store numbers as a set of 3 items: a sign, + or -, a 12 digit number called mantissa which is always greater or equal to 100,000,000,000 and an exponent.

For example, 34.432 is stored as '+', 344320000000, 1.

Dividing two numbers is pretty much the opposite of how multiplication is done by a calculator.

The first thing to do before trying to multiply two numbers is to deal with the division by zero. Anything but 0 divided by 0 is infinity (or an error if you do not want to deal with infinity) and 0/0 is undefined.

Once this is done, the calculator goes on to calculate the two other easy quantities to compute:

The sign: The sign of the result is positive if both numbers have the same sign and negative in the other case (positive / positive -> positive, positive / negative -> negative, negative / positive -> negative and negative / negative -> positive).

The exponent: The exponent of the result of the division of two numbers is the exponent of the first number minus the exponent of the second number.

The last part is the actual division. The calculator proceeds in a way similar to the way division is done on paper, it successively removes the second number from the first, counting the number of times it can do it.

Let's look at the actual code:

```
// division by 0 handling
if y=0 then
{
  if x=0 then return Error_0/0
  if Sign_x=Positive then
    return PositiveInfinity
  else
    return NegativeInfinity
}
// fast exit if x=0...
if x=0 then return 0

// compute exponent and sign of the result
exponent_result= exponent_x - exponent_y;
if sign_x=sign_y then sign_Result= Positive else sign_Result= Negative;

// This makes sure that the mantisa of the result is >=1
```

```

if mantisa_x < mantisa_y then
{
  mantisa_x= mantisa_x*10;
  exponent_result= exponent_result-1;
}

// this is the division itself.
mantisa_result= 0;
for i=1 to 12 do
{
  mantisa_result= mantisa_result*10;
  // this loops counts the number of times we can remove y from x.
  // this is exactly what you do when you do a division by hand...
  while (mantisa_x >= mantisa_y)
  {
    mantisa_x= mantisa_x - mantisa_y;
    mantisa_result= mantisa_result+1;
  }
  // this and the multiplication by 10 of the result above allows to move to the next
  // decade..
  mantisa_x= mantisa_x*10;
}

```

If you try to divide 1.234567891012 by 11 (or 123456789012 e0 by 1.10000000000 e1), you will get a result of 0.112233444556 or 112233444556 e-1.

The exponent is -1 because 0-1 is -1. The sign is positive because both numbers are positive and the following table shows you how the mantissa gets constructed:

i	x	y	result
1	123456789012	110000000000	1
2	134567890120	110000000000	11
3	245678901200	110000000000	112
4	256789012000	110000000000	1122
5	367890120000	110000000000	11223
6	378901200000	110000000000	112233
7	489012000000	110000000000	1122334
8	490120000000	110000000000	11223344
9	501200000000	110000000000	112233444
10	612000000000	110000000000	1122334445
11	620000000000	110000000000	11223344455
12	700000000000	110000000000	112233444556

Click here for more information about the [HP Calculators](#).