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DATAFILE

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HP announces the HP20b Business Consultant - a new business model with RPN and scientific functions.



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indicates the shortcut function of the $($ and $)$ keys. Very nice. RPN is not an afterthought on the 20b.

Chain mode is what HP has used on their low end machine (10bII) for some time. This mode is algebraic without hierarchy such that $1+2\times 3=$ gives a 9 as an answer. I thought we had all been taught in grade school that multiplication and division come before addition and subtraction. To make matters worse, the HP10bII had shifted parentheses keys too. Well, the HP 20b has Chain mode but adds Algebraic mode. In Algebraic mode, fairly normal rules of algebraic hierarchy are followed, as you would expect. This is a very, very welcome addition – something I have wanted to see for years! Very good, HP – just wish you had done this 10 years earlier! Parentheses can be used to alter the order of execution. The 20b can handle up to 12 pending operations.

Menus, menus, menus. The HP 20b takes a new approach to providing functionality compared to many former HP calculators. It is more similar to the 17bII+ in some ways than the 12c. Pressing one of 16 keys will open up a menu where you use a combination of the $\boxed{\text{INPUT}}$ key and the $\boxed{\blacktriangledown}$ and $\boxed{\blacktriangle}$ arrow keys to move between your choices. Jake has an article in this issue with this take on this approach to packing functions into a calculator. This approach has the benefit of greatly expanding the available features without adding an additional shift key. It is also a departure from the 32s, 32sII, 33s, 35s menu approach. The approach taken by the 20b is designed to be familiar to student financial calculator users, who probably have never seen or used one of these other models. A couple of menu maps showing the functions of these menus are included in this article. In addition to a Mode menu, the 20b menus include:

Interest rate conversions	Breakeven analysis	Amortizations
Depreciation	Cash flow entry	Internal rate of return
Net present value	Bond calculations	Date calculations
% calculations	Data entry for statistics	Statistics calculations
Math functions	Reset	Memory display

Items displayed in a menu may be computed results, places where you enter needed values as inputs, or both. For example, in the Stats menu, the menu item for the average x value is read-only – it is a computed result. However, in the breakeven menu, the variable cost per unit can be input or computed. This difference is indicated by a small = sign in the top right area of the display. If this = sign is present, pressing $\boxed{=}$ will compute the result for the menu item displayed using available information.

Bond and date calculations. The bond calculations are a welcome addition to the low-end financial calculator and include all the expected features, including call

provisions. The date calculation menu provides some nice touches, such as working in either actual or 360-day calendar mode. It also indicates the day of the week. The screen capture below prompts for the bond settlement date with the default date of January 1, 2008, which fell upon a Tuesday (1 is Monday and 7 indicates a Sunday). The display message is “Settlement Date” which scrolls twice completely and then stops with the image shown below.



Figure 3

Extended financial features. The 20b includes several extended cash flow analysis features compared to other financial calculators. In addition to the usual NPV and IRR, the 20b provides net future value, net uniform series, payback and discounted payback. The “Discounted Payback” prompt is one where the scrolling display comes in very handy.



Figure 4



Figure 5



Figure 6

Scientific functions on a financial model. Well, not so much new as finally returned. For the first time since the HP 19bII calculator, HP has a financial model with functions such as these: trig and inverse trig in degrees or radians, and hyperbolic functions and inverses. At last! An HP financial model again with trigonometric functions! Why is this so important? It greatly reduces the need, particularly in college, to have two calculators. As a former college instructor, I can’t tell you how many times people carried two calculators – one for their physics or chemistry class, the other for their business classes...all because their business calculators did not have trigonometry and other scientific functions. It is also very important to keep the functional comparisons level with the competitors, all of whom offer these functions on their business models.

Many math functions on are the keyboard, as the included picture indicates. , , , as well as , , , , , and . Where then are the inverse trig functions?

That brings us to the   menu, shown below. The MATH menu can be thought of as an “extension to the keyboard.” If you have keyed a number, or if a

number is present in the display, then functions in this menu will operate on that value.

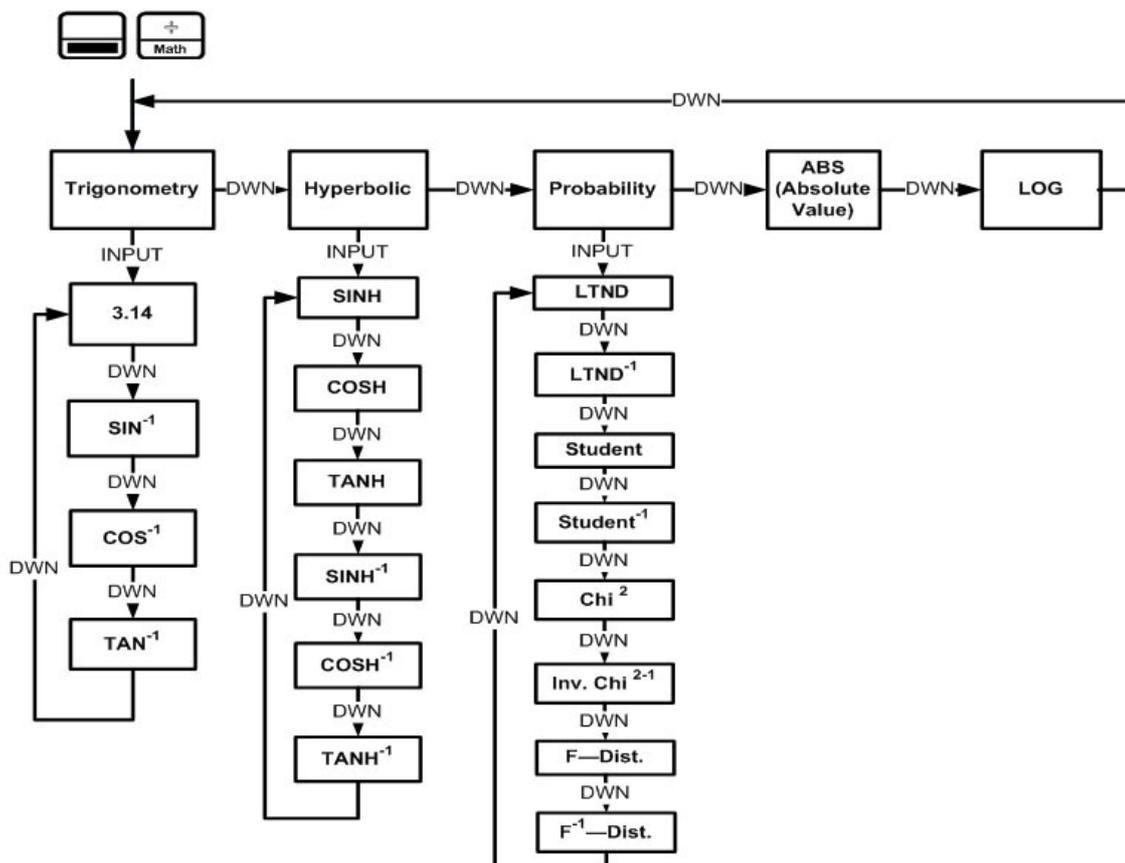
Pressing   displays “Trigonometry”. Pressing input will enter the trigonometry sub-menu. The first function displayed is PI, which, if pressed, will enter PI for computations. To move through this inverse trig menu, press  or . Repeated presses of  or  will rotate you through the menu and back to where you started. As you scroll down through the functions, the 20b previews the result of the function upon the number in the display. The operation is not actually performed until you press . To find the arc sine of 0.4, you would press        . Yes, that is a bit keystroke intensive.



Figure 7



Figure 8



The Hyperbolic sub-menu works the same way, but includes all six hyperbolic functions.

The Probability sub-menu is a real gem. It includes FOUR common probability distributions and their inverses. The normal distribution (called LTND for lower-

tail normal distribution), Student's t distribution, Chi-square distribution, and the F-distribution along with their inverses. This greatly increases the usefulness of the 20b for the student as well as professional. As a former college statistics and finance teacher, I can't tell you how many times students had to flip over to a page way in the back of their textbooks to look up a probability. No more, because the table may well be in the 20b. Since some of these probability distributions require more than one argument, they are entered with a slight twist. For example, to find the inverse Student's t value for 20 degrees of freedom at a 0.05 significance level, you would press 20 [=] 0.05 then  Math   INPUT    and you would see -1.72. For the F-distribution, which requires THREE arguments, you separate the first two arguments with an [=] in between them, then key the third argument and navigate to the F-distribution function.

Statistics functions too. Combinations  and permutations  are back, finally and on the keyboard. Without these, users had to manually compute them using the factorial function, which is certainly doable, but very manual. The factorial function  computes the *gamma* function if given a real number. A random number generator is present as well. The other statistics functions work on data entered into the Data menu.

The  Data menu allows you to enter up to 50 pairs of statistics data. (Note: Memory is shared between the data and cashflow areas – the 20b has 50 slots for pairs of statistical or cashflow data in total). If you try to enter the STATS menu before you've entered any data, the 20b will enter the Data menu for you. Numbers are entered, pressing  in between them. Once your data is input, enter the  Stats menu. A menu map is shown on the next page. Yes, it is quite complex.

You are asked to tell the 20b what type of data is present: 2 Variable, 1 Variable, or 1 Weight. Once a choice is made, you are presented with three sub-menus: Descriptive, Predictions, and Sums. Sums contains the usual statistical summations data. Descriptive provides the normal averages and standard deviation functions, but also provides two functions not seen on HP financial calculators before: standard error of the sample X and Y means, which are very useful for things such as hypothesis tests and confidence intervals. The Predictions sub-menu first asks you to choose a regression model. Six models are included:

Linear: $a \cdot X + b$	Logarithmic: $a \cdot \ln(X) + b$	Power: $b \cdot X^a$
Base e exponential: $b \cdot e^{(aX)}$	Base a exponential: $b \cdot a^X$	Inverse: $a/X + b$

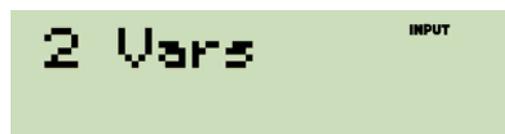


Figure 9

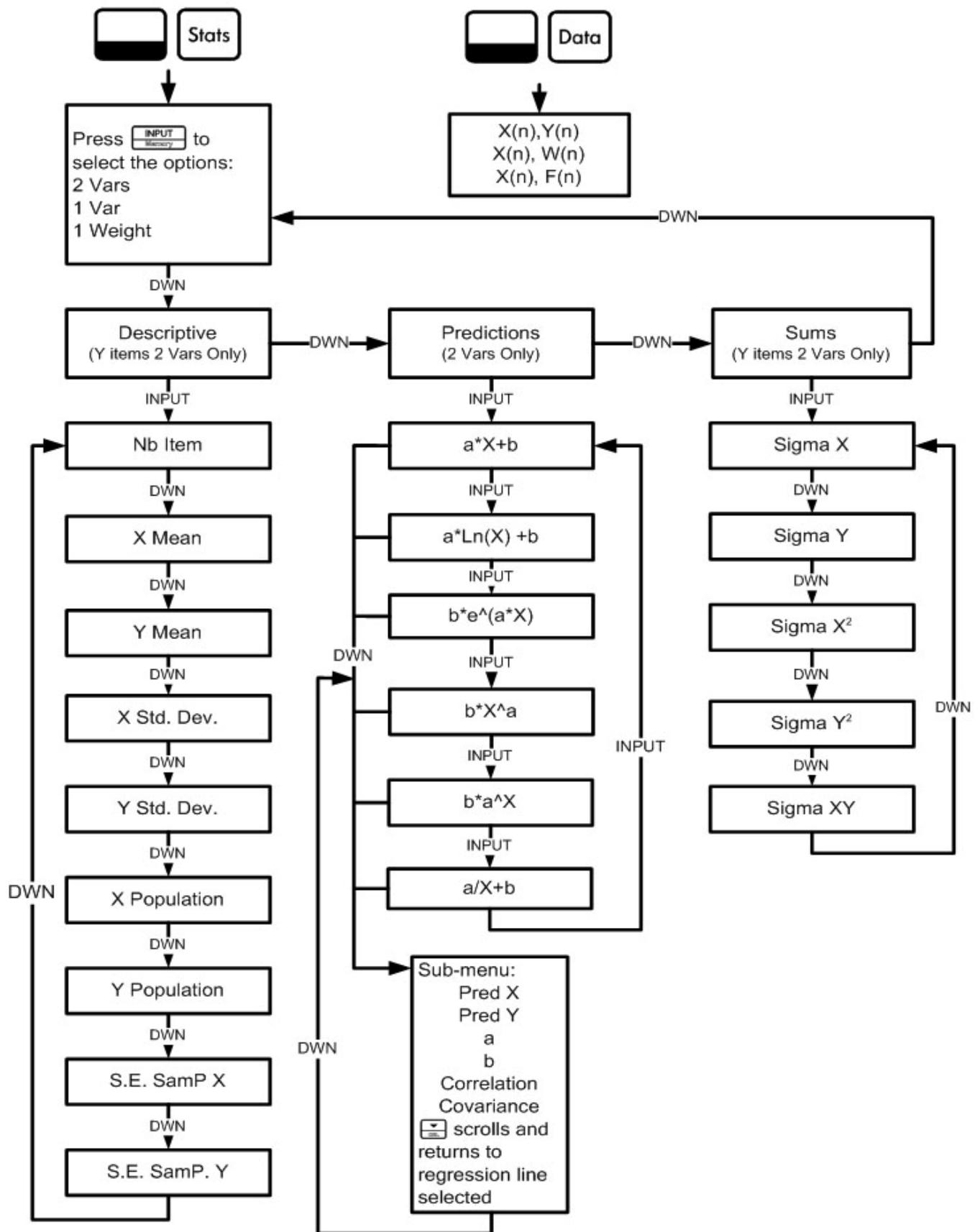




Figure 10



Figure 11

Once a model is chosen, pressing enters the rest of the Predictions menu and allows you to predict X or Y, displays the value computed for a and b, the correlation coefficient and a function not seen on HP financial calculators before: the covariance of X and Y.

A somewhat hidden function is the BEST FIT function. When the regression model is displayed, pressing causes the 20b to quickly fit all six models to the data and choose the model with the correlation whose value is closest to the absolute value of 1. The displayed regression model will be changed to the model that provides the best fit. If the display does not change, the model shown was the best already.

Other menus and features. In addition to loan amortizations, the 20b includes several depreciation methods other than the normal straight line, declining balance and sum-of-digits: it includes declining balance crossover and French straight line and an accelerated French method. The breakeven menu performs the calculations you would expect including solving for a target profit, i.e. a non-breakeven breakeven. The %calc menu is where the markup as a % of price and as a % of cost functions are found as well as part as a % of total and % change. The % change provides a useful extension by allowing for the number of periods to be specified before computing the % change, turning this into a quick compound growth rate computation if desired. The Memory menu opens a list of the data memories (there are 10 of them, 0 through 9) that you can scroll up or down through. When any memory value is displayed here, you can type another value and press to replace the previous value. The 20b also has store and recall register arithmetic.

The reset menu is context sensitive. If you are in the breakeven menu and press Reset, the 20b prompts you about resetting the breakeven menu. If you are in no menu, it defaults to a prompt to reset the time value of money registers. Regardless, you can scroll up or down through this menu as well to reset any area of the 20b.

What else is interesting? The 20b provides a function no other financial calculator has ever provided built-in. When doing interest rate conversions, you can solve for any of these three if the other two are known: Effective rate, nominal rate or periods per year. Even on the venerable 17bII+, you can't solve for the number of periods per year unless you use the equation $\text{EffectiveRate} = (1 + \text{NominalRate} \div (\text{P/YR})) ^ (\text{P/YR})$ in the solver. If you put the 20b up against a solver solution on the 17bII+, the 20b will win. Hands down. It's really that fast. For example, if you

have a nominal rate of 10%, how many times per year must this rate be compounded before the effective annual rate is 10.51%?



Figure 12

So, more often than once a week, but less often than daily. Worst case result would be a value for P/YR of 999,999,999,999 periods per year (a rather outrageous result). The 20b computes results of this magnitude INSTANTLY. There really is no delay. You just can't do that on any other financial machine using a built-in function. Be aware that a computed P/YR value is stored into the P/YR setting. If a computed value is a non-integer, you will get an error in the next TVM calculation. How did HP put this function into the 20b? Let's just say it has something to do with HP Solve.

What's missing? 1) The user-accessible solver. To put the user-accessible HP Solve in the 20b would have required the ability to enter letters, etc., which really would further complicated this entry-level machine. It really would have been nice, but HP certainly can't be faulted for wanting some product line differentiation. The HP 17bII+ has the solver and the 12c/12cp has programming. This is an entry-level financial machine, after all. 2) Some sort of programming. It would really have been nice, if to do nothing other than speed up some common operations that take many keystrokes to perform. 3) A primary key for storing numbers. While it is probably true that users recall values more often than storing them, memories are provided to be helpful and useful to the user. Making  a shifted function is a decision I wish would be changed going forward, as it adds keystrokes. 4) Well-thought-out shift key position. I am also hoping that someone will evaluate the shift key location. In general, the shift key should be centrally located on the keyboard to reduce finger travel when using shifted functions. On the 20b, this could have been achieved by moving the two arrow keys down and placing the shift key right under the  key. 5) Click feedback from the keyboard. The 20b keyboard is not the 50g or 35s keyboard. Pressing a key does not give that good old "click" that you hear on those models. That said, it's not a squishy keyboard by any means either, as some competitors use, where you can't tell if the key has been pressed or not. It is somewhere in the middle. Over the course of testing, I did not notice a single time where a keystroke went missing. By comparison, I reported missing keystrokes within an hour of ever first using a 49g+. While I wish it gave a click when a key was pressed, I do not believe this keyboard will give users grief. It is certainly better than the competitor's keyboards.

What are some other goodies included? The   menu includes a variety of nice settings. In addition to choosing the number of decimals to display, you can choose the angle mode, the date display format, the choice of radix, whether thousands are separated in the display or not, an operating mode of Chain, Algebraic or RPN, language (presently, English, French, German, and Spanish),

calendar day mode (actual or 360-day calendar), and annual or semiannual bond interest payments.

What are some tips? You can change the number of decimal digits shown without entering the menu by pressing the shift key \square then pressing and holding \square again and pressing \square through \square . The 20b can display up to 11 digits after the decimal point. FIX 10 and 11 settings are possible in the \square \square Mode menu but not through this shortcut. Also, choosing -1 for the FIX setting uses the 20b's opinion for the best way to display a number. For example, with this setting, the 20b would display 2.718 with three decimal digits and a result of 2 with no decimal digits. Using the shortcut described above, you can choose this FIX -1 setting by pressing \square rather than \square through \square .

You can also view the full precision of a computed number by pressing the \square key. This key is a true backspace key and begins deleting the rightmost digit of the full precision of a number (not the displayed, rounded value) upon the second press of the key. However, the first press of \square has the nice effect of showing all digits of a number. To stop this "editing" of the displayed number, press \square .

Conclusion. The HP 20b is another sign that HP is still actively investing in the calculator market. This is a good financial machine that addresses many wish-list items financial users have had for quite some time, as well as

providing a very nice set of math and stats functions for use by everyone. Now, HP, we're all hoping for a new low-end scientific model ...

