

# **Entry Level Scientific Calculator Comparison:**

## **featuring the TI-30XII, the TI-34II and the HP-30S**

Let's face it; sometimes everyone needs to use a scientific calculator. Perhaps this is because a teacher doesn't allow graphing calculators, a test requires only a scientific calculator, batteries are dead or maybe one just chooses to use something simple. If you had just spent near \$100 or upwards on a nice graphing calculator, the last thing desired is to spend a lot of money for an expensive scientific calculator that will only be used occasionally. This document is designed to allow for a more informed decision to find the best entry-level scientific calculator for your needs. I always carried one to loan someone who forgot a calculator so my expensive one wouldn't get "lost" ;-). I do not include a CASIO or SHARP model in this document as I don't own one and they are less popular than these models (at least around my area).

Now I will be happy to discuss anything with anyone, provided that you don't act like a first grader (or less) when doing so. E-mails that consist of "TI RULES! – HP SUCKS!" or vice versa will be ignored. To those people I say, "Grow up!" If you would like to act mature, I would love to have you write to me at [timwessman@calc.org](mailto:timwessman@calc.org). Why would anyone care so much as to flame me over a simple scientific calculator? I don't know. Please don't do it.

The format used for the rest of this document will be a direct comparison of similar features. I will not draw conclusions, but rather allow the reader to do so. I will point out any inefficiencies or problems, but will not use any sort of tally system to come out with a winner. I will give my opinion at the end, so don't read that if you don't want to hear it. ;-)

I will not have many screenshots in the document as all these calculators have only a two line display. AKA: You don't really need to see pictures of the screen! Use your imagination a little for once! ;-). This document is based on my personal experiences with the calculators, and any other information I can find. If you notice a mistake, feel free to respond to me at the above e-mail address. I intend to cover every aspect I can and will try to explain everything to the best of my ability.

For the rest of this document the calculators will be referred to as follows:-

- the TI-30XII will be referred to as the 30II or TI-30
- the TI-34II will be referred to as the 34 or TI-34
- if it applies equally to both of them I will just say the TI's
- the HP-30S will be referred to as the 30S or the HP

### **Why compare these three calculators?**

To be frank, these three calculators are very similar in function, similar in price and I've seen more of these three scientific calculators than any others at my former high school. These three calculators comprise a readily available selection of entry-level scientific calculators and are a natural comparison as they are direct competitors. As stated earlier, chances are a cheap, yet functional, calculator will be desired at some time. This will help pick which one to get.

### **History of these calculators**

The TI-30 has been a long standing part of TI's calculator lineup. I am guessing that the II (two) in it's name, and in the 34's name, is to indicate that they have a two line display. Both were released into the retail market around January, 1999. The 30S (any guesses what S stands for in this scientific calculator? ;-)) was released May, 2000 to fill a gap in HP's calculator lineup between the 6S (a small middle-school targeted calculator) and the 20S (a more advanced/expensive scientific calculator). Why is the name 30S if it is between the 6S and 20S? I don't know. I guess that 30S sounds good (and it does:-) and the 10-20 numbers have been used for business calculators in the past. Maybe they wanted to keep confusion down.

Maybe one of the designers has a fetish for the number thirty. Maybe it was one of the other reason I spoke of. Whatever the reason, 30S is the name so stop bugging me about it! ;-)

With the 30S being released over a year after the other two, it raises some interesting questions about some of the “eerie similarities” <wink wink> of these calculators. I’ll touch more on that throughout the document.

## **First Look**

Here is a picture of each calculator. As you can see, the two TI’s look very similar other than color differences. This is because they were made using the same mold and internal hardware. The 30II is quite dull compared to the bright coloration of the other two calculators. This is not always the case with the HP as we will see in a short while.



TI-30XI2

TI-34 II

HP-30S

## **Size and Feel**

These calculators are all about the same size. Height and width are almost identical, but depth is not. The two TI’s are about twice as thick at the top as they are at the bottom. The HP has a small depth increase near the top, but it is very small. It is about the same thickness as the lower part of the TI’s all the way through the calculator. This means the 30S is a little more than half the thickness of the TI’s.

Both feel nice in resting in the palm. The curves on the upper part of the TI’s give a nice resting spot for a thumb or two. (if you happen to be built that way ;-). The TI’s are also slightly heavier than the 30S, but not by any great amount.

The TI’s will bend and flex more than the HP, but both will flex when force is applied to them. The upper part of the HP is more rigid due to the hard acrylic LCD cover. I also noticed that the LCD on the TI’s will flicker when twisted. This suggests they have a looser connection inside connecting the circuitry to the LCD. This \*may\* indicate a problem later on.

I emphasize may because I don’t know if the screen will have problems later on. I’m basing that statement on previous experiences with scientific calculators. I owned three different varieties in my early years: one a TI, one a SHARP, and one a nameless supermarket variety. The first two flickered like that and the screen gave out after a few years. The third one never flickered and is still working just fine. :-)

## **Power**

The 30II is available in either a solar powered model, the 30X IIS (any guesses on what S stands for), and a battery powered model, the 30XIIB (same question again). I think the 34 is only available in a battery powered model, but I am not sure. The 30S is powered by two watch batteries in the top of the calculator. Solar power is nice, but batteries last forever in these small calculators so it isn’t a problem. Chances are the calculator will outlive its usefulness before running out the batteries.

## **Keyboard Comparison**

All the calculators have plastic keyboards. The TI’s both have forty keys not counting arrow keys. The HP has forty-four keys not counting arrows. The TI keys are larger and blocky whereas the HP’s are rounded smoothly. This makes it easier to type with larger fingers without bumping adjacent keys. Both calculators

keys wiggle, but the TI's are much looser. They also have a "spongy" feel to them that takes some getting used to. The 30S clicks nicely and generally feels much nicer.

The arrow keys are used to scroll back and forth in entries as well as to move between past entries. The TI's are placed in the upper right and are separate keys, while the 30S has them placed in the upper center. This presents a problem for the HP. The arrows are on a "disk" button (look at the picture). When first using the calculator, it creates a problem when scrolling back and forth on entries. Sometimes if you don't press exactly straight on the right or left edge, it will accidentally detect an up or down push. This will move to the previous/upcoming entry and lose any change made. This problem only affects new users as it is easy to get used to how to push the arrow disk without pushing the wrong direction, but you still must be careful.

## Screen

All of these calculators use a two line display. How this works is that an upper row of dot matrix LCD crystals (5\*7) allows letters (in commands), numbers and math symbols to be shown clearly. There are eleven 5\*7 squares across the upper row. The lower row has standard LCD display like most other cheap calculators and it shows the numerical results.

The 30S has an acrylic screen cover to protect the screen which is heavier than the one on the TI's. It does become scratched over time from the cover sliding over it. This won't make the display hard to read as the scratches will be on the very outside edge, but it still shouldn't happen. HP should have used a harder acrylic material. The LCD's on the 30S are about 1/3 again larger than the ones on the TI's. This makes it much easier to read from a farther distance and for those with poor eyesight (like some of the teachers I know;-).

## Covers

The covers for these calculators both function in the same way. The lower end of the calculator slips into some small edges on the cover. The TI's have a tight fitting cover that is harder to get in than the HP's. The HP's cover has two protrusions that secure the top to prevent the calculator from sliding out. It is very quick and easy to get in, and secures the calculator just as well as the TI's tight friction-fit cover. The HP cover actually fits perfectly on the TI.

## Features

All these calculators use algebraic entry. The other features on these calculators are . . . interesting. What I mean by interesting is that most of the menus and abilities are so. . . similar, it is almost like a cloning experiment gone bad. While I don't think HP copied the 30II, judging from the similarities I'm sure the designers were familiar with it. The 30S is different enough and has enough different features that you can't really say they are the same calculators though. They do operate very similarly, so it is easy for anyone to switch between them.

## Exchangable Faceplates

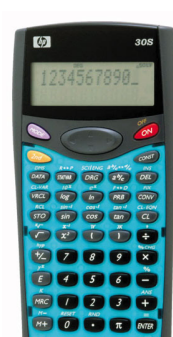
One of the most interesting features of the 30S is the changeable faceplates. Many cell phones have these to allow customization, and HP decided to put this into a calculator now too. The package the calculator comes in has three colors included: purple, electric blue, and gray. Changing faceplates is simple. Just push in a small tab on the bottom edge of the calculator to



purple (included)



In order from left to right: sky blue, amethyst, forest green, ocean blue, and wicked pink. The next two are gray and electric blue which are included in with all calculators



electric blue (included)

remove the old color. Then the new one pops into place securely. If the gray faceplate is put on, the calculator becomes a “classic” color that appeals to those who don’t like wild colors. There is also a package of five more colors that can be ordered from HP to customize your calculator in even more ways (for about 6 dollars plus shipping). To quote from HP’s site : “Personalize your HP 30S with a 5-pack of stylish new faceplates. You get five vibrant colors: Forest Green, Sky Blue, Wicked Pink, Ocean Blue and Amethyst.” They do look really cool and make a good present for a younger sibling. Junior high kids love to have a personalized colored calculator to “show off”. I like the ocean blue on mine because it looks awesome! Some students thought I had eight different calculators before they found out about the faceplates. ;-)

## **Memory**

The calculators store memory in registers. They also store previous entries and statistics data. The HP has ten memory registers (A,B,C,D,X,Y,X1,X2,Y1,Y2,EQN) while the TI’s have five (A,B,C,D,E). Both have K (constant) that is applied to whatever is entered for doing multiple calculations (useless example: ‘something\*5/3’ repeatedly very quickly). The 34 has two stored operations functions that work in the same way as a K function but without pressing ENTER. The 30S also has standard M+, M- and MRC buttons for quick recall of a single number. The TI’s can store 42 statistic data points in memory; the 30S can store 40. Why anyone would want to spend all that time entering that many data points in one of these calculators is beyond me, but you can if you want to.

## **Menus**

Variables and commands are accessed using menus. These menus are almost identical, and work the same way. For example: to recall a variable, push RCL. Then scroll the underscore bar over using the arrows to find the memory register desired and push enter. Modes are accessed the same way. Both have a standard mode and a statistics mode; the 30S has two additional modes that will be discussed later.

## **Interactive History**

These calculators have an interactive history that stores previous calculations. This allows for quicker computations and is also useful to make sure that you worked the problem correctly. To use, simply press up or down to move through the saved history and use left and right to move back and forth to edit the entries.

## **Notation**

All of these calculators have the same display modes: Floating, Scientific and Engineering. All operate in fixed decimal mode by using the FIX menu to select 0-9 decimal places.

## **Angles and Angle Conversions**

All of these calculators can operate in Degree, Scientific or Gradian mode and convert among them. All of them have DMS (“degree minute second” or  $^{\circ}$  ‘ “) conversions. All will convert from rectangular to polar and vice-versa.

## **Trigonometry and Logarithms**

All of these calculators have all three trig functions including inverses. Coincidentally, or not ;-), these are in the same identical spot on the keyboards. They also have all three hyperbolic trig functions and inverses. All have logarithmic functions such as  $\ln$ ,  $e^x$ ,  $\log$  and  $10^x$ .

## **Fractions and Percents**

These calculators all have fractional capabilities. This includes converting fractions to decimals and back again, as well as rational to non-rational and back. The 34 has some additional fractional abilities not in

either of the other two. It can be set to not simplify fractions automatically and has the ability to divide integers to give a remainder. All have a % operation. I like how when  $2\%3$  is entered into the 30S, it is stored in the history as  $2\%*3$ , and not as  $2\%3$  like the TI's. This prevents some confusion. The HP also has a %change function that calculates the percentage change.

## Probability

Probability functions in these calculators are identical. They each do permutations and combinations, factorial, random numbers between zero and one, and random integers between bounds specified.

## Statistics

The 30S accesses statistics mode by using the light purple MODE button in the upper left, while the TI's use 2<sup>nd</sup> STAT. Other than that, these calculators operate identically with statistics. Data points are entered for either one or two variable statistics; to move through them use the arrows. Pushing STATVAR on either calculator computes the statistics. Both calculate the same things ( $N$ ,  $\bar{x}$ ,  $S_x$ ,  $\sigma_x$ ,  $\bar{y}$ ,  $S_y$ ,  $\sigma_y$ ,  $a$ ,  $b$ ,  $r$ ,  $\Sigma x$ ,  $\Sigma y$ ,  $\Sigma xy$ ,  $\Sigma x^2$ ,  $\Sigma y^2$ ) and provide a way to predict  $x$  and  $y$  values using a linear regression. One problem with the TI's statistics mode is that once it is closed, all the statistic data is wiped. The HP retains the data for reuse.

## Linear System Solver

The 30S also provides a mode to solve linear equations not offered by the TI's. Using the MODE button to select "L Solv" mode allows users to enter a linear system and solve it. An example would be  $5y+3x=1, 2x-y=-4$ . Enter equations separated by commas and push enter. If able to be solved, a menu with  $X$  and  $Y$  pops up to allow you to view the answers. If not solvable, it pops up an error message that says "Multiple Solutions", "No solution" or "No Real Solutions". This is very handy for solving linear systems which are rather time consuming to do by hand. ;-)

## Quadratic Solver

Another solver in the 30S is the quadratic solver. To use, simply change the mode to "Q Solv" and type in a quadratic equation. A menu will pop up with the two roots, or else one of the above error messages. This is another very nice feature.

## Scientific Constants

Anyone who has taken physics or chemistry has used many physical constants. The 30S has many of them built in. I will give a list of these.

- $c$  - speed of light
- $g$  - acceleration of gravity
- $G$  - gravitational constant
- $V_m$  - molar volume of ideal gas
- $N_A$  - Avogadro's number
- $e$  - elementary charge
- $m_e$  - electron mass
- $m_p$  - proton mass
- $m_n$  - neutron mass
- $R$  - molar gas constant
- $h$  - Planck's constant
- $k$  - Boltzmann's constant

It can be rather time consuming to type these in by hand. I know this because I almost went crazy typing in 6.023E23 during a chemistry class one semester. On second hand, maybe I am crazy. . . ;-)

## Unit Conversions

The 30S also provides a handy unit conversion system. Simply type in a number, push CONV, select a base unit, and then select the desired unit. Presto-Chango! Your unit is now converted. Included is conversions for distance (inch, cm, mm, feet, m, yard, mile, km), area (feet<sup>2</sup>, m<sup>2</sup>, yard<sup>2</sup>, mile<sup>2</sup>, km<sup>2</sup>, acres, hectares), weight (lb, kg, troy oz, oz, g), temp (F,C), volume (gallon, liter, British gallon, pint, fluid oz), heat (Cal, kJ) and pressure (atm, kPa, mmHg, cmH<sub>2</sub>O). This is very useful for physics and math! :-)

## Manuals and Other Features

These calculators come with “manuals” which are actually just large unfolding papers. The TI’s have a double-sided one page sheet. On the front is information, and on the back is keystrokes for all commands. The HP comes with two sheets, front and back, that have information and commands. It is a more detailed than TI’s which totally reverses recent documentation trends. All calculators come with a quick-reference card that slides into the cover. Again HP’s is more detailed. It is interesting to note that the manuals for these calculators are so close they almost completely describe how to operate the other calculators. That is how close these calculators are in the functions they share.

The 30S has a built-in test feature that tests memory and the display to let you know if there is a problem. If the calculator is acting strange and you talk to HP’s support, they’ll probably ask you to run it. I’ve never had to use it, but it is there if it is needed.

## Price

Here’s the most important part. An entry-level calculator shouldn’t cost very much, and none of these do. All are available at most department stores and business supply centers. The TI-30XI costs about \$15(US). The TI-34II costs about \$20(US). The HP-30S costs about \$15(US). All of these prices are approximate. They can all be found for cheaper if they are on sale or for more depending on where you look.

## Wrapping It All Up

Well, I’ve enjoyed writing this; I hope that you enjoyed reading it. If anyone would like to contact me, I’m available at [timwessman@calc.org](mailto:timwessman@calc.org).

If you’d like to know my recommendation on what to buy, it’s not hard to figure out. The HP-30S does all the things the other two calculators do. In addition, it solves linear systems and quadratics, has built in constants, does unit conversions, has a larger display and better keypad, and comes with three changeable faceplates for your personal style; all for about \$15 which is the same price as the lesser of the two TI models. I think out of all low price scientific calculators, the HP-30S gives the highest ratio of power to price.

In conclusion, I hope you’ve learned a little something you didn’t know before. If so, I’ve succeeded in my goal. Thanks for spending some time reading my ramblings.

Thanks also goes out to Nate Buda of [www.calc.org](http://www.calc.org) for reading and proofreading this document for me, as well as being a cool guy, fun to talk with and a good friend.