

Mueck Free42/Plus42 skin family (for fields like electrical engineering etc.)

NOTE: Please use at least Free42 v3.4 or Plus42 v1.4 for these skins

SOME PROMINENT FEATURES:

If you use both a physical HP42S and Free42/Plus42 then, to save your sanity, choose a skin matching the physical HP42S layout (names containing "hp"). Otherwise, please consider the remaining skins which I think have a much more efficient and intuitive layout.

- High resolution, large display font, big buttons with easy to see press animations, hot-key hints shown on the desktop skin buttons. All skins come in portrait and landscape versions.
- Menu buttons can **only** be pressed on the display - the top row of buttons always perform the operations printed on them. TOP.FCN is now redundant and allows for a new function.
- The double wide ENTER key supports two shifted functions, allowing another new function.
- The useless OFF function has been removed, allowing for a 3rd new function.
- Additional space is allocated below the bottom row to prevent accidentally hitting the decimal point when swiping up from the bottom on a phone. That "dead" space is now constructively used for a customizable "secret" HP Logo button for two more functions, making 5 all up :-).
- So ALL skins have 5 new functions: CONSTANT (see below), TVM (Time Value of Money), POLY (formula solutions for quadratic, cubic & quartic equations) and the HP Logo button which you can customize in the layout file. Defaults are VIEW and FIX02 (toggle current DISP with FIX 02).
- All 8-row skins also have $R\uparrow$, $x\Rightarrow$, $x!$, $\Delta\%$, $SST\uparrow$. Plus42 skins have PLOT, EQN, EQN.FCN, DIR, DIR.FCN, UNIT and UNIT.FCN, whereas Free42 skins instead have $\log_2$, 2^x , dB & dB^{-1} , RSS & RDS (Root Sum/Difference of Squares), and either CLST or MOD.
- These skins require an accompanying suite of programs to be loaded. All program names and variables (except for TVM) start with a "." to identify themselves as skin-related e.g. ".POLY" or ".CONST". Instructions for using the programs are provided in their text program listings.
- Desktop versions support numeric pads on extended keyboards and lots of additional useful functions via hot-keys e.g. $\sqrt[3]{x} \rightarrow x^{\frac{1}{3}}$ or $\sqrt[9]{x} \rightarrow x^{\frac{1}{9}}$ and many more. A full hot-key "cheat-sheet" is provided in this document. All emulate built-in functions i.e. they correctly update LASTx and don't mangle the stack. All are also NULLable in the usual way. Please consider using a desktop skin - I spent waaay more time on them than the mobile skins!
- All desktop skins have full engineering notation hot-key capability, making it simple and fast to enter values spanning 10^{-15} to 10^{15} using the standard suffixes f , p , n , u , m , k , M , g/G , t/T and P e.g. $1.2g \rightarrow 1.2E9$, $3.4n \rightarrow 3.4E-9$, $5.6u \rightarrow 5.6E-6$, $7.8p \rightarrow 7.8E-12$, $9.0T \rightarrow 9.0E12$ etc.
- All landscape skins include an extended display version for use with Plus42's multi row display capability. You can even select the font size in the layout file to best fill the display with your desired number of rows - search for "font", uncomment the desired line, and reload the skin.
- Amongst other things, my alternate layout skins address several aspects of HP's layout I never liked e.g. press $\uparrow$ at the bottom and then go to the top for the most common functions, press STO/RCL at the top and then go to the bottom for a number or $+ - * /$. R/S as a button was too dangerous to accidentally press yet it was in the numeric entry area and right next to $+$, etc.

PHYSICAL CONSTANTS and PROPERTIES:

The HP42S has lots of math functions, yet many of my calculations involve formulas containing physical constants e.g. the electron charge, the Boltzmann constant, the permittivity of free space etc. HP only give you ONE constant: π . It's a fully neglected category! The skin's program suite contains a program ".CONST" that is run when you press CONSTANT. The 1st menu level shows 6 classic high school science constants, the next level caters to electronics engineering, and the 3rd is just crazy specific - all to entice you to tailor it for your own needs. A mechanical engineer may want various material thermal and strength properties etc. Modifying ".CONST" for your content and number of menu levels is pretty obvious from the program's comments.

SKIN NAMING CONVENTION:

These skins come in a HP or my layout version, each with a Free42 or Plus42 version, a mobile or desktop version, and a portrait or landscape version. Because a Free42 skin can be used with Plus42 (with a larger display) the Free42 landscape skins also come in regular (2-row) and extended (multi-row) display versions. That yields 28 viable skin versions, each named according to:

Mueck_[f,p]42[hp,lp7]_[m,d][p,l,lx]

e.g. Mueck_f42_dp Free42 desktop portrait (my layout)

e.g. Mueck_p42hp_ml Plus42 HP Layout mobile landscape

e.g. Mueck_f42_mlx Free42 mobile landscape (extended display)

QUICK INSTALLATION GUIDE:

- Install your chosen gif and layout file pair according to:
thomasokken.com/free42/skins/README.html
- Install **one** skin program bundle (Mueck_f42 or Mueck_p42) according to:
thomasokken.com/free42/importexport.html
Mueck_p42 is the same as Mueck_f42 except it doesn't have TVM because Plus42 already has a built-in TVM function. If you're not using Plus42 then install Mueck_f42. Note that Plus42 for the desktop is **FREE** so use that! :-).
NOTE: Delete all previous skin programs if upgrading from an earlier version

Install either via "Menu→Program Import & Export" on a mobile device or "File→Import Programs" on the desktop, or by pasting the text in program mode. **Then go into program mode and enter XEQ "LOCK" - it'll look like you're adding a line of code, but you're actually performing a write protect function. That will avoid future grief if you accidentally modify or delete any code. The program pointer turns "gray" to indicate the LOCK was successful. The process can similarly be undone with XEQ "UNLOCK".**

- For the mobile versions, I recommend turning off the preference setting for "Maintain skin aspect ratio" (tap the top-left of the display for preferences).
- If you see a header line at the top of the display (a Plus42 feature you might not want) you can turn it off via DISP and navigating to HDR (for Header).
- In Plus42 I prefer showing 5-6 rows (via the DISP menu's ROW+ and ROW-) to always see the full stack and also optionally LASTx even when a menu is displayed. You can view LASTx via the DISP menu and navigating to LTOP.
- For the mobile versions, set preferences for Orientation: Auto. With the phone in portrait orientation, install a portrait skin and set it's preferences as indicated above. Then put the phone in landscape orientation and install a landscape skin and separately set it's preferences. Now your phone will switch between portrait and landscape skins automatically :-).

HP Compatible Skin Comparisons

Mueck_f42hp_mp
Free42 hp layout mobile portrait
(8-row Free42 hp layout)

Buttons are bigger, easier to read and press.
Button press animation is much easier to see.

POLY:
Solves quadratic, cubic & quartic equations using exact formulas
 $\log_2$ & 2^x :
Binary log & power
dB & dB⁻¹:
(decibel conversions)
RSS/RDS:
Root-Sum-Squares & Root-Difference-Squares (also for Pythagorean triangles)
ENTER has TWO shifted functions

CONSTANT: Physical constants & properties (fully customizable)
TVM:
Time Value of Money

Extra bottom space to minimize accidentally pressing "." when swiping up to switch apps.



Mueck_f42hp_ml
Free42 HP layout mobile landscape

Mueck_f42hp7_mp
Free42 hp7 layout mobile portrait
(Original hp layout)

Free42 specific buttons:
Plus42 specific buttons



Mueck_f42hp7_mlx
Free42 HP7 layout mobile extended landscape
(when using this Free42 skin with multiple rows in Plus42)

Mueck_p42hp_dp
Plus42 hp layout desktop portrait
(8-row Plus42 hp layout)

Skin is very high resolution - won't be blurry.
Magnified display is much easier to read



Display menu buttons aligned with keyboard buttons and can **ONLY** be pressed on the display

Top keys are **ALWAYS** available (removed TOP.FCN) (also removed OFF)

Desktop skin shows hot-key hints or highlighted characters

All hot-keys work across all skins in this family.

There are **MANY** more hot-keys than those shown on the skin itself

HP button defaults:
HP: VIEW
⇧HP: FIX02
Customizable in the layout file.

ALL skins come with TVM, CONSTANT, POLY, FIX02 & VIEW



Mueck_p42hp_dlx
Plus42 HP layout desktop extended landscape
(display font size easily changed in the layout file)

Mueck Layout vs HP Layout

NOTE: All comments from the HP Layout page also apply here.

Mueck_f42_mp
Free42 mobile portrait



- ▲▼ & EXIT beside the display menus
- Programming and navigation cluster
- R/S now a shifted function (safer!)
- The most popular operators now all on their own buttons
- 1/x beside y^x for rapid n^{th} roots
- Stack cluster
- MOD intuitively anchored by /
- Solving cluster
- Free42 cluster
- Number type cluster
- Time cluster: H.MMSS+/- intuitively anchored by + & -



Mueck_p42_dp
Plus42 desktop portrait



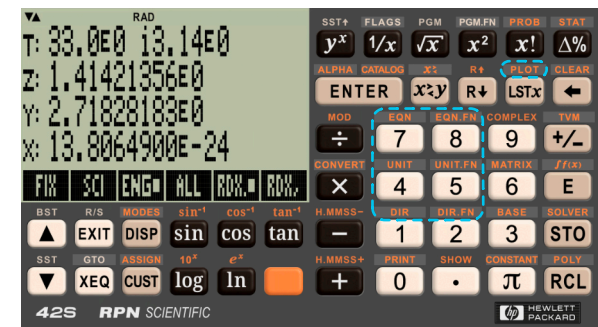
- DISP is now a button. Intuitively beside the display
- Intuitively anchors MODES
- CUSTOM is now a button. Intuitively beside the XEQ
- Shift beside all the most popular shifted functions
- Probability & Statistics cluster: x! intuitively anchors PROB, $\Delta\%$ intuitively anchors STAT
- Plus42 cluster: Demoted DIR, UNIT & EQN to shifted buttons and promoted higher "daily use" functions
- Rapid entry of most popular engineering notation suffixes e.g. E3 $\rightarrow$ E9, E-3 $\rightarrow$ E-9
- STO/RCL beside numeric keys
- Separate π button, near 2 because 2π is very common. Intuitively anchors CONSTANT
- HP button defaults:
HP: VIEW
 $\triangle$ HP: FIX02



Mueck_f42_ml
Free42 mobile Landscape



Mueck_f42_mlx
Free42 mobile Extended Landscape
(when using this Free42 skin with multiple rows in Plus42)



Mueck_p42_mlx
Plus42 mobile Landscape

For about 10 years all HP calculators (including the legendary HP41) had +,*/ on the LEFT side... You'll get used to this new layout - it's highly efficient! These skins do NOT have %. It's a waste of space on a scientific calculator. Every scientist knows the 4 keystrokes . 2 7 * are the same as 2 7 $\triangle$ % These skins do NOT have Σ +/- . If you're using them then your end game is bringing up the STAT menu, which already has Σ +/-, so just use that menu!

Standard, Alternative & Bonus Hot-keys

⌈Ca	→ 10 ^x		
⌈b,B	→ log ₂ , 2 ^x (binary log)		
c,C	→ CUSTOM, ASSIGN		
' or D	→ MODES	'	→ PGM.FCN
⌈d,D	→ dB, dB ⁻¹ (decibels)	, &	→ decimal '.'
{ ⌈e,E	→ e ^x , e ^{ix}	⌈	→ R↑
{ ^⌈e	→ e ^{-x}	⌈	→ SST
F	→ FLAGS	⌈	→ SST↑
⌈f	→ FACTORIAL	⌈	→ SST↑
⌈g	→ GAMMA	⌈	→ SST↑
⌈h,H	→ H.MMSS+,-	⌈DEL, ⌈BkSp	→ CLx
^⌈h,H	→ HMS, → HR	⌈DEL, ⌈BkSp	→ CLST
j,J & i,I	→ √-1, COMPLEX	⌈2→9	→ x ² →x ⁹
/ & ⌈m	→ MOD	⌈3→9	→ √x→√x
			REAL results for x<0 e.g. √-27 = -3

f (**femto** E-15)
p (**pico** E-12)
n (**nano** E-9)
u (micro E-6)
m (**milli** E-3)
k (**kilo** E3)
M (**Mega** E6)
G (**Giga** E9)
T (**Tera** E12)
P (**Peta** E15)

Unlike in the main keyboard area, in the numeric pad you can enter $\hat{+}$ and $\hat{*}$ and $\hat{8}$ is **not** multiply

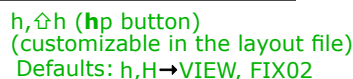
The top left of the keyboard nicely covers programming and execution.

$x \preceq y$ & $R \downarrow$ are in the arrow cluster

Windows & Linux

COMPLEX F16 STO	% F17 RCL	.FIX02 F18 LASTx	CLEAR F19 ←
DISP clear E	MODES = +/-	STAT /	PROB *
SOLVER 7	$f f(x)$ 8	MATRIX 9	PRINT —
BASE 4	CONVERT 5	FLAGS 6	CATALOG +
ASSIGN 1	CUSTOM 2	PGM.FCN 3	ALPHA
CONSTANT 0	SHOW .		enter

Standard, Alternative & Bonus Key Mappings



-  **Shift**
shifted version of a main button
-  **Option/Alt**
mathematical functions
-  **Control**
screen buttons, bonus functions

Add ^ for hyperbolic versions
 - $\mathbb{R}e \rightarrow e^x$
 $\mathbb{H}e \rightarrow e^{ix}$
 $\mathbb{A}e \rightarrow e^x - 1$
 $\mathbb{L}n \rightarrow \ln(1+x)$

} complex capable
 $\mathbb{P}GM \rightarrow PGM.FCN$
 $\mathbb{P}GM$

- j, J & $i, I \rightarrow \sqrt{-1}$, COMPLEX
 $w \rightarrow \text{TVM}$ (**w**ealth)

 key looks like $\pm$ symbol

- ↑q → EQN.FCIN
- ↑; → UNIT.FCIN
- ↑\ → DIR.FCIN

- $b \rightarrow \text{BASE}$

y → POLY

(used in some countries)

h, ⇧h (**h**p button)

Defaults: h,H → VIEW, FIX 02

$\backslash a$ → 10^x
 $\backslash b, B$ → $\log_2, 2^x$ (binary log)
 c, C → CUSTOM, ASSIGN
 $'$ or D → MODES
 $\backslash d, D$ → dB, dB^{-1} (decibels)
 $\left\{ \begin{array}{l} \backslash e, E \rightarrow e^x, e^{ix} \\ \wedge \backslash e \rightarrow e^x - 1 \end{array} \right.$
 $\frac{y^2 + x^2}{y^2 - x^2}$
 $\sqrt{}$
 F → FLAGS
 $\backslash f$ → FACTORIAL
 $\backslash g$ → GAMMA
 $\left\{ \begin{array}{l} \backslash h, H \rightarrow H.MMSS+, - \\ \wedge \backslash h, H \rightarrow HMS, \rightarrow HR \end{array} \right.$
 j, J & i, I → $\sqrt{-1}$, COMPLEX
 $\backslash /$ & $\backslash m$ → MOD
 $\left\{ \begin{array}{l} \backslash n \rightarrow \ln(x)$ (natural log)
 $\wedge \backslash n \rightarrow \ln(1+x)$
 o, O → π , CONSTANT (circles)
 $\backslash p$ → $\Delta\%$ or %CH
 $\backslash p$ → PRINT
 $\left\{ \begin{array}{l} \wedge \backslash s, c, t \rightarrow \sinh, \cosh, \tanh \\ \wedge \backslash S, C, T \rightarrow \sinh^{-1}, \cosh^{-1}, \tanh^{-1} \end{array} \right.$
 v → VIEW
 $\left\{ \begin{array}{l} \backslash v \rightarrow RSS (\sqrt{y^2 + x^2})$ *macOS: $\backslash v$ is $\sqrt{}$*
 $\backslash V \rightarrow RDS (\sqrt{y^2 - x^2})$
 $\wedge \backslash v, V \rightarrow RSSdB, RDSdB$
 $\backslash +, -$ & $\backslash w, W \rightarrow \Sigma+, \Sigma-$ (*macOS: $\backslash w$ is Σ*)
 $\backslash x$ → x^x

Metric Notation

f (**f**emto E-15)
p (**p**ico E-12)
n (**n**ano E-9)
u (micro E-6)
m (**m**illi E-3)
k (**k**ilo E3)
M (**M**ega E6)
G (**G**iga E9)
T (**T**era E12)
P (**P**eta E15)

Unlike in the main keyboard area,
in the numeric pad you can enter
⌘+ and ⌘* and ⌘8 is **not** multiply

Numeric Pads

$x \rhd y$ & $R \downarrow$ are in the arrow cluster
Windows & Linux
(Plus42 skin)

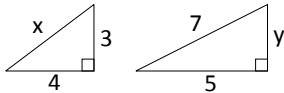


The top left of the keyboard nicely covers programming and execution.



SOME DESKTOP VERSION USAGE EXAMPLES:

In the following examples, the buttons implied might not exist on your chosen skin, but the corresponding hot-keys are always available if using any of the desktop skins.

- Q: How many meters does light travel in 1nsec?
A: $\hat{c}$ o (CONSTANTS), F3 (c: the speed of light), n (10^{-9}), * (which yields 0.2998)
- Q: What is the electronic thermal voltage, V_T , at 300K, where $V_T = kT/q$
A: $\hat{c}$ o (CONSTANTS), Δ , F1 (k: Boltzmann constant), 300, *, F2 (q: electron charge), / (which yields 0.0259)
- Find x and y for the two right angled triangles shown:

x: 3, ENTER, 4, $\sqrt{}$ v (RSS)
y: 7, ENTER, 5, $\hat{c}$ $\sqrt{}$ v (RDS)
- Q: What is the total noise when 3 rms sources of 1.2 μ V, 2.5 μ V and 666nV are added?
A: 1.2u, ENTER, 2.5u, $\sqrt{}$ v (RSS), 666n, $\sqrt{}$ v (RSS) (which yields 2.8519 μ)
Q: How much noise is left if we now remove the 2.5 μ Vrms source?
A: 2.5u, $\hat{c}$ $\sqrt{}$ v (RDS) (which yields 1.3724 μ)
- Q: How many bits are needed to represent the unsigned integer 1234567890?
A: 1234567890, $\sqrt{}$ b ($\log_2$) (which yields 30.20, so 31 bits)
- Q: What is the biggest unsigned integer that 32 bits can represent?
A: 32, $\hat{c}$ $\sqrt{}$ b (2^x) (which yields 4,294,967,296. So, 1 less than that)
- Q: What is $e^{i\pi}$?
A: Mobile skin: -1, SQRT, π , *, e^x (loses the T-register)
A: Desktop skin #1: o (π), $\hat{c}$ $\sqrt{}$ e (e^{ix}) (only modifies the X-register)
A: Desktop skin #2: i ($\sqrt{-1}$), o (π), *, $\sqrt{}$ e (e^x) (loses the T-register)

OTHER RANDOM DETAILS:

- The hot-key NULLing capability is only achievable by using a separate small program for each function. Those programs (whose names all start with ":") will be visible in the menus when you press e.g. XEQ or GTO and perceived as "clutter". The HP42S always displays the most recently loaded program first. To bring your own programs to the top of the list, export, delete & re-import them AFTER you've loaded the program bundles that contains all the skin programs. Annoying, but you only have to do it once.
- Using hot-keys, *desktop* skins can trigger programs unavailable directly via the buttons on the skin graphics e.g. $x^3 \rightarrow x^9$, $\sqrt[3]{x} \rightarrow \sqrt[9]{x}$, hyperbolic trig functions etc. For this reason, desktop skins contain more programs than the mobile phone versions. Despite the large number of skins, there are only 2 program suites - the mobile suite and the desktop suite. Other than the added clutter, there is no harm in loading the desktop suite onto a phone or tablet incase you later decide to attach a Bluetooth keyboard.
- To customize the HP button, search the layout file for "# HP" and replace the existing macro numbers in both places with those of your choice.
- All units in the CONSTANTS menu are metric, but can easily be changed to Freedom units for the few places in the known galaxy that still support them ;-).
- When using a landscape skin with Plus42, you can increase the number of rows in the display than would normally fit. When that happens, the skin grows to accommodate the added rows. If you prefer, you can also change the display font size in the layout file so more rows will fit before the skin grows. Search for "font" and you'll find it.

Some caveats regarding metric notation hot-keys:

- Just because you pressed one hot-key that saved you typing "E +/- 1 2" doesn't mean a single press of delete fully backspaces over all that.
- Pressing e.g. 1.2pn enters "1 . 2 E +/- 1 2 E +/- 9". Sadly, the HP42S ignores all subsequent presses of E (instead of resetting the exponent) and therefore yields the awkward 1.2E129...

INTUITIVE HOT-KEY MNEMONICS:

Choosing intuitive hot-keys for calculator buttons gets ugly quickly because many names share the same key first letter e.g. (STO, SIN) & (RCL, $\sqrt{x}$) etc. As a result many Free42 hotkeys were forced into awkward mnemonics. This skin makes that worse because metric notation reserves the characters (f, p, n, u, m, k, M, G, T & P) e.g. 1.2p yields 1.2×10^{-12} . I chose to adopt a new rule to tackle hot-keys: if a mathematical operator is referenced then the hot-key uses the alt/option modifier - the symbol for which is $\sqrt{}$. It fixes much of the awkwardness e.g.

	Free42 HOT-KEY	MY HOT-KEY
STO	m	s
SIN	s	$\sqrt{}$ s (a mathematical operator)
RCL	r	r
$\sqrt{x}$	q	$\sqrt{}$ r (a mathematical operator)

This skin has hot-keys for every letter of the alphabet except one, and hot-keys for alt/option every letter of the alphabet except 7. And there are quite a few hot-keys involving the control modifier and also non-alphabetic characters. The desktop version is really quite expansive!

CALCULATOR BUTTON vs DESKTOP KEYBOARD HOT-KEY PARADOXES:

All skins try to maintain consistency between the 42S buttons and keyboard hot-keys e.g. the 42S "1" button maps to "1" on the keyboard, and the 42S $\hat{c}$ 1 button ("ASSIGN") maps to $\hat{c}$ 1 ("!") on the keyboard. However, all skins have exceptions to that consistency caused by mapping 42S buttons to traditional, but *already shifted* keys on the keyboard, specifically multiply $\rightarrow$ * ($\hat{c}$ 8) and add $\rightarrow$ + ($\hat{c}$ =), so you can't now use $\hat{c}$ multiply $\rightarrow$ $\hat{c}$ * because that implies typing " $\hat{c}$ $\hat{c}$ 8" and likewise $\hat{c}$ add $\rightarrow$ $\hat{c}$ + implies typing " $\hat{c}$ $\hat{c}$ =" both of which are impossible on a keyboard.

In the previous version of my desktop skins, I scrapped multiply $\rightarrow$ * ($\hat{c}$ 8) and instead used "x" (matching the 42S button icon). That enabled using the separate hot-key pairs 8 & $\hat{c}$ 8 and x & $\hat{c}$ x just like on the real 42S without any conflicts. Similarly I scrapped add $\rightarrow$ + ($\hat{c}$ =) and instead used "a" (for "add") so that you could then use "a" & " $\hat{c}$ a" instead of the impossible " $\hat{c}$ =" & " $\hat{c}$ $\hat{c}$ =". It made everything perfectly consistent. Once you got used to it, adding and multiplying could be typed very quickly because shifted characters won't involved. However, that proved too brain-twisting for some folks, so I relented to the traditional multiply/add hot-key mappings and made exceptions for shifted hot-keys above the calculator buttons for 8, + and x, just like all the other skins :-). Fortunately, you don't have to remember those exceptions because, unlike most skins, this desktop skin shows all the hot-keys on the buttons. Note that a $\rightarrow$ + and x $\rightarrow$ multiply are still defined on these skins :-).

If your keyboard has a numeric pad then those conflicting Add/Multiply mappings can be avoided because *ONLY* there can you physically do $\hat{c}$ * and $\hat{c}$ +. Always use the numeric pad if it exists - especially on the Mac where you have amazing flexibility! There's plenty more to say about these skins, but you're probably not even reading this anyway ;-). Good luck. I'd be interested if you have any feedback (good or bad).

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