



Welcome to PCalc

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Introduction

For anyone who had to do more than basic grocery-store math in their head, a good calculator was as essential as one's wallet or purse: you simply did not go without it. Now, all the power of those cutting-edge machines is always with you in your phone and on your Mac...and your watch...and even your TV!

PCalc is a fully featured calculator app for iOS and macOS with companion versions for watchOS and tvOS (**Figure 1**). PCalc has been in development for over 25 years, across many computers and devices, to bring the best calculator functions to your fingertips, wherever you work.

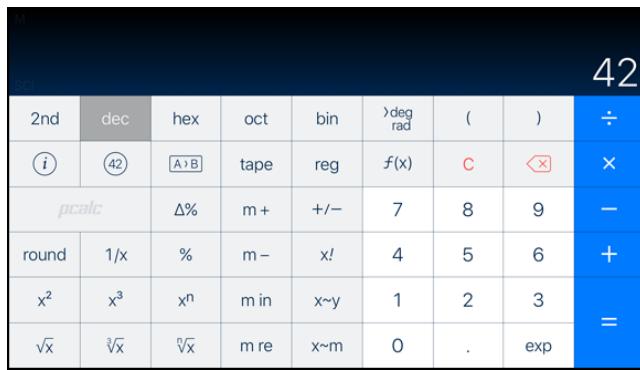


Figure 1. PCalc in iOS.

While many features in PCalc are immediately apparent to anyone who has tapped a real-life calculator or a simple virtual one, PCalc puts a lot of power beneath the hood that you can access. At its heart, it lovingly mimics a physical calculator for the combination of familiarity and utility people like (**Figure 2**).



Figure 2. The kind of calculator that has delighted people for decades.

In this introduction, I take you through the major features of PCalc and how to get started in using them, as well as where to find more information.

PCalc Lite

This manual is generally intended for the full version of PCalc on iOS, as well as PCalc on macOS, watchOS, and tvOS. PCalc Lite is a free introductory version of PCalc that can be upgraded to exactly the same functionality as the full version through in-app purchases.

If you're using PCalc Lite, and you see something here that's not available in your version, the "PCalc Store" section in the app will let you purchase that functionality through a variety of "packs" (**Figure 3**). Tap on the ⓘ buttons in the store to see exactly what's contained in each pack.

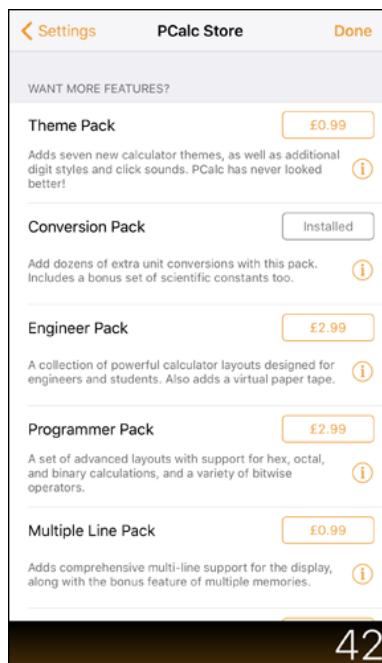


Figure 3. The PCalc Lite store.

The "Power User Pack" for example, adds the "Advanced Settings" section which will give you a lot of control over how PCalc behaves. The "Theme Pack" adds a collection of different visual themes. And so on!

Or you can go ahead and buy the full version directly from the store, which has everything you read about here. Thanks!

An overview

If you've ever used any physical calculator, the first time you launch PCalc in any of its versions on any devices, you'll see a familiar display: a keypad, basic operators (like the times and subtraction symbols), some specialized function buttons for common math scenarios (like squaring a number), and a few more exotic items useful for programmers and those who need to calculate arcs and angles.

Let's start with basic terminology that I'll use consistently throughout (**Figure 4**).



Figure 4. The parts of PCalc.

- **Buttons.** As with almost all software, PCalc has buttons you can press or tap. Buttons let you enter numbers, run functions, and bring up special features.
- **Display.** The PCalc display shows intermediate steps for calculations in progress and results. You can customize it to show many additional details related to its current state.
- **Tape.** Like an old-fashioned paper roll on a printing calculator, PCalc's tape is a chronologically organized running account of every operation and action, with the newest items almost at the bottom (**Figure 5**).

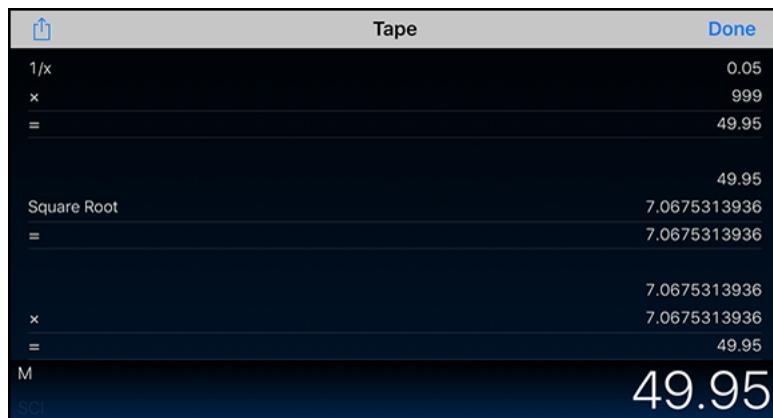


Figure 5. PCalc's tape shows the history of calculations.

- **Registers.** PCalc, like many physical calculators, has an X and Y register, which are temporary memory locations for holding values while you act upon them. The X register typically holds what's shown on the display. The Y register is often used with functions that require two separately entered numbers, such as "take value X to the exponent Y." I'll talk about the *active register* or the *X register* interchangeably to refer to the value in the display that's being acted upon.
- **Memory.** Memory is a special kind of register, where you can store values persistently and perform operations on them, like swapping memory and the current display value, X. By default, PCalc has one memory active, but a preference can let you use 10.
- **Operations.** A calculator allows calculations, and calculations require operations, which here almost always represent a mathematical act performed between two numbers, like addition or division.
- **Functions.** In PCalc, a function performs an operation on a single value, and you typically click a button to carry out a function or select it from a list. (Functions are a simple form of algorithm.)

You'll notice four buttons that seem more out of place than the ones likely to be most familiar: $f(x)$, $A>B$, \textcircled{i} , and a friendly little 42 in a circle that you find strangely reassuring (**Figure 6**). These buttons guide you into a deeper set of features. (In the full-screen iPad version of PCalc, these four buttons appear at the upper left above the display.)



Figure 6. The four special PCalc buttons.

Let's take a quick look at those buttons, which we'll return to later:

- \textcircled{i} : The info button opens Settings in iOS and Preferences in macOS.
- 42: This brings up *constants*, which are fixed values that represent properties in physics, math, and other realms, including those you choose to define. For instance, pi (π) is pi the world (and universe) round. Instead of looking up these numbers, you can tap or click 42 and retrieve them.
- $f(x)$: PCalc lets you tap into functions, which take inputs from the current calculator registers, as explained above, and run them through mathematical transformations. This includes manipulating registers and memory values directly.
- $A>B$: If you're like me, you are constantly faced with unit conversions when cooking, mailing a package, or figuring out how far the Voyager 1 probe is from the sun. The $A>B$

button brings up unit conversions, allowing you select among a large array of unit types, like power and currency, and convert among them.

In the chapter “Conversions, Constants, and Functions,” learn how to define your own entries for those three kinds of features.

You can also move quickly beyond the basic default layout, both in terms of presentation and features (**Figure 7**). PCalc has built-in templates for different color themes and different calculator layouts. If you find none of these suitable, you can even create your own via the iOS version, which can be copied to PCalc for macOS.



Figure 7. PCalc has a lot of variations to choose from, and you can define your own.

Just one more bit of terminology: because PCalc can be used in iOS and macOS, with adjunct versions for watchOS and tvOS, you have various ways of interacting with it: finger taps, dial twirls, remote control clicks, and mouse clicks. For simplicity, throughout this introduction, I’ll use the term “tap,” and will call out details for macOS as needed. There’s a separate section with a brief walkthrough of the Apple Watch and Apple TV versions to help explain their interfaces better, too.

Now, let’s start to drill down more deeply into different ways to use PCalc.

Starting out with PCalc

I imagine that if you're reading this guide, you know the basic functions of a calculator. PCalc works just like you'd expect: you tap a number, an operator, a function, or a special button, and it carries out the task at hand. The results are shown in the display.

In iOS, you can use PCalc in either portrait (vertical) or landscape (horizontal) orientations (**Figure 8**). The app by default shows a simple calculator in portrait, and a more fully featured layout in landscape with more math functions. (These are both labeled Default in Settings.)

Let's start with basic tasks.



Figure 8. The default vertical and horizontal PCalc layouts in iOS.

The basics of operation

The basic operation buttons should make plain sense: \div (divide), \times (multiply), $-$ (subtract), $+$ (add), and $=$ (equals for executing the operation). You'll also notice a few other keys that can help even for basic math:

- $+/$: The sign key takes the active register and turns it to its exact negative or positive opposite. That means 50 (implicitly +50) becomes -50, while -32.6 becomes 32.6.
- $\%$: This simply divides the current active register by 100, making it a percentage.
- ⌫ : While entering a value into the display, tap or press ⌫ to delete the previous character one or more times.
- $($ and $)$: Change the order of operations by grouping items with lower precedence within parentheses. If that statement makes no sense, read this explanation and tutorial. (If you'd like to have this visualized for normal precedence, tap ⓘ and then enable Advanced Settings > Show Implied Parentheses. The parentheses are always shown in the tape.)

- **exp:** This key lets you use powers of ten to make it faster to enter larger numbers. Tap in a number, like 2, then tap **exp** and the power-of-ten value, like **4**. You'll see this represented with a superscript in the display, like 2^4 . As soon as you press any operation key, it's transformed into 2 times 10 to the fourth power, or 20,000.
- **RPN:** Reverse Polish Notation is a specialized numerical entry approach that I go into more detail about later. If you don't know what it is, you're highly unlikely to ever use it. (Depending on layout, you may have a button or you may have to use Settings or Preferences to activate this mode.)
- **2nd:** On more advanced layouts, like the engineering one, the **2nd** button swaps out a set of buttons on the layout with alternate ones. This lets you effectively have more buttons in a calculator layout, showing the most regularly used by default, and using this option to bring up less-used ones that are still useful.

A few other buttons require a deeper look, because, if you're like me, you might never have understood precisely how they worked on a real-life calculator.

Memory. It's a straightforward concept: you want to retain one value while you're working with another. PCalc's default screen offers **MR**, **M+**, and **M-** buttons. **M+** and **M-** take the current active X register value shown on the display and either add or subtract it from the memory value. **MR**, memory recall, copies the memory value to your active register. (It's labeled **m re** in the engineering layout.)

In the engineering layout, you also have an **m in** button, which moves the current register value directly into memory, replacing whatever was stored there.

PCalc has the nifty advantage over older calculators in that it can both show an M to indicate that memory contains a value, but also show an M value in the display above the current active X register value.

Memory tips:

- In iOS, the initial PCalc display automatically resizes deeper to show the M value. In macOS, you need to select View > Lines and choose two or more to show it (**Figure 9**).



Figure 9. The deep-enough display shows the memory value.

- Erase memory by tapping **C** (clear) and then **AC** (all clear). These appear as separate buttons in some layouts.
- Switch from a single memory to 10 separate memory registers by changing preferences (discussed later).

Using register-based functions. In the default layouts for all PCalc versions in iOS and macOS, you'll see function buttons that show an X along with mathematical symbols. These buttons act on values stored in the active X register. Rotate an iPhone to landscape to see the expanded default layout and access additional standard functions. (A secondary Y register is also used on different and custom layouts.)

Some of these functions include **1/x**, **x2**, **√x**, and **x!** (That's 1 divided by X, X squared, the square root of X, and X factorial, if you don't know all the symbols.) In each case, the function acts on the value stored in your active register.

The Y register is used less often in most PCalc modes, although RPN makes more use of it. Some functions include the Y register as one of the input values, and you can create functions that use both X and Y.

If you want to see the values in the X, Y, and memory registers all at once, you can tap the **reg** button (**Figure 10**). A Registers view (iOS) or window (macOS) appears.

Registers		
Main Registers		
x		4462
y		0
Memories		
M		7785
Bases		
Decimal		4462
Hex		116E
Octal		1 0556
Binary		1 0001 0110 1110
Text		
ASCII		"On"
UTF-8		"On"
UTF-16		"T"
UTF-32		"T"

Figure 10. The Registers view.

The Registers view shows items that you will find useful at times: it shows the X register value converted into decimal, hexadecimal, octal, and binary, and displays the ASCII, UTF-8, UTF-16, and UTF-32 character encoding representation when they exist for that value.

(You can also push some of these items into the display through customization described later in “Customize PCalc.”)

Register tips:

- In many layouts, including engineering, an **x~y** key lets you swap the X and Y registers.
- On an iOS device with 3D Touch, you can *peek* on the display area to glance at registers and *pop* to bring up the Registers view as if you’d pressed the **reg** button.
- Double-tap on any value in the Registers view in iOS and you can then tap a Copy button. For the Y register or any memory register, you also get the Set X option, which copies that register to the X register.
- Tap the Share button at upper left to copy the full text of the view or email its contents.
- If you want to keep the Registers view visible while working in the full app on an iPad, turn the iPad from a vertical to horizontal orientation, and then tap the **reg** button.

How the display works

You spend a lot of time looking at the display, as it shows you data entry, details of registers, and calculation and function results (**Figure 11**). The default iOS and macOS versions, reveal relatively little detail in order to keep the view uncluttered, but it’s still quite telling.



Figure 11. The display above a row of buttons.

Whenever you have a value stored in memory, an M label appears at the left of the display. In iOS, the display deepens, reducing the text display size and showing the memory on the top line and the active X register on the second line. (The deeper the display, the more different values you can show all the time, discussed in “Customizing PCalc.”)

In iOS, the display has a number of interactive extras:

- Swipe right to undo; you can do this repeatedly. It brings up the previous results and resets the calculate state just like an undo. (You can also shake your iOS device.) After swiping right one or more times, you can swipe left to redo if you haven’t taken any new actions.

- Double tap to display a popover menu with options to cut, copy, and paste, or switch to other notations (Figure 12). (See “Notation” for more details.)

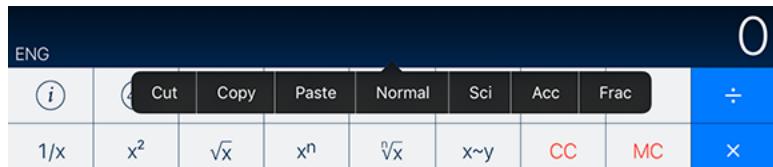


Figure 12. A popover menu shows clipboard options and notations.

- With 3D Touch models, hold down lightly to *peek* the Registers view; press down harder to *pop* it up as if you’d pressed the **reg** button.
- Swipe down just within the display’s left side and you can make the display deeper by one line until you reach the maximum. Swipe up to reduce it by one line’s depth.
- On an iPad in the full-app view, the four special PCalc buttons, and the **tape**, **reg**, **undo**, **redo**, and **help** buttons appear along the top at left and right.

Control-click the display in macOS to bring up a full array of options: those that appear in iOS with a double tap, plus functions, constants, and conversions, and display options (Figure 13).

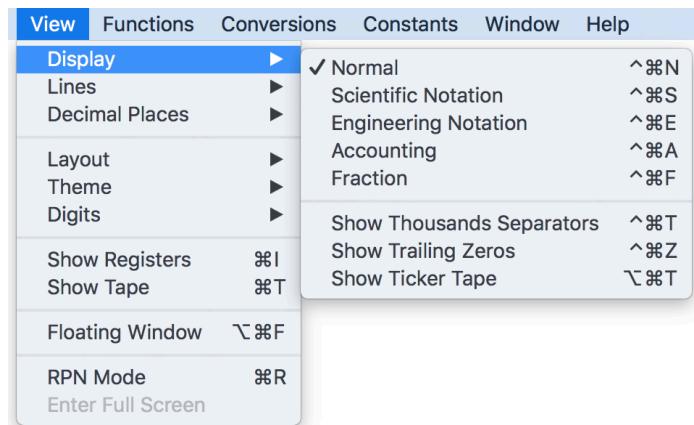


Figure 13. macOS handles display options with menus.

Understanding the tape

If you’ve used a calculator with a printable “tape,” a roll of continuous paper on which operations and outcomes appear a line at a time, the tape feature in PCalc should be familiar. If not, the tape simply records what you do and lets you scroll back to find the history of your operations and functions. A timestamp appears at intervals in the tape to help you remember when you performed the calculations.

You can view the tape at any time by tapping the **tape** button (**Figure 14**). This brings up a view in iOS and a window in macOS.

The tape works nearly identically in iOS and macOS, although options are found in different places.

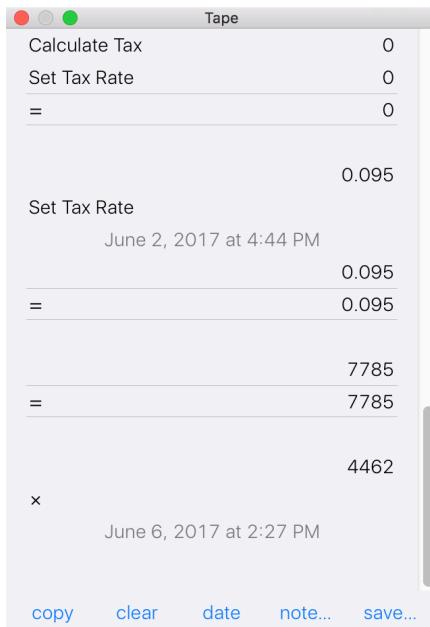


Figure 14. The tape view.

You can clear the tape, copy its text exactly, email it (iOS only), save it (macOS only), add a note at the current position, or add a datestamp at the current position. The corresponding buttons appear at the bottom of the macOS Tape window and in iOS when you tap the Share button (**Figure 15**). The copied, emailed, and saved versions of the tape are identical: an exact, monospaced formatted duplicate of what you see.

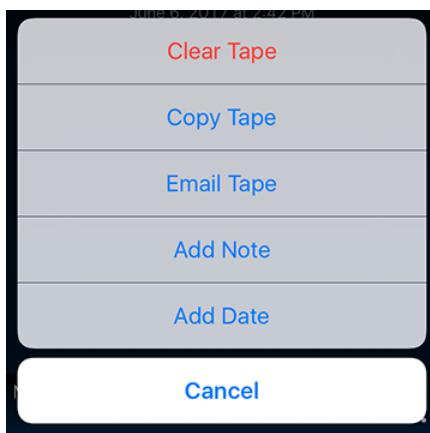


Figure 15. PCalc offers a lot of ways to share and copy the tape's contents.

iOS also lets you double tap any value in the tape and choose to either copy the value or set the X register with it, just like in the Registers view.

You can pass the tape back and forth between two devices that support Continuity and Handoff, too, as explained in “Syncing across versions.”

Extra features in iOS and macOS

PCalc in iOS and macOS have a number of little extras you might find useful, and might overlook or wonder how to configure. Wonder no more!

Widgets

Both iOS and macOS have widgets that work with the Today notification screen that appear slightly differently in each OS.

In iOS, swipe down to reveal the Today view and swipe right if you’re not seeing widgets. Swipe all the way to the bottom of Today, and then tap Edit to bring up the widgets manager. Swipe down to More Widgets and tap the green circle with a plus sign in it next to PCalc to add it to Today. The PCalc widget has a shallow view with just numbers, basic operations, clear, delete, copy, paste, and a period (**Figure 16**).

Tap Show More for an expanded layout that adds \pm and %. macOS has the same widget as the expanded iOS view.

In Settings > Widget in iOS, you can opt to pick a dark theme, sync values between the app and widget, and control settings. In Preferences > Widget in macOS, PCalc lets you use a more complete layout, among other options.

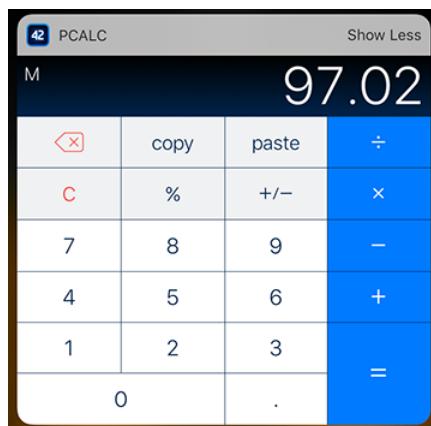


Figure 16. The iOS PCalc widget.

Extra iPad screen modes

Starting in iOS 9, Apple added [the ability to split an iPad screen](#) in two ways: Slide Over and Split View. PCalc supports both these modes, in landscape and portrait modes. (You need either model of iPad Pro, a fifth generation iPad, an iPad Air 2, or an iPad mini 4 to use these views.)

In both modes, you have access to a full version of PCalc that has a layout that reflows to fit the available space. The difference between the two modes?

- Slide Over keeps the current app active occupying the full screen, but literally slides a panel over the app containing PCalc that you can use and then slide back (**Figure 17, top**).
- Split View divides the screen roughly in two, with the first app at left and PCalc at right running at the same time (**Figure 17, bottom**).

To bring up either view, swipe left from the middle-right edge of the screen. Swipe a little left and let go, and it's Slide Over. Swipe further, until you see a dividing line appear from top to bottom, and the app at left switches to fill the remaining space to turn into Split View.

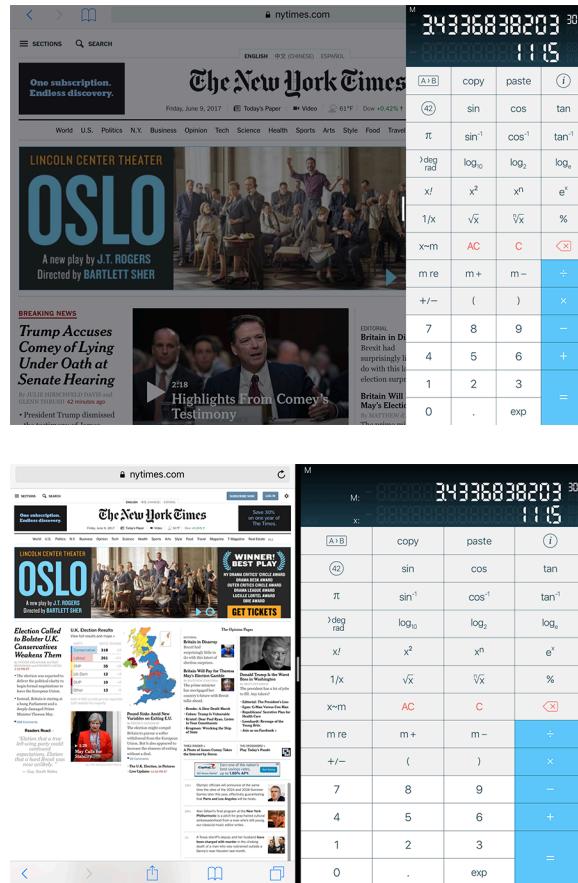


Figure 17. The Slide Over (top) and Split View (bottom) options on newer-generation iPads.

The first time you use either view in an app, iOS shows all available apps and lets you select from a scrolling list. In my testing, I can't tell if it always remembers your choice, as sometimes you're presented with a list of apps and other times the last app used. You can select PCalc from this list. To bring the list back up, swipe down from the top of either Split View or Slide Over, and the apps reappear.

You can use PCalc as the dominant app, with other apps in the Slide Over pane, or use it in Split View on the left or right with other apps.

To dismiss either view, tap the main app with Slide Over or swipe the dividing line to the right edge with Split View.

Syncing across devices

PCalc has the neat automatic ability to keep your experience in sync across all the iOS devices and Macs you work with that are logged into the same iCloud account. You don't have to do anything for this synchronization to stay up to date.

Using iCloud. PCalc synchronizes user-defined conversions, constants, and functions from iOS and macOS, as well as and layouts created in iOS, via iCloud. User constants and conversions also sync to watchOS, as well as Apple Watch settings you change in iOS.

Layout sync requires a little extra explanation. Currently, you can design and edit layouts only in iOS. However, these layouts sync and can be used in macOS. PCalc for macOS organizes layouts by device type, as you can see in View > Layout, where Mac, iPhone, and three iPad categories appear.

Thus, if you design a layout on an iPad, it will sync to a Mac, and be available there, but you won't be able to use that iPad layout in an iPhone. (You can flip a switch on an iPad to use iPhone layouts, however: tap ⓘ and then tap Advanced Settings, and change Use Phone Layouts to on.)

Tip: You can share a layout from iOS with someone else or a device you own that doesn't use the same iCloud account. Tap ⓘ and then either Vertical Layout or Horizontal Layout, and pick a layout. Then tap the Share button at the bottom and use AirDrop or one of the other listed methods to send that layout (**Figure 18**).

Using Continuity and Handoff. With devices that support both Continuity and Handoff, PCalc can pass along the current tape, underway operations, and registers. Continuity lets hardware talk among itself, and Handoff covers how data is shared. (Continuity and Handoff both have minimum system requirements.)

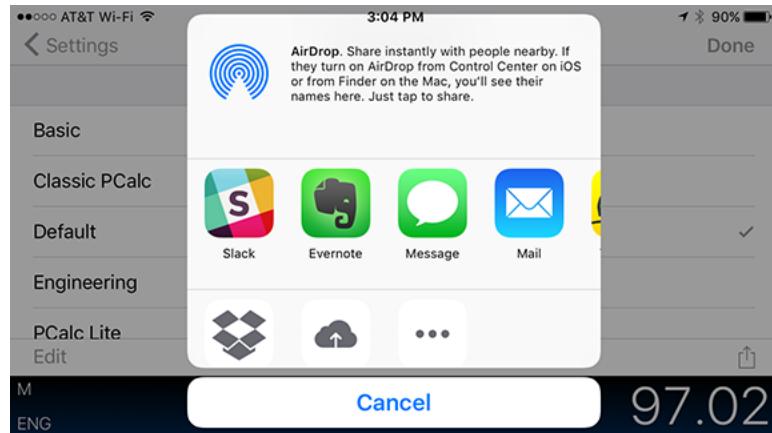


Figure 18. Share layouts.

Like with Handoff from other apps, you see a PCalc icon either in the lower-left corner of an iOS lock screen or at the leftmost or topmost part of the macOS Dock. Swipe up on iOS or click the Dock Handoff icon, and PCalc assumes the state sent by the other device.

Universal Clipboard also relies on Handoff, and works with the same compatible devices, letting you copy a value on one device and then paste it on another. The copied values only last briefly, then revert to whatever the Clipboard held before that.

Customizing PCalc

PCalc's defaults are designed to appeal to everyone, but you may want to make different choices than those defaults. You can change many aspects of the app's appearance, from layout to theme to what's shown on the display. PCalc also has accessibility support, which can be useful in a range of circumstances.

In this chapter, I explain how to pick alternative layouts (button arrangements), themes (color choices), and display options (number of lines shown in the display). Each of these elements adds up to what you see in PCalc's main screen, but they're all effectively independent from one another.

Tip: As you make changes to PCalc for iOS via details here and in later chapters, you might want to use the export feature found at the bottom of Settings to save your current state. Then, later, if you make changes you don't like and want to reset to defaults — described at the end of this chapter — you won't have to re-create any of your interim customizations.

Layouts

Each arrangement of buttons and settings for the display comprises a layout, and PCalc comes with several layouts built-in (**Figure 19**). Some layouts are more appropriate for different modes. For instance, if you use the Engineering mode, the Engineering layout might be the best match. (See “Notations and RPN Modes” for more details.)

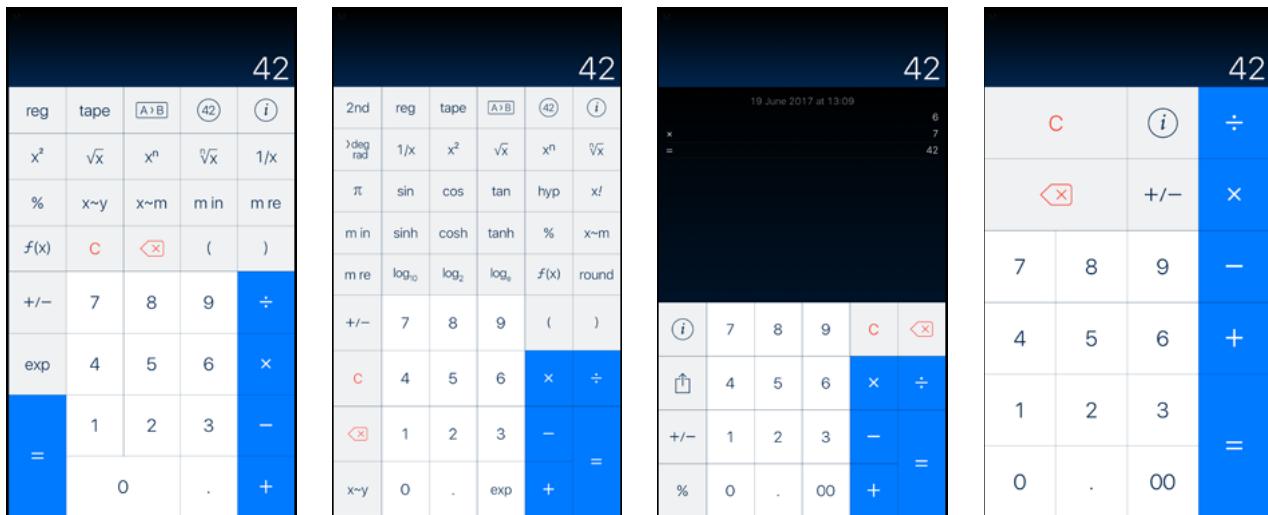


Figure 19. Some of the default layouts available with a click.

When you first launch PCalc or reset it to defaults, the iOS version sets separate Vertical Layout (portrait) and Horizontal Layout (landscape) choices to Default. The macOS version uses iPhone default.

To change the layout in any version, you first tap or click ⓘ.

In iOS, you select layouts from several Vertical Layout and Horizontal Layout choices. These vary by device:

- iPhone: Basic, Classic PCalc (for long-time users), Default, Engineering, Mirror (Horizontal only), PCalc Lite, Programming, Retro (Vertical), Retro Hex (Horizontal), Retro Scientific (Horizontal), and Tape.
- iPad (full screen): Basic, Default, Mirror (horizontal only), and PCalc Lite. You can send iPhone layouts to an iPad, however. (See “Syncing across devices.”)

In Split View on an iPad, you can tap ⓘ and select Advanced, Basic, Default, and Tape from the Split Layout menu.

macOS collects *all* of these layouts under its View > Layout menu, grouped by device type. You can also view, select, and manage layouts via PCalc > Preferences > Layouts. The Rotate option at the bottom of the View menu lets you use the Vertical Layout version of a layout you selected.

Themes

Everybody prefers different sets of colors and button types, whether that's appearing as minimal as possible or replicating the feel of favorite calculators. PCalc includes themes to let you swap the entire look of your current layout, including themes that work for you at different times of the day.

In iOS, tap ⓘ, select Theme, and then choose among 14 themes that color the buttons, display, and background differently (**Figure 20**). In macOS, select from the View > Theme menu, where a 15th Mac-only Aqua option also appears.

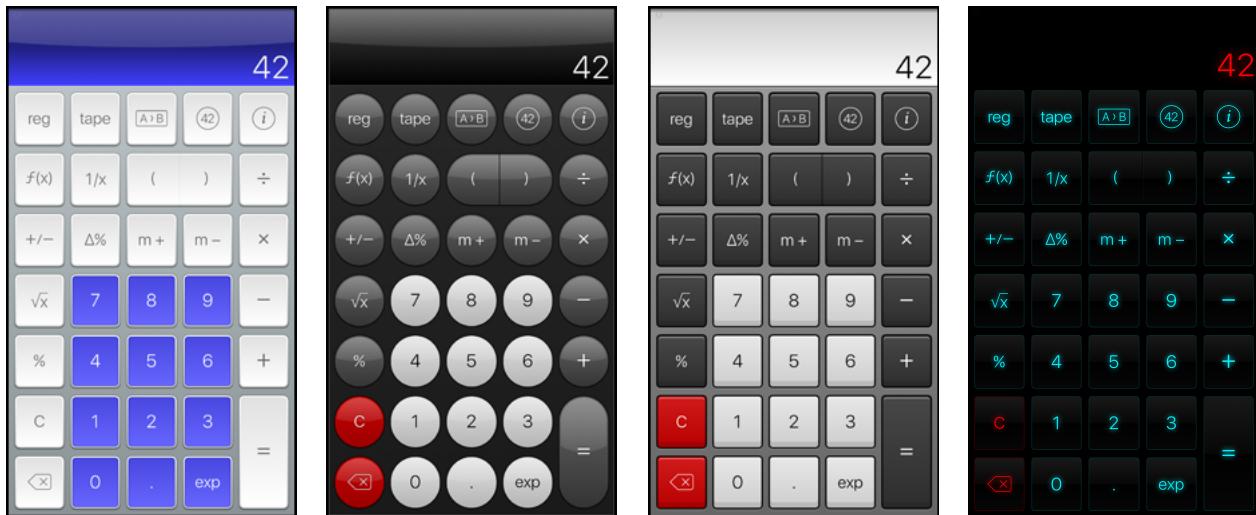


Figure 20. Some of PCalc's many themes.

The Automatic Night Theme option in iOS, when enabled, lets you pick separate day and night themes, and choose location or a screen brightness threshold to swap modes. (Location calculates the local sunrise and sunset times based on your current position, and uses that to decide whether to switch between light and dark.)

You can control the color or tint of three kinds of items in layouts: theme, digits, and display.

In iOS, you find these options at the bottom of the Theme, Digits, and Display menus. In macOS, open PCalc > Preferences > Display, which shows them as Digit, Display, and Theme Tint (**Figure 21**). Digits changes the color of numbers in the display, while Display changes its background color. The theme tint affects the background of buttons that use the default color instead of having a color defined, as well as text and tinted background, such as a color gradation used behind the display in some themes.

All display, digit, and theme tints and colors are saved with a given theme. If you make changes, they remain for that layout, but aren't applied PCalc-wide to other layouts.

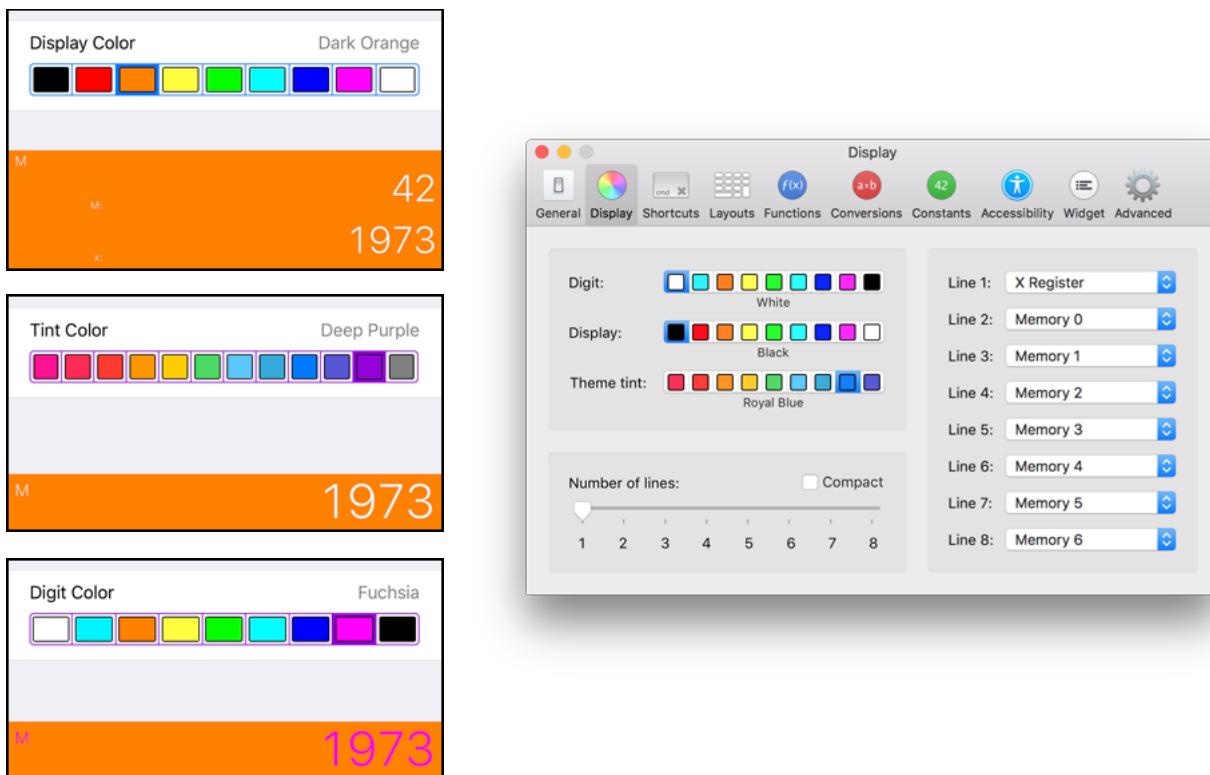


Figure 21. The tint and color options in iOS and macOS.

Display

The display in PCalc can be highly customized, from what appears on it and how it looks to how deep it is—how many lines it shows.

Tap ⓘ and use Display and Digits to customize the appearance. (In macOS, these features are split between the PCalc > Preferences > Display settings and the View > Digits menu.)

You have a number of choices you can make:

- How many lines to show in the display, from 1 to 8. In iOS, you can control this depth separately for horizontal and vertical views.
- What appears in each line, such as the default X register, a memory register, the last conversion, and RPN stack levels.
- How the digits in the display appear. You can choose from a variety of typefaces that vary in emphasis, legibility, and style. (Pick LCD, and the display background shows faintly the “unlit” virtual LCD elements.)
- In macOS, select the Compact checkbox to reduce the size of digits when multiple lines are used.
- In iOS, swiping up and down in the left area of the display adds or removes lines, but you can opt to disable this swipe feature by turning off Vertical Swipe to Change in the Display settings.
- PCalc for iPhone offers a Smart Resize option, which can be disabled, that changes the display’s depth depending on what’s being displayed to conserve space.

One other option for the display is to add a horizontal ticker tape-style version of the PCalc tape beneath the calculations. Tap ⓘ and turn on Show Ticker Tape; in macOS, choose View > Display > Show Ticker Tape (**Figure 22**). By default, it appears at the bottom of the display. Use Advanced to move the ticker tape to the top.



Figure 22. A fully tricked-out display view.

Advanced settings (plus the View > Display menu in macOS) let you customize the display further, such as including a thousands separator or trailing zeroes.

Accessibility

The accessibility features provide aid to people who identify as having a given impairment, such as partial blindness, but accessibility goes further. In fact, accessibility features, when they're as well designed as those Apple provides, offers accommodations and improvements for everyone.

PCalc includes a number of specific options in addition to support for iOS and macOS built-in accessibility features such as VoiceOver.

Tap ⓘ and choose Accessibility (iOS) or choose PCalc > Preferences (macOS) to set options described below.

Speech. PCalc can use the built-in iOS and macOS voice synthesis systems to speak actions aloud, like pressing a button or delivering the results of operations, or both. In iOS, tap the Speech item and you can customize speech options directly (**Figure 23**).



Figure 23. Customize speech options in iOS.

In macOS, check Speak Actions, Speak Results, or both, and then select whether speech is truncated (stops when you start the next task), overlapped (spoken simultaneously if not finished with the previous text), or queued (spoken consecutively until done). To customize the style and accent of the voice, go to the macOS Accessibility preference pane and select the Speech option in the sidebar.

Labels. Four options in PCalc let you make key and tape text larger, in bold, or both. iOS also can use dynamic type, which picks up the preferred text size you've set globally in Settings >

Display & Brightness > Text Size. iOS also offers key popups, which show larger versions of each key above the button you press.

Motion. PCalc has a variety of motion (iOS) and animation (both platforms) behaviors that give the app a smoother visual appeal. Some people find these distracting or cause unwanted optical responses, so the effects can be disabled. Switching off animations, for instance, disables a scroll up/down sequence when you enter or leave settings. Certain themes also feature parallax, which is disabled when motion effects is turned off.

More settings

A number of additional settings customize PCalc further. For instance, you can override the default system-wide settings in iOS and macOS for how numbers are displayed — like a comma or a period between groups of 1,000 in larger numbers.

Explore the Settings (iOS) or Preferences (macOS) options for other customizations. You can tweak PCalc until it closely fits all your preferred methods of working.

Reset

If you've messed with PCalc to the point that you don't like how it looks or functions, you can revert most of your changes with a single command. Reset to Defaults (iOS) and Reset All Settings to Defaults (macOS) revert to the fresh-from-the-factory settings for all standard features. Your custom layouts, and user-defined conversions, constants, and function are retained (synced via iCloud).

- In iOS, tap ⓘ, swipe to the bottom, and tap Reset to Defaults. You're prompted to tap Cancel or Reset.
- In macOS, choose PCalc > Preferences, click the Advanced button, and then click Reset All Settings to Defaults. You're prompted to tap Cancel or Reset.

In iOS, you can import previously exported PCalc settings and user data by tapping the Import Settings button, which effectively restores PCalc to the state at which you saved.

Conversions, constants, and functions

PCalc saves you a large amount of time by having prefabricated elements in the app that you can call up as needed. This includes:

- Conversions, which handle moving a number between units for the same kind of measurement, like distance, weight, or time.
- Constants, useful for invariable numbers that represent fundamental properties of math, nature, or measurement.
- Functions, which let you run numbers through mathematical transformations.

Each of these categories allows for customization, so you can create your own conversions, constants, and functions as you need them. They all sync between copies of PCalc installed on iOS devices and Macs that are logged into the same iCloud account. watchOS also picks up these customizations through sync from PCalc on the iPhone with which it's paired.

Recent conversions, constants, and functions appear at the top of the respective view in iOS and at the top of the respective menus in macOS.

Conversions

If you're like me, you often have a value in one set of units that you need to convert into another. This might be Fahrenheit into Celsius, pints into gallons, or centimeters into inches. PCalc features a large array of built-in conversions, including daily updates for currency conversion.

Tap **A>B** to bring up the Conversions view (**Figure 24**). In macOS, you can also drill down through the Conversions menu to find the specific one you want, or use the search field to enter units or other keywords (like “km to cm”) to find matches.

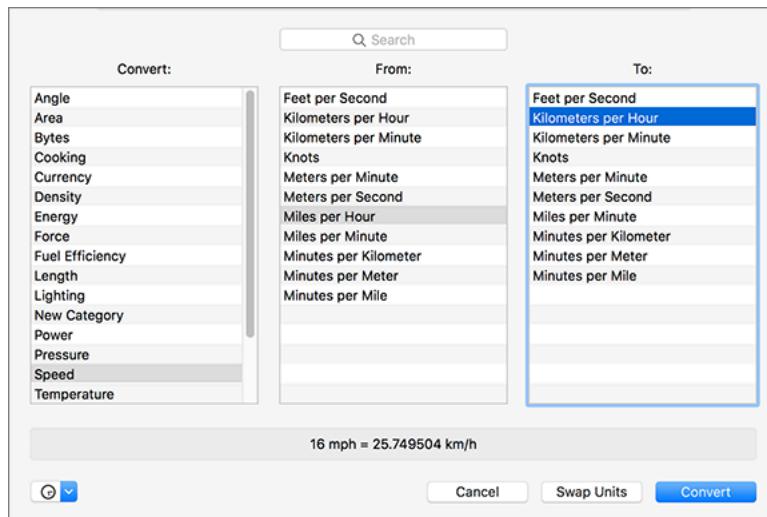


Figure 24. The Conversions view shows you available options.

PCalc always previews conversions from the X register before inserting them. In iOS, when you drill down to the units *from* which you’re converting, you then see all the conversions. In macOS, you have to select a “To” conversion to see the preview.

For instance, if you’re trying to convert 4 liquid tablespoons into the equivalent Metric measurement, tap 4 and then tap Cooking > Tablespoons (US); PCalc for iOS reveals the conversion not just into milliliters (roughly 59), but also into cups (0.25), UK fluid ounces (2.08), and others. In macOS, click Cooking > Tablespoons (US), and then click on one of the matches, such as milliliters.

Sometimes you’ve drilled down to the wrong “from” unit. PCalc lets you tap a swap icon (iOS) to swap the from and to units for a given system. Tap the swap icon next to Cups (US), and now Cup (US) is the selected unit and the conversions are shown from cups to other units. In macOS, tap the Swap Units button to swap the From and To selections.

PCalc groups conversions into these categories:

- Angle
- Area
- Bytes
- Cooking
- Currency
- Density
- Energy
- Force
- Fuel
- Length
- Lighting
- Power
- Speed
- Temperature
- Time
- Torque
- Volume
- Weight

Currency values update daily, but you can force an update if it hasn’t performed one within 24 hours by pulling down in the Currency category in iOS, or, in macOS, clicking the Update Rates button when Currency is selected in the conversion window; you can also choose Conversions > Update Currency Rates in macOS.

These conversions may still not be enough. For instance, your author is a typesetter, and works in old-fashioned units of points (12 to a pica, 72 to an inch) and picas (6 to an inch). I can add a conversion through this process in iOS:

1. Tap an appropriate category in the Conversions view (such as Length in this example).
2. Tap Edit.
3. Tap the + button.
4. Tap the New Unit entry.
5. Name the unit.
6. Enter its abbreviation (modern users use pt for point and pc for picas).
7. Tap another conversion in the list to provide the conversion factor and basis (Inches, for instance).

8. Tap the entry (which defaults to Multiply X by 2) to define the mathematical operation (**Figure 25**). (For points, the conversion is to divide inches by 72, as there are 72 points per inch.)
9. Add additional steps if necessary. (For example, Fahrenheit conversion to Celsius and vice-versa requires both an addition or subtraction operation before using multiplication or division.)
10. When all operations are complete, press Done.
11. Add additional units by tapping Edit, and then following steps 6 to 9.

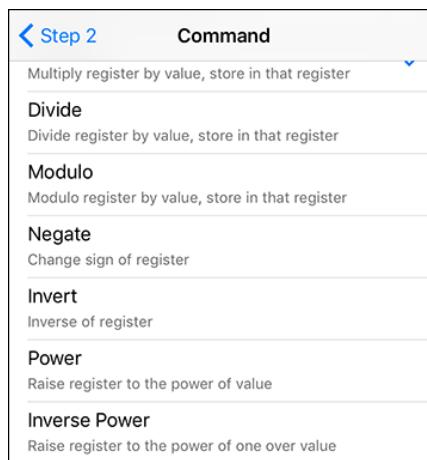


Figure 25. Choose among many mathematical operations for each step. These options appear with functions later, too.

Each new unit you want to convert must have its own entry within the category. In my typesetting example, I created both points and picas. Then, when I tapped on points, I could define the conversion from that to any of the other units that are defined at the top level of the category, including picas.

Remember: you'll need to create the reverse conversion as well. If you make an entry for points to picas, you need to also create one for picas to points. PCalc can write the reverse conversion for you in most simple cases.

If you don't find a category in which your unit fits, you can add a new one by tapping Edit and then + in the main Conversions view. Each unit is only visible within that category. If you create a completely new category, you'll need to populate it with all the units you want to use, even if they exist elsewhere in different categories.

In macOS, select Conversions > Edit User Conversions (or PCalc > Preferences > Conversions) and follow a very similar set of steps.

Constants

You typically refer to constants to drop in a fixed value that you don't otherwise want to have to look up. Tap the 42 button in a layout, or choose an item from the Constants menu in macOS (**Figure 26**).

Constants	Done
Astronomical	>
Atomic	>
Electromagnetic	>
Mathematical	>
Physicochemical	>
Universal	>
User	>

Figure 26. The Constants view.

PCalc offers constants in these categories:

- Astronomical, like the mass of the sun.
- Atomic, such as the mass of an electron.
- Electromagnetic, which includes the elementary charge.
- Mathematical, for when you need the natural log (e).
- Physicochemical, if you can't recall offhand the Avogadro Constant.
- Universal, like the speed of light in a vacuum.

It also lets you create your own constants. To do so in iOS:

1. Tap a category.
2. Tap Edit.
3. Tap the +.
4. Enter the name of the constant, its value, its symbol, and its numeric base.
5. Tap Done.

You can also create a new category by tapping Edit in the main Constants view and tapping +.

To create a custom constant in macOS:

1. Choose Constants > Edit User Constants, which opens the Constants pane of PCalc's Preferences window.
2. Select a category.
3. Click +.
4. Enter the name of the constant, its value, its symbol, and its numeric base.
5. Close the Preferences window.

To create a new category, click + with no category selected.

Functions

PCalc's built-in functions let you perform a more detailed or less frequently required algorithm. Bring up functions by tapping $f(x)$ in a layout, or choose an item from the Functions menu in macOS (**Figure 27**). In iOS, selecting a category previews the results for every item; in macOS, only for the selected item.

◀ Functions	Financial	Done
Add Tax		
16.8		
Calculate Tax		
2.8		
Get Tax Rate		
20		
Round to Nearest		
14		
Set Tax Rate		
14		
Subtract Tax		
11.66666666667		

Figure 27. The Functions view.

Functions divide into five categories:

- Complex Numbers, included for people who need to work with this kind of math. ([Read more here](#).)
- Financial, which performs tax calculations. (You first have to choose Set Tax Rate to load the functions with the tax value you want to use.)
- Memory, which are options to handle the memory register.
- Special, a variety of useful functions rarely needed as buttons.
- Trigonometric

- User, which includes a predefined example of generation a random number between 0 and 100.

You can also define functions using an editor similar to that for conversions. In iOS, tap **f(x)**; in macOS, choose Functions > Edit User Functions. Then do the following:

1. Select a category.
2. Tap or click Edit.
3. Tap or click **+**.
4. Tap or click New Function.
5. Name the function, choose the numeric base, and choose the mode of entry.
6. Tap or click the first operation, choose its details and settings, and tap or click the function name to return to the definition view.
7. Tap or click the **+** in the upper right to add additional operations, defined as in Step 6.
8. When complete, tap or click the category name, and then tap Done.

Notations and RPN Mode

Many calculator users rely not just on basic mathematical operations and functions, but also on particular sets of functions and even the way in which operations are represented. PCalc's notations present several ways to configure its appearance and display to work for different kinds of uses. Beyond notation, you can also enter and display numbers in different numeric bases.

PCalc also offers RPN Mode, an alternative way to enter the operators related to calculations. Some people may prefer a given notation and want to use RPN Mode at the same time.

In this chapter, I'll first explain how the default mode works, and then the differences among the five alternate notations. Then I'll look at which prefab layouts can work best based on devices and platforms for a given notation. Finally, I explain PCalc's implementation of RPN Mode for people who prefer that method of entry or who have wanted to learn it and use a calculator that supports it.

Notation

The five notations correspond to the best way to see entries and results relative to the kind of numbers and scale you're working with (Figure 28). (The one exception is Accounting, which also changes numeric entry.)



Figure 28. Numbers shown in each of the five notations: Normal, Scientific, Engineering, Fraction (exact), Fraction (approximate), and Accounting.

- **Normal.** In Normal notation, the default when you first launch PCalc or reset it to its initial state, numbers are shown as decimal fractions with all digits displayed to the limits set. It will shift large and small numbers into scientific or engineering numbers as required to display them.
- **Fraction.** Instead of using extended decimal representation (like 0.3333333333), the Fraction notation shows non-integer portions as a ratio of two numbers, a numerator and a denominator. This is particularly useful for repeating decimals, such as $1/3$ or $1/7$, where the number repeats in a pattern forever. Some fractions are easy to represent exactly using a few digits of precision, like 0.75 displaying as $3/4$. But most require some approximation. When that approximation is far enough from the original decimal representation, PCalc shows the approximation symbol, \approx , in the display.
- **Scientific.** All numbers appear in exponent format with the exponent always being a power of 10. Add 12560 to 23430 and the Normal result would be 35990, but in Scientific notation it's 3.599^4 . The superscript doesn't mean, as it would in standard mathematics "3.599 to the fourth power"; rather, it's "3.599 times 10 to the fourth power." This notation makes it easy to deal with extremely large and small numbers.
- **Engineering.** Similar to scientific notation, Engineering shows all numbers represented relative to powers of 10, but always by units of three, which correspond to SI (international system) standard units, like kilo, mega, and so on. That is, 3,585 is shown as 3.586^3 , but 486,234 is shown as 486.234^3 .
- **Accounting.** In accounting mode, the display always shows two digits of precision (.00), and all values entered are treated as values in 1/100ths. To enter the whole number 6, for instance, you tap in 600, which is shown as 6.00.

Alternate base entry

While it's not a notation as such, you can switch among four different numeric bases for entry, which is useful for programming. In the default view on all platforms (horizontal default on iPhone), the dec, hex, oct, and bin buttons correspond to decimal (base 10), hexadecimal (base 16), octal (base 8), and binary (base 2). Tap a button to both switch the display to that base and to allow data entry in that form (**Figure 29**).



Figure 29. Moving among bases in PCalc.

Tapping any button but decimal switches part of the layout to show bitwise operators (not, and, or, and xor), and display digit entry buttons appropriate to the base. Tap any base button, and the display and layout automatically swap back to the appropriate units and entry choices.

RPN

PCalc supports RPN for people who prefer to use that mode of entry. Because RPN is a conceptually difficult mode of entry to master, I won't attempt to explain *how* to use it here. If you'd like to learn RPN, [study this page](#). Instead, for RPN fans, let me explain how to use it with PCalc.

In iOS, tap ⓘ and then switch RPN on, or tap the **RPN** button that appears on some layouts. In macOS, choose View > RPN Mode (**Figure 30**).



Figure 30. A standard layout in RPN Mode.

Because RPN works as a stack of numbers rather than a series of calculations, PCalc helps you manage the stack. The stack starts with X, the normal display register, moves into Y, and then into numbered entries.

The basic RPN operations are:

- Enter a number and tap **Enter**; the number is pushed onto the bottom of the stack.
- Tap **Drop** to pop the bottom number off the stack.
- Tap **Roll** (really, Roll Down), and the number at the bottom of the stack rolls to the top.
- Tap **Swap** to take the values in the X and Y registers and swap them.

If you need Roll Up, moving the number at the top of the stack to the bottom, you can customize a layout with that option in PCalc for iPhone. All layouts adopt to RPN mode, such as switching out buttons that aren't needed in RPN for RPN-specific options.

RPN Mode works with all the unary operators, like addition and multiplication. Press + and the bottom two numbers are popped (from the X and Y registers), added together, and the result pushed onto the bottom of the stack (into the X register).

Basic layout instructions for iOS

While PCalc includes a number of alternative layouts and other customizations, as discussed earlier in “Customizing PCalc,” you can go one step further in iOS: you can create your own custom PCalc layouts. These layouts can be transferred to macOS to use there as well.

Create or modify layouts

You might have noticed that if you held down on a key for a couple seconds, PCalc pops up an Edit Layout prompt that asks if you’d like to start editing, edit without asking in the future, or cancel (**Figure 31**). (You can disable this hold-to-edit feature by switching it off: tap ⓘ > Advanced Settings > Tap & Hold to Edit Layout.)

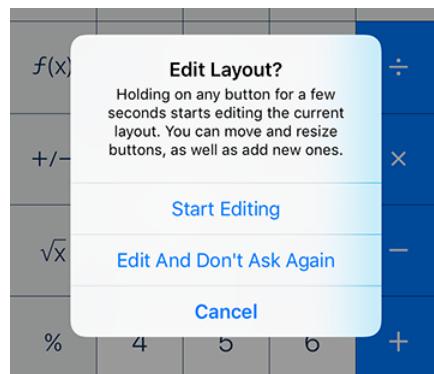


Figure 31. Tap and hold to bring up an in-layout editing option.

But that’s more useful for a layout already underway.

To create a new layout from scratch or duplicate an existing one:

1. Start at Settings and choose either Vertical Layout or Horizontal Layout.
2. Tap Edit in the lower-left corner.
3. Tap either the + in the upper-right corner to create a new, empty layout, or choose one of the listed layouts and tap Duplicate.

A new layout starts with a set of default buttons arrayed around the screen, including a core number pad with all the digits, a period, an **exp** key, and the four main operators. It also includes an ⓘ button, \otimes button, = button, and C and AC buttons.

In a new layout, a duplicated one, or one that ships with PCalc, you can add and remove buttons, move individual buttons or blocks (Figure 32), or reassign what a button does and how it's labeled (Figure 33).

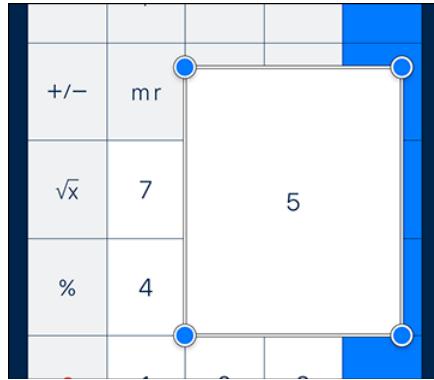


Figure 32. Resize a button.

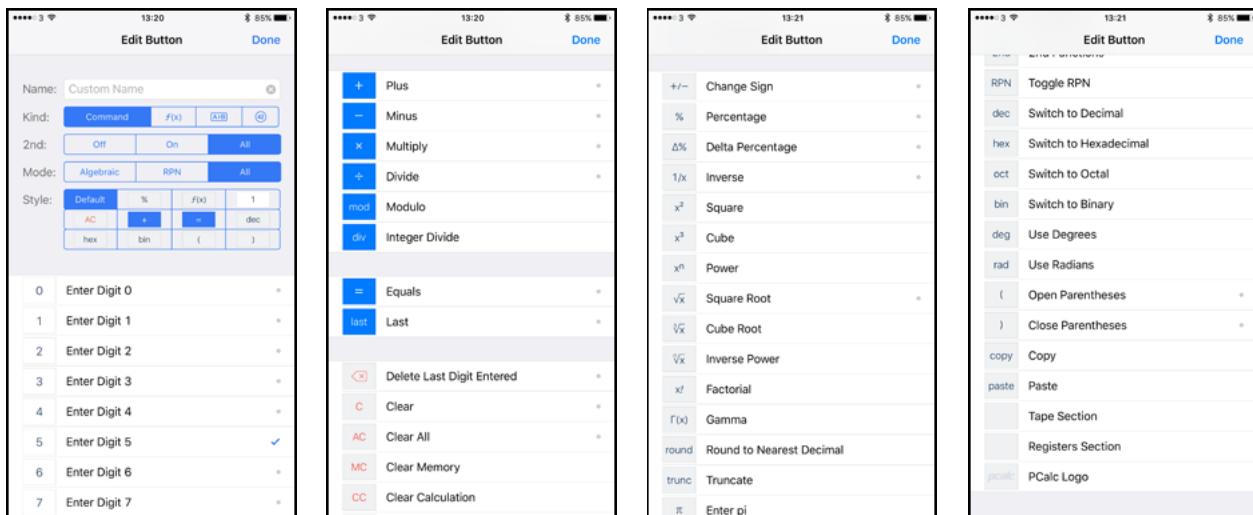


Figure 33. You can pick from a huge number of options for a button's function.

Create a button. Tap the + sign in the lower-left corner, and a new button appears on screen with resizing handles.

Edit a button's action. Double tap a button or, when it's selected, tap Edit at the lower-left corner. See below for more on how to use these settings.

Delete a button. Select it and then tap the trash can icon.

Move a button. Tap the button and then drag it.

Resize a button. Tap the button and then use its resizing handles in any corner to resize it.

Select a group of buttons. Using two fingers, tap the opposite corners of the selection area you want. A set of resizing handles appears around the rectangle formed. You can drag it as a unit or resize all the buttons via the handles.

A few more controls appear in the main toolbar if there's room, as on an iPad, or will be accessible by tapping the hamburger (three vertical line) button in the lower right:

- Reset All reverts you to the original layout before you began this editing session.
- Select All does just that.
- Deselect drops all current selections.
- Increase/Decrease Text Size changes the text display on any selected buttons.
- Switch 2nd On swaps you into the alternate layout available with the 2nd key.
- Switch RPN On shows what appears in RPN mode.

Export a custom layout to macOS

PCalc automatically syncs layouts with all other copies of itself on devices logged into the same iCloud account. However, if you want to share the layout with another person or a device that doesn't use the same iCloud account, you can.

Tap ⓘ and choose either layout orientation. With a layout selected, tap the Share button, and use any available method, including AirDrop, to pass along that layout. Because layouts export as a file, you can save it to Dropbox, email it to someone, message it, or use any other means.

In macOS, you can import a saved layout file by going to PCalc > Preferences > Layouts and clicking the Load button. (You can also save a layout that have synced or you've imported in that location by selecting it and clicking Save.)

watchOS and tvOS

The two other versions of PCalc you might encounter are for watchOS and tvOS. The watchOS version is part of PCalc for iOS, so it comes along for the ride. You need to purchase the tvOS version separately.

watchOS operations

In watchOS, PCalc offers basic calculator functions, as well as access to constants and conversions and a tip calculator. Its abilities are divided over three screens:

The first screen allows number entry, but you can also tap the mic/finger button to dictate a number or speak a simple calculation, like “six times nine” (Figure 34). You can also use your finger to draw numbers using Scribble text input. The **C** (clear) button changes to **AC** (all clear) after being tapped once, just as in many iOS layouts. After starting to enter numbers, the mic/finger button switches to a delete button to remove digits. Force Touch also brings up **Clear All**, **Undo**, and **Redo** options.



Figure 34. watchOS entry screens.

Tap the ... button to pull up operators, like plus and multiply. You can also swipe among screens. After tapping an operator, PCalc returns you to the number-entry screen. The third screen, reachable by swiping or by tapping the ... on the second screen, offers a tip calculator, conversions, and constants.

The digital crown lets you control elements within a section. For instance, with tips you tap a button like **For 2** and use the crown to adjust the number up. (You probably don't need to split a bill for one person.) The crown also lets you move to the conversions/constants section.

Apple Watch settings in the iOS version of PCalc let you set a few preferences, but the most important is Mirror Settings. With that enabled, several options change in PCalc for watchOS when you change them in iOS. Notably, if you want to use RPN Mode, you first enable it in iOS,

then the Watch switches the equals sign with Enter, and the two parentheses buttons on the operations screen become three: **Drop**, **Swap**, and **Roll**.

watchOS syncs constants and conversions with iOS. You can use Handoff with an iOS or macOS version of PCalc to pass a calculation in progress.

tvOS operations

PCalc for tvOS is a trimmed-down version of the app meant for quick calculations when you want to show them to someone else or don't have another device handy. tvOS is standalone, and it doesn't sync settings from other platforms or support Handoff.

However, you can get quite a lot done with it. The main screen offers a simplified layout (**Figure 35**), but click the i button, and you can reach an extensive array of settings that let you, among other things, switch to the expanded default Horizontal Layout on an iPhone or iPad (**Figure 36**).

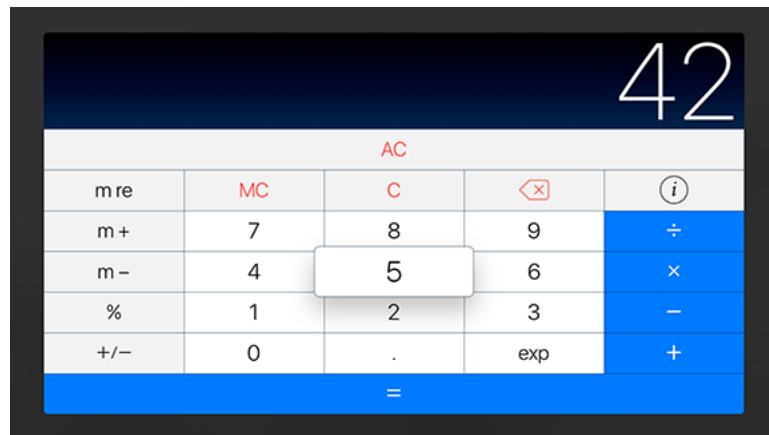


Figure 35. PCalc for tvOS in regular layout.

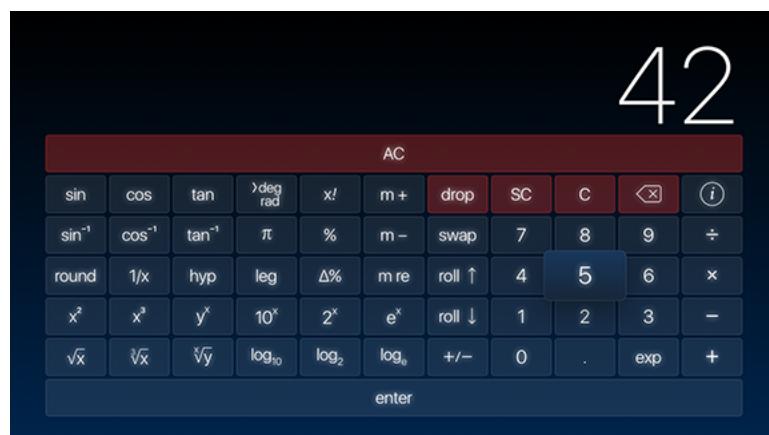


Figure 36. PCalc for tvOS in advanced layout.

Entry and operations are just as you'd expect, using a Siri Remote or the Remote app, tapping or clicking numbers and operators. With a game controller, a different circular UI appears for ease of entry.

Via settings, you can also:

- Enable RPN Mode.
- Select from a subset of PCalc themes.
- Choose one of PCalc's standard alternate notations via the Display Mode menu.
- Opt for advanced features, like multiple memories.
- Turn on the Speak Actions and Speak Results features.

Why 42?

The number 42 appears in PCalc as an homage to Douglas Adams, the author of the ultimately extremely inaccurately named five-book *Hitchhiker's Guide to the Galaxy* trilogy, the Dirk Gently mystery/sci-fi novels, several non-fiction books, and an all-around well-liked man who James got to know a little via email, met in person once, and who died all too young, right before their second meeting.

In 1993, one year after PCalc was created, Adams explained why “42” appeared as the ultimate answer to life, the universe, and everything in his books:

“The answer to this is very simple. It was a joke. It had to be a number, an ordinary, smallish number, and I chose that one. Binary representations, base 13, Tibetan monks are all complete nonsense. I sat on my desk, stared into the garden and thought 42 will do. I typed it out. End of story.”

Appendix 1: A list of every setting in PCalc on iOS, and what it does

Number of Decimal Places

The maximum number of digits that are displayed after the decimal point for a given number. If there are more digits than can be shown, the value will be rounded to that number of decimal places. This setting applies wherever a value is shown throughout PCalc, including on the tape.

Display Mode

How numbers are displayed throughout PCalc.

Normal

This is the default. If a number is deemed too big, or too small, it will switch automatically to using Scientific or Engineering mode for display. You can specify which in the Advanced section of the settings, along with the upper and lower bounds.

Scientific

Numbers are always displayed in scientific notation, with an exponent display that means “times ten to the power of”.

Engineering

Like Scientific, only the exponent is always a multiple of three.

Accounting

Used for displaying currency - it automatically uses two decimal places, with zeros shown automatically after the decimal point. Entering numbers also changes in this mode, with the decimal point added in automatically after two digits. A [oo] button also appears instead of the [exp] button.

Fraction

An fractional approximation to the current decimal value. Will display \approx in front of the fraction as it becomes more of a rough approximation.

RPN

RPN, or Reverse Polish Notation, is a different way of performing calculations that is popular with engineers. Instead of the operator being pressed between two numbers, like [1] [+] [2] [=], you would enter the numbers first, and then press the operator afterwards. So, [1] [enter] [2] [+].

PCalc's style of RPN is similar to older HP calculators. There is an option in the Advanced settings "HP48 style RPN" that makes it behave more like newer HP calculators. For more details about RPN, [look at this summary](#).

Lock Orientation

This option will lock and remember the current orientation of the calculator - so if you only ever want to use PCalc in a horizontal mode, and not have it rotate as you rotate your device, change to that orientation and then switch on this option. This is iPhone only currently, because iPad rotation works slightly differently.

Multiple Memories

With this option on, any operation that operates on a memory such as [M+] or [MC] will prompt you for which of ten memories (or all of them) to use. It does this by dimming all other buttons on the calculator apart from [0] to [9]. Press the appropriate button or just press [last] to use the same memory you used before. You can see a list of what is currently in each memory by using the [reg] button to see the registers. In RPN mode it's the [stack] button.

Thousands Separators

This displays a separator every three digits, to make long numbers easier to read. PCalc will typically use the separator specified for your device in Settings / General / Language & Region / Region, if it is a comma, full stop, or quote. You can also override which thousands separator is used in the Advanced section of the settings.

Show Ticker Tape

A running list of previous number entries and calculations is shown as part of the main display. This is similar to the paper tape view you can get by pressing the [tape] button, just in a more compact form. You can tap and drag on the ticker tape to scroll back to see earlier entries. There is an option to show it above the display instead of below in the Advanced settings.

Theme

Set the visual appearance of the calculator here from a collection of pre-defined themes.

Automatic Night Theme

This option lets you automatically switch PCalc to a darker theme at night, to save your eyes.

Use Location / Use Screen Brightness

The night theme switching can either be controlled by calculating whether it is night time outside based on your location on the planet and the time and date, or by looking at the

current brightness of your screen. Using the former will mean you have to authorise PCalc to access your device's location.

Brightness Threshold

If you are using the “Use Screen Brightness” option to switch to the night theme, set the brightness where you would like it to switch between themes here.

Day Theme

Specify which theme you would like to use during the day.

Night Theme

Specify which theme you would like to use at night. Probably a dark one!

Tint Color

Some themes, like “Samurai” and “Samurai” will use this to tint the whole look of the theme, to make it all blue or orange, for example. Pick your favourite color here!

App Icon

Choose from over two dozen alternative icons for the app here, in many different colors and styles.

Digits

Choose between a number of fonts for the main display.

Digit Color

Allows you to pick the color used to draw the digits in the main display.

Display

A collection of settings to control the main display.

Vertical Number of Lines

Horizontal Number of Lines

The number of lines of display shown on the main display, for the specified orientation of the device. If a line doesn't have anything to display, not all lines might be shown. See the “Smart Resize” option below.

Line 1, 2, 3, 4, etc

For each line, you can specify exactly what is shown. Examples might be some of the additional memories, or the result of the last unit conversion you performed. In RPN mode, you would typically show the other lines of the stack.

Smart Resize

This option will hide lines that don't have anything in them, and make the main register bigger instead. So you might have PCalc set to display four lines, but if three of them are empty, it will just display the one.

Vertical Swipe to Change

Swipe up to decrease the number of lines being displayed, swipe down to increase.

Display Color

Choose the background color of the display.

Vertical Layout

Horizontal Layout

Pick the layout you would like to use for the given orientation of the device. Different layouts have different buttons in them, some more geared towards certain types of tasks. You can also duplicate and edit any layout, to replace buttons you don't use, or just create a new one entirely from scratch.

Split Layout

This is the layout used when PCalc is in split-screen multitasking mode on an iPad.

Edit / Edit Buttons / Share

Edit will let you change the list of pre-defined button layouts, including duplicating and removing any custom layouts you have. Edit Buttons will switch PCalc into layout editing mode, which allows you to completely change any layout. The share button will let you export a custom layout as a file that you can send to somebody else. Normally, changes to your layouts will sync automatically via iCloud to all your devices, including PCalc on the Mac.

Key Click

Settings to control the click sound when you press any button.

Volume

Of course it goes up to 11!

Use Stereophonic Sound

Button clicks will happen in stereo, depending on where they are on the keyboard. A bit silly.

Allow Clicks Via Bluetooth LE

Many bluetooth hearing aids use the low power Bluetooth LE, and sometimes having clicks go through to the hearing aid can cause delays due to the nature of the connection. By default this is switched off.

Clicks

Select between a variety of click sounds here.

3D Touch

Settings for the 3D Touch functionality found on iPhone 6S and later iPhones.

Press Display

Choose what is shown when you press hard on the display area - you can either see the registers / RPN stack, or the tape.

List of shortcuts

When you press hard on the PCalc icon on your phone, a menu of shortcuts will appear. You can choose here which four shortcuts are shown in the menu by dragging them from the list of possible items up to the area at the top.

Layout Shortcuts are Temporary

When this option is on, and you select a shortcut for a button layout, it will only be used for this one opening of the application. Next time you open PCalc, it will go back to the layout you've chosen in the settings.

Accessibility

Settings for making PCalc easier to use for everybody.

Speech

Speak Actions

Speak the name of each button aloud as you press it. Also speak the name of any settings or conversions / functions / constants you select.

Speak Results

Speak the value of the display after you press enter or equals.

Speech Volume

The volume of the voice used for speaking anything in PCalc. This is separate to the voice used by VoiceOver.

Speech Rate

How fast the voice speaks.

Speech Pitch

How high or low the pitch of the voice is.

Voices

A list of every voice that is available. If you select a voice that is used by another language, some things like numbers will be spoken in that language rather than in English. Buttons names will all still be read in English however.

Use 3D Touch

This allows you to switch off any use of 3D Touch within the application, such as pressing on the display to show the registers or tape. It doesn't switch off the 3D Touch menu for the application icon.

Use Dynamic Type

Makes PCalc respect the system-wide Accessibility settings for how big you want text to be.

Large Key Text

Text will be displayed at roughly twice the normal size on buttons.

Bold Key Text

Text will be displayed in a bolder, easier to read, font on buttons.

Large Tape Text

Text will be displayed at roughly twice the normal size in the tape section and on the ticker tape.

Bold Tape Text

Text will be displayed in a bolder, easier to read, font in the tape section and on the ticker tape.

Use Animations

Lets you switch off all animations within PCalc. This may be helpful to those people with sensitivity to motion.

Use Motion Effects

Lets you switch off the animation that gives a mild 3D effect on the buttons when you rotate the device.

Show Key Popups

Shows the name of the key you are currently pressing.

Apple Watch

Settings for use with PCalc on the Apple Watch. This section will only appear if you have an Apple Watch paired to your phone.

Use Dictation

Shows a button on the watch that lets you dictate or (in some languages) draw numbers to enter them into the watch.

Use Haptic Feedback

The watch will vibrate every time you press a button, to let you know the press was successful.

Only Basic Conversions

Reduces the list of unit conversions on the watch to a small group of common units. Makes it easier so you don't have to scroll through lots of them.

Switch Back to Numbers

After pressing certain buttons like the operators, the watch app will switch back to the first number entry screen automatically.

Mirror Settings / Custom

With Mirror Settings switched on, the RPN, Thousands Separators, Number of Decimal Places, and Display Mode settings from the phone will automatically be reflected on the watch. If you switch it to Custom, you can specify these separately for the watch app.

Widget

Settings for use with the widget version of PCalc.

Use Dark Theme

The widget will be drawn with the “Samurai Night” theme instead of the standard “Samurai” one.

Use Key Clicks

Controls whether the widget buttons click. All other sound options are taken from the Key Click settings for the main app.

Sync App and Widget

With this option on, calculations in the main app will be reflected in the widget and vice versa - they both share the same state.

Mirror Settings / Custom

With Mirror Settings switched on, the RPN, Thousands Separators, Number of Decimal Places, and Display Mode settings from the phone will automatically be reflected in the widget. If you switch it to Custom, you can specify these separately.

Advanced Settings

A collection of stuff you probably don't need, but will be glad of if you do!

Clear on Open

Wipes the calculator every time it is opened.

Paste on Open

Automatically pastes whatever number is on the clipboard into the main register when you open PCalc. This will wipe whatever number you are currently entering.

Copy on Close

Automatically copies whatever is in the main register to the clipboard when you leave PCalc. This will wipe whatever is on the clipboard.

HP48 Style RPN

By default, PCalc's style of RPN is like older HP calculators, where if you wanted to multiply 6 and 7 you would press [6] [enter] [7] [\times]. On newer HP calculators you would have to put a second [enter] in, so [6] [enter] [7] [enter] [\times]. This is sometimes referred to as RPL. Switch this option on for the latter behaviour.

Four Register Stack

The RPN stack on PCalc is usually set to 128 levels, that is, you can enter 128 different items onto the stack at once. With this option on however, the maximum is set to four, labelled T, Z, Y, X. Also, if you have something in the T register, and drop the stack, the T value will be copied downwards. This behaviour is similar to some HP business calculators.

Show Memories with Stack

When you press the [stack] button to see the contents of the RPN stack, normally you'll also see the contents of the memories and other information like the ASCII/Unicode equivalent of the main register. To hide this additional information and just see the stack, switch this on.

Use Operator Precedence

When entering calculations, if you type something like [1] [+] [2] [\times] [3] [+] [4] [=], you will get the answer 11, because the 2×3 is calculated first, and added to the 1 and the 4. If you would expect the answer to be 13, because everything is just calculated from the left to the right in order, switch this option off.

Show Implied Parentheses

When you are looking at the tape or the ticker tape, any implied parentheses that are created by the operator precedence feature, will be shown as part of the calculation.

Constant Functions

With this option on, pressing [=] will cause the last operation to be repeated. [6] [×] [7] [=] [=] is 294, because the 6 was multiplied by 7, and then multiplied again by 7 with the second press of [=].

Display Percentage Result

Normally, when you type [1] [0] [+] [5] [0] [%] [=], at the moment you press the [%] key you will see the value of 50% of 10 before you press the [=] key to finish the calculation. With this option off, pressing the [%] key will automatically perform the whole calculation. The former behaviour is preferred by Myke Hurley.

Quick Fraction Entry

Pressing the decimal point key twice will switch to entering a fraction, so you don't need to use the [frac] key. [1] [.] [.] [2] would be interpreted as 0.5.

Use Improper Fractions

When in Fraction display mode, 1.25 would normally be displayed as $1\frac{1}{4}$. With improper fractions on, it would be shown as $\frac{5}{4}$.

Use E Notation

In Scientific display mode, 10000 would be displayed as 1^4 , meaning “1 times ten to the power of 4”. To display it as 1e4 instead of using smaller superscript numbers, switch this on.

Show Trailing Zeros

If you set the calculator to ten decimal places, and the number to be displayed is 1.5, it will be shown as 1.500000000. This will make all numbers the same length, which is useful if you are trying to visually line them up.

Show Edit Cursor

When you are entering a number, a blinking cursor is shown after the last digit to give you a visual indication of whether you are still entering a number, or have pressed an operator or equals button to stop entering.

Clear Tape on AC

When you press the [AC] button, the contents of the tape are automatically cleared as well.

Clear Memories on AC

When you press the [AC] button, the contents of all the memories are automatically cleared as well.

Rounding

This section allows you to choose what type of rounding is used when displaying numbers throughout PCalc. There are various options with examples given, but the default is “Nearest or Even” where numbers are rounded to the nearest value, or in the case where they are equidistant between two numbers, it will round to the even one.

Decimal Separator

Allows you to override the decimal separator that is used throughout PCalc. Normally this is taken from the region settings on your device.

Thousands Separator

Allows you to override the thousands separator that is used throughout PCalc. Normally this is taken from the region settings on your device.

Shake Behaviour

Pick what happens when you shake your device vigorously - do nothing, clear the display, or undo the last calculation. The default is to do an undo, but it’s a lot easier just to swipe right on the display.

Use Game Controller

PCalc supports use of a game controller. Yes, really! If you have a controller paired to your device, use the left stick to bring up the command wheel interface, and use the shoulder buttons and triggers to switch between different wheels. Press A to select a command.

Tap & Hold to Edit Layout

This is a shortcut to switch on the edit mode for layouts - if you find that you are accidentally triggering it, you can turn off this shortcut. You can still start editing from the Layout sections of the settings.

Show Layout Edit Warning

When you try to edit a layout by the tap and hold shortcut, PCalc will display an alert asking if you really want to switch to edit mode. This is to avoid accidental edits. You can turn off the warning here.

Ticker Tape at Top

Determines whether the ticker tape is shown above the main display, or below it.

Use Phone Layouts

On an iPad, use the iPhone layouts instead of the dedicated iPad ones. This is useful if you have a custom layout on your phone and you want to use that everywhere.

Momentary 2nd

When you press the 2nd button, it will stay switched to the 2nd key functions only until you press another button. Normally it will stay switched until you press the 2nd button again.

Show 2nd Labels

Displays small labels for the 2nd functions at the top of each key. These are the functions that will be made visible when you press the 2nd button.

Hide Status Bar

Hides the status bar at the top of the screen which shows signal strength, current time, etc, and makes the calculator slightly taller and take up the entire screen.

Copy on Double Tap

Double-tap the display area to quickly copy the current value to the clipboard.

Sidebar on Right

On the iPad, and the larger iPhones, the tape and registers can be shown in a sidebar that's always visible. This option controls whether it is shown at the left or the right hand side of the screen.

Update Currency Rates

Currency rates are automatically downloaded from the European Central Bank once per day. Pull down in any of the currency conversion sections to manually download the rates.

Sync User Data to iCloud

Changes to user functions, conversions, and constants will be automatically synced with other devices via iCloud.

Sync Layouts to iCloud

Changes to user button layouts will be automatically synced with other devices via iCloud.

Use Handoff

PCalc will advertise the current state of your calculation via Handoff, so you can easily transfer the calculation between devices.

Vibrate on Error

When an error occurs, such as trying to divide a number by zero, as well as flashing "Error" on the screen, the device will vibrate if it can. iPhones usually have the ability to vibrate, iPads do not.

Use Haptic Feedback

For some user interface actions, such as opening and closing the settings, or adjusting a slider, faint vibrations will be generated to make it feel more realistic.

Disable Auto-Lock

When PCalc is running and visible, the screen will not fade out and go black. This means you can keep using PCalc as you think about a calculation, but it will use more battery power, and you'll need to remember to manually lock your phone when you are finished.

Gravity Mode

Not terribly useful, but it keeps the labels on buttons level with the floor, regardless of what angle you are holding the calculator.

Recent Conversions

The number of recent items that are shown at the top of the Conversions section.

Recent Constants

The number of recent items that are shown at the top of the Constants section.

Recent Functions

The number of recent items that are shown at the top of the Functions section.

Automatic Display Mode

When the display mode is set to Normal, and the number is smaller than the lower bound, or greater than the upper bound, which display mode is automatically switched to, to display the number.

Tip Jar

We've never charged for an update to PCalc, so we added a tip jar if you'd like to throw some spare coins in there to help with development. It's most appreciated! In return we'll unlock some extra app icons.

Reset to Defaults

Puts all settings back to their default factory values. Does not remove any user functions, conversions, or constants, or any layout changes.

Import Settings

If you have saved your settings, or have any user functions, conversions, constants, or layouts exported to a file, you can use this to import them again from a variety of sources like iCloud or Dropbox.

Export All Settings and User Data

Saves absolutely everything about your copy of PCalc to a file, including the current state, all settings, and any user functions, conversion, constants, or layouts. This is useful if you have got everything exactly the way you like it, and want to replicate those settings on another device, or send your setup to somebody else.

Appendix 2: A list of what every button in PCalc does

0

Enter digit 0. Pretty obvious, I know. It gets more interesting further down.

1

Enter digit 1.

2

Enter digit 2.

3

Enter digit 3.

4

Enter digit 4.

5

Enter digit 5.

6

Enter digit 6.

7

Enter digit 7.

8

Enter digit 8.

9

Enter digit 9.

A

Enter hexadecimal digit A. Only available in “Hex” mode.

B

Enter hexadecimal digit B. Only available in “Hex” mode.

C

Enter hexadecimal digit C. Only available in “Hex” mode.

D

Enter hexadecimal digit D. Only available in “Hex” mode.

E

Enter hexadecimal digit E. Only available in “Hex” mode.

F

Enter hexadecimal digit F. Only available in “Hex” mode.

00

Enter two 0 digits. Only available in “Accounting” display mode.

000

Enter three 0 digits.

0000

Enter binary 0000 digits. Equivalent to a hex “0”. Only available in “Bin” mode

0001

Enter binary 0001 digits. Equivalent to a hex “1”. Only available in “Bin” mode.

0010

Enter binary 0010 digits. Equivalent to a hex “2”. Only available in “Bin” mode.

0011

Enter binary 0011 digits. Equivalent to a hex “3”. Only available in “Bin” mode.

0100

Enter binary 0100 digits. Equivalent to a hex “4”. Only available in “Bin” mode.

0101

Enter binary 0101 digits. Equivalent to a hex “5”. Only available in “Bin” mode.

0110

Enter binary 0110 digits. Equivalent to a hex “6”. Only available in “Bin” mode.

0111

Enter binary 0111 digits. Equivalent to a hex “7”. Only available in “Bin” mode.

1000

Enter binary 1000 digits. Equivalent to a hex “8”. Only available in “Bin” mode.

1001

Enter binary 1001 digits. Equivalent to a hex “9”. Only available in “Bin” mode.

1010

Enter binary 1010 digits. Equivalent to a hex “A”. Only available in “Bin” mode.

1011

Enter binary 1011 digits. Equivalent to a hex “B”. Only available in “Bin” mode.

1100

Enter binary 1100 digits. Equivalent to a hex “C”. Only available in “Bin” mode.

1101

Enter binary 1101 digits. Equivalent to a hex “D”. Only available in “Bin” mode.

1110

Enter binary 1110 digits. Equivalent to a hex “E”. Only available in “Bin” mode.

1111

Enter binary 1111 digits. Equivalent to a hex “F”. Only available in “Bin” mode.

7777

Enter four 7 digits. Only available in “Oct” mode.

FFFF

Enter four F digits. Only available in “Hex” mode.

.

Start entering a decimal. Press it twice to enter a fraction.

exp

Start entering an exponent.

frac

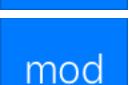
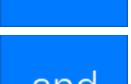
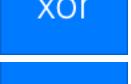
Start entering a fraction. The equivalent of pressing the decimal point button twice.

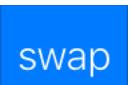
+

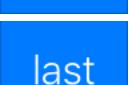
Plus operator.

-

Minus operator.

	Multiply operator.
	Divide operator.
	Modulo operator.
	Integer divide operator.
	An operator that performs a bitwise “and” between two numbers.
	An operator that performs a bitwise “or” between two numbers.
	An operator that performs a bitwise “exclusive or” between two numbers.
	Performs a bitwise “not” of the current number.

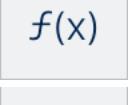
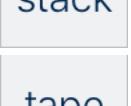
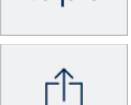
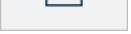
	Swap the current value with the next item on the RPN stack.
	Roll all the items on the RPN stack down by one, and move the item at the very bottom to the top.
	Roll all the items on the RPN stack up by one, and move the item at the very top to the bottom.

	Completes the current calculation. If the “Constant Functions” option is switched on in the Advanced section of the settings, it will repeat the last action when pressed again.
	Add the current number to the RPN stack and move everything on the stack up by one.
	Sets the current number to be the result of the previous calculation.

	Deletes the last digit that was entered.
	Just clears the current number being entered. If you don't see an AC button, pressing C will change the button to be an AC button, so just press twice to clear all.
	Clear all - clears everything including the current number being entered and the whole calculation. Will also clear the tape and memories unless you specify not to in the Advanced section of the settings.
	Memory clear. If you have the "Use Multiple Memories" option on, you'll be prompted which memory to clear. "All" will clear every one.
	Calculation clear - clears the current calculation, but not the tape or memories.
	Stack clear. Clears the RPN stack only.
	Tape clear. Clears the tape only.
	Drop the current number from the RPN stack and move everything on the stack down by one.
	Adds the currently displayed value to a memory. If you have the "Use Multiple Memories" option on, you'll be prompted which memory to use.
	Subtract the current value from a memory. If you have the "Use Multiple Memories" option on, you'll be prompted which memory to use.
	Memory in. Sets a memory to the current value. If you have the "Use Multiple Memories" option on, you'll be prompted which memory to use.
	Memory recall. Sets the current value to a value from a memory. If you have the "Use Multiple Memories" option on, you'll be prompted which memory to use.
	Swaps the current value with a memory. If you have the "Use Multiple Memories" option on, you'll be prompted which memory to use.
	Swaps the current value with the Y register. In RPN mode, this is the equivalent to a "Swap" operation.

$+\/-$	Changes the sign of the current number.
$\%$	Percentage function. Use this to do things like [1] [o] [+] [5] [o] [%] [=] to add 50% to 10 get the result 15.
$\Delta\%$	Delta percentage - calculates the percentage difference between two numbers.
$1/x$	Calculates the inverse - one divided by the current number.
x^2	Square.
x^3	Raise the current value to the power of three.
x^n	Power. Raise the current value to the power of a number.
y^x	RPN equivalent of the power function.
\sqrt{x}	Square root.
$\sqrt[3]{x}$	Cube root.
$\sqrt[n]{x}$	Inverse power. Calculates the nth root of the current value. [1] [o] [o] [o] [$\sqrt[n]{x}$] [=] would calculate the cube root of 1000, i.e. 10.
$\sqrt[x]{y}$	RPN equivalent of the inverse power function.
$x!$	Factorial. Calculates the product of all numbers less than or equal to the input. [5] [$x!$] [=] is $5 \times 4 \times 3 \times 2 \times 1 = 120$.
$\Gamma(x)$	Gamma.
round	Round the current number to the nearest integer value.

trunc	Truncate the current value to an integer by throwing away everything after the decimal point.
π	Enter the value of pi.
sin	Perform a sine function on the current value. It will be treated as degrees or radians depending on the current “deg / rad” setting.
cos	Perform a cosine function on the current value. It will be treated as degrees or radians depending on the current “deg / rad” setting.
tan	Perform a tangent function on the current value. It will be treated as degrees or radians depending on the current “deg / rad” setting.
\sin^{-1}	Performs an inverse sine function. Output will be in degrees or radians depending on the current “deg / rad” setting.
\cos^{-1}	Performs an inverse cosine function. Output will be in degrees or radians depending on the current “deg / rad” setting.
\tan^{-1}	Performs an inverse tangent function. Output will be in degrees or radians depending on the current “deg / rad” setting.
sinh	Perform a hyperbolic sine function on the current value. It will be treated as degrees or radians depending on the current “deg / rad” setting.
cosh	Perform a hyperbolic cosine function on the current value. It will be treated as degrees or radians depending on the current “deg / rad” setting.
tanh	Perform a hyperbolic tangent function on the current value. It will be treated as degrees or radians depending on the current “deg / rad” setting.
\sinh^{-1}	Performs an inverse hyperbolic sine function. Output will be in degrees or radians depending on the current “deg / rad” setting.
\cosh^{-1}	Performs an inverse hyperbolic cosine function. Output will be in degrees or radians depending on the current “deg / rad” setting.
\tanh^{-1}	Performs an inverse hyperbolic tangent function. Output will be in degrees or radians depending on the current “deg / rad” setting.
\log_{10}	Log base 10.

	Log base 2.
	Natural log, or log base e.
	Raise 10 to the power of the current value. The opposite of [log10].
	Raise 2 to the power of the current value. The opposite of [log2].
	Raise e to the power of the current value. The opposite of [loge].
	Hypotenuse. Calculates the longest side of a right-angled triangle. [3] [hyp] [4] [=] would give the answer 5.
	Leg. Calculates the length of one leg of a right-angled triangle, given the other leg and the hypotenuse.
	Shows the settings section. Possibly the most important button on the calculator!
	Shows the function section.
	Shows the unit conversion section.
	Show the list of scientific constants.
	Shows the list of all registers and memories.
	Shows the RPN stack.
	Shows the virtual paper tape, that has a record of previous calculations.
	Share the current contents of the tape.

2nd	Shows the second functions for the current layout. When you press this, some keys might change function - sometimes to a related or opposite function.
RPN	Toggle RPN mode. RPN, or Reverse Polish Notation, is a different way of performing calculations that is popular with engineers. Instead of the operator being pressed between two numbers, like [1] [+] [2] [=], you would enter the numbers first, and then press the operator afterwards. So, [1] [enter] [2] [+].
	PCalc's style of RPN is similar to older HP calculators. There is an option in the Advanced settings "HP48 style RPN" that makes it behave more like newer HP calculators. For more details about RPN, look at this summary: https://en.wikipedia.org/wiki/Reverse_Polish_notation
deg	Use degrees. This is used with any trigonometric functions. Some layouts have a combined deg/rad button.
rad	Use radians. This is used with any trigonometric functions. Some layouts have a combined deg/rad button.
(Opens a new parentheses in the current calculation. Use this when trying to group parts of your calculation to make sure they are done first.
)	Close any open parentheses in the current calculation. Use this when trying to group parts of your calculation to make sure they are done first.
copy	Copy the current value to the clipboard.
paste	Pastes the current value on the clipboard into the calculator.
pcalc	Shows the about screen when double-tapped.
dec	Switch to Decimal mode.
hex	Switch to Hexadecimal mode.
oct	Switch to Octal mode.
bin	Switch to Binary mode.

<< n

Bitwise shift everything to the left by n bits, any bits shifted past the end are removed.

<< 1

Bitwise shift everything to the left by one bit, any bits shifted past the end are removed.

<< 3

Bitwise shift everything to the left by three bits, any bits shifted past the end are removed.

<< 4

Bitwise shift everything to the left by four bits, any bits shifted past the end are removed.

<< 8

Bitwise shift everything to the left by eight bits, any bits shifted past the end are removed.

rol n

Do a bitwise rotate left by n bits on the current number.

rol

Do a bitwise rotate left by one bit on the current number.

>> n

Bitwise shift everything to the right by n bits, any bits shifted past the end are removed.

>> 1

Bitwise shift everything to the right by one bit, any bits shifted past the end are removed.

>> 3

Bitwise shift everything to the right by three bits, any bits shifted past the end are removed.

>> 4

Bitwise shift everything to the right by four bits, any bits shifted past the end are removed.

>> 8

Bitwise shift everything to the right by eight bits, any bits shifted past the end are removed.

ror n

Do a bitwise rotate left by n bits on the current number.

ror

Do a bitwise rotate right by one bit on the current number.

end

flip

inc

dec

Endian. Does an endian swap of the current number.

Does a bitwise flip of every bit in the current number.

Increment the current number by one.

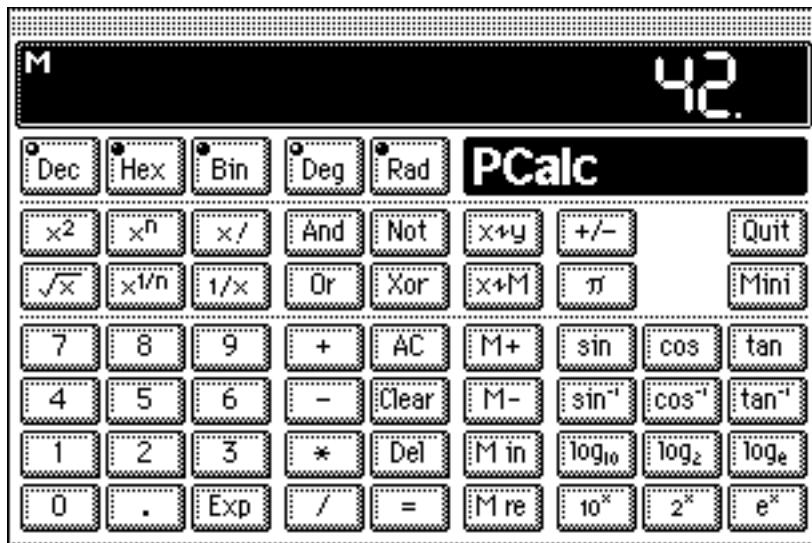
Decrement the current number by one.

Appendix 3: Forty Two Minus Twenty Five - a PCalc origin story

By James Thomson, creator of PCalc

Many people using [PCalc](#) on their shiny devices today don't realise that the app has been around for a lot longer than they think. In some cases, a lot longer than they've been *thinking*.

PCalc is twenty-five years old on the 23rd of December 2017, so I thought I should take the opportunity to look back at how it has evolved over the last two and a half decades.



The app you've known for all these years...

PCalc actually started out in 1992 as a design for a central heating control panel.

I was a student at Glasgow University's [Computing Science](#) department, taking a class in [Human Computer Interaction](#) on how to build good user interfaces. One of the class projects was to design a simulated control panel for a central heating system - setting temperatures, letting you switch heat and water on and off separately, and so on. It was to be implemented as a [Hypercard](#) stack. Sadly, it doesn't survive to contradict me, but my design was likely impeccable.

I figured it had to look authentic, and handcrafted a set of custom 1-bit black and white fake LCD digits and little buttons that you could push in. [Skeuomorphism](#) has been around a *lot* longer than Corinthian leather.

At around the same time, we'd started coding using [THINK Pascal](#), and I had begun to explore the Macintosh programming APIs in my own time.

I had come to the conclusion that I was *not* going to be the next [Jean Michel Jarre](#), but I really liked the way the Mac user interface worked in comparison to my old Atari. So I sold all my [synthesizers](#) and my [ST](#), and bought one of the latest Mac Classics - 4 meg of RAM, a 40 meg hard disk, and a 512x342 1-bit display.

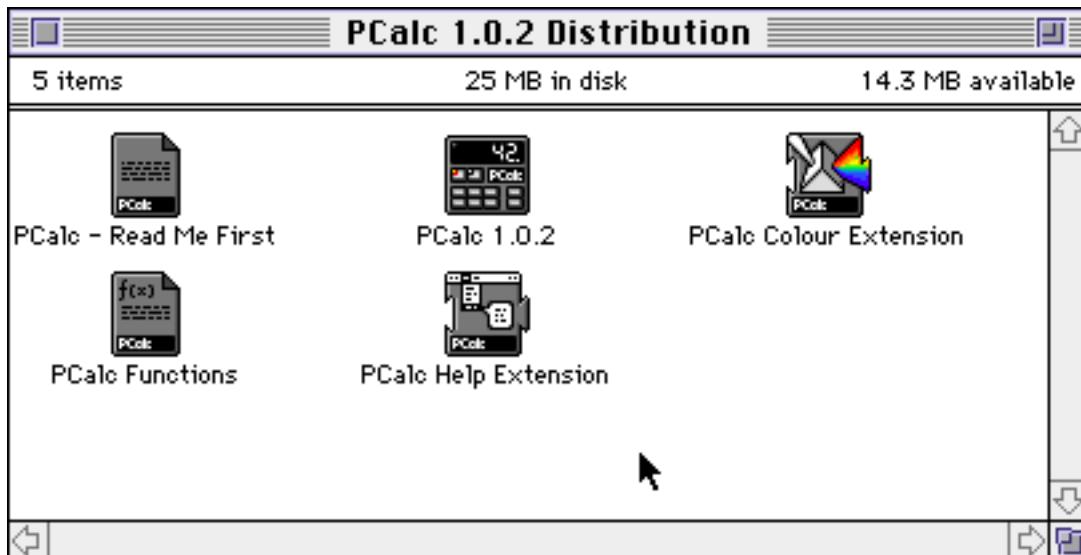
I was looking for a small project to learn how to program my new Mac properly, and I remembered the graphics I'd done for the control panel, and thought that they would work well for a calculator as well. Take note of "a small project just to do X", this will be referred to many times during this story.

The built-in Mac OS calculator of the day was a very simple affair, and so I decided I would write a calculator that could do binary and hex, to help me with my programming. And so the idea for PCalc was born. I bought the books [Inside Macintosh](#), Volumes I, II, and III, and sat down to figure it all out. We didn't have the Internet back then - well, no web at least - so that was basically all I had to go on. Eventually, I started to get the internal logic working, and built a user interface around it all. System 7 was new, so I eventually got a copy of the massive Volume VI to see what had changed there. I didn't think I needed any of the stuff in the middle.

The application needed a name (we didn't have "apps" back then) and I decided on PCalc, officially short for Programmers' Calculator. In truth it was really a Programmer's Calculator. That programmer being me. I simply wrote what I wanted to use myself. I started sharing it with a few friends on the course, and slowly improved it over the next six months until the point where it was actually useful and did a lot more than just help with programming. I added a colour interface to it as well, even though I didn't actually have a Mac that could display colours.

See [here](#) for more screenshots of the original release. The original "Read Me" file is [here](#).

On December 23rd 1992, I decided I would release it freely to the world as a present.



Again, this was back in 1992 - FTP sites were the new hotness. Our class had discovered this application called [Fetch](#) which quickly got passed around. You ran this one application, and it could get you *more applications*. I quickly realised there was this thing called the [Info-Mac Archive](#) which was mirrored all around the world, and I could send my app to them, and it would then be mirrored everywhere automatically for people to download. So, I read all the submission guidelines carefully and packaged it up.

Here's the email:

Date: Wed, 23 Dec 92 17:41:10 GMT
From: thomsonj <thomsonj@dcs.gla.ac.uk>
Subject: [*] PCalc 1.0 Submission

Enclosed is a binhex file containing a submission for your archives.
PCalc is a neat simulation of a programmable scientific calculator.
Please note that it ***requires*** System 7.x.x.

If you use System 6.0.x or earlier, here is what you are missing:
Programmable functions via a simple mini language.

System 7.x.x savvy:

Can be controlled & programmed via Apple Events.
Balloon Help for every button, menu & dialog item.
Resolves Aliases.
32-bit clean.
Multifinder aware.

Large 16+3 digit display.

Hierarchical menu of user functions.

Includes many functions for converting between different weights and measures.
Quick, one click, conversion between decimal, hexadecimal and binary numbers.
AND, OR, NOT, XOR, ROL, ROR and other extra functions in hex and binary mode.
30 named user constants, 10 for each mode.

'Undo' of any action.

Enhanced graphics when viewed on a 256 colour or 16 gray (or better) screen.

Colour graphics and help screens are stored in separate plug-in extensions.

Runs on any Mac with System 7.x.x or greater, with or without Color Quickdraw.

And of course it's freeware. If you only download one calculator this year, give this a try...

[Archived as /info-mac/app/pcalc-10.hqx; 122K]

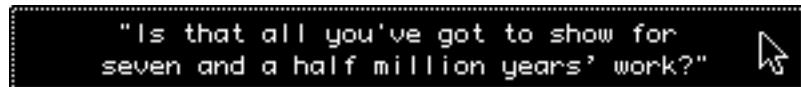
I got a lot of good feedback, and continued to improve it over the next year. Version 1.0.2 from March 1993 had the following note:

Version 1.0.2 fixes some bugs that caused problems on colour macs, notably those with 16 and 24-bit displays. Vast speed increases too on some 8-bit screens. Shouldn't turn bright orange at inconvenient moments either. Some other silent bug-fixes and support for the ',' key as a decimal separator.

(More importantly, there are a ton of new easter eggs ;-)

Yeah, I really should have bought those missing Inside Mac volumes about how to do colour.

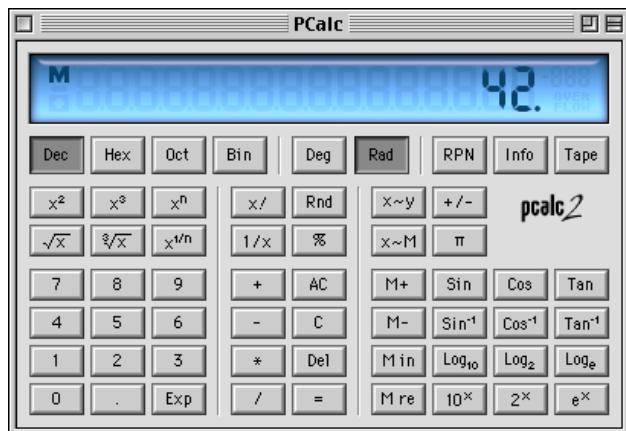
As for one of the easter eggs in question, if you put 42 into three specific memory registers, then clicked the screen, a sound recording of [Douglas Adams](#) said “Don't Panic!” and it displayed the following quote from my favourite series, [The Hitch Hiker's Guide To The Galaxy](#):



As an aside, sometime later Douglas became a beta tester for my other app, [DragThing](#). I never asked him what he thought of all the Hitch Hiker's references in PCalc, if he ever saw them. The icon has always had a 42 on it, I try to put 42 on the screen whenever I take a screenshot, and there's always been an Ultimate Answer scientific constant in there. I had the pleasure of shaking his enormous hand at [WWDC](#) once, and he greeted me with genuine recognition and a smile. I had been due to meet up with him again at a later WWDC, but he died suddenly just beforehand, just a few weeks after we'd exchanged emails, and it hit me quite hard. That's why the PCalc icon still has a 42 on it - it's meant as a tribute to him. I didn't know him very well, but he was always enthusiastic about my work, and as a huge fan of his writing, that meant a lot.

Anyway, I let PCalc make its way around the world, while I actually did some work for my degree. I got distracted a bit after that, first by writing DragThing, and then by going off and getting a job with Apple where I worked on the OS X Finder and Dock. Yes, yes, I know. But that's [another story](#).

When I was back in Glasgow in 2000, I was looking for another small project to learn the new [Metrowerks CodeWarrior](#) development environment and accompanying [PowerPlant](#) application framework. I still got emails about PCalc, even though it had been seven years since the last update, and it was the perfect size to quickly build something usable. So, PCalc 2 was born. The Pascal core mathematics code was hand-translated into C, and a new user interface was written around it in C++.



PCalc 2 would still run on old [68K](#) machines, but it would now not only run natively on [PowerPC](#) machines, but it would run on both the Classic Mac OS, as well as on the new OS X, with an appropriate user interface on both.

I'd also decided, based on the popularity of DragThing, that I should probably charge a little bit for it. One reason I'd been happy to let it sit for seven years between releases is that the first version had been completely free. Having paying customers would be a good incentive to keep it updated.

At WWDC in 2001, I pressed my business card into the hand of a young fresh-faced [Phil Schiller](#), and told him about PCalc. Afterwards, I remember his assistant emailed me asking for a serial number for Phil, which I gladly passed on. Later, I learned that [Steve Jobs](#) had used PCalc and allegedly had *not completely hated it*. [Steve Wozniak](#) bought a number of copies that year too.

By January of 2002, Apple still didn't have a decent calculator on OS X (some *might* argue that is still the case), and with the new "angle-poise" iMac G4s about to come out, Apple approached me and licensed PCalc to include it on some iMacs shipped in the US. A very small license fee was agreed per copy, but any number multiplied by around a million is still pretty good!



Sadly, it didn't last - Mac OS 10.2 was released, and with it came a new Apple-written scientific calculator. The rumour was that someone high up in Apple had worked out exactly who they were paying royalties to - an ex-Apple employee they had not always seen eye-to-eye with. But, I couldn't verify that. In any case, PCalc was no longer bundled, and things went a bit quiet again for a while.

In 2005, I rewrote PCalc once again. This time, it was to learn the new Carbon HIToolbox APIs - this was a different way of writing an application, somewhat similar to PowerPlant, but provided by Apple.



PCalc 3 sported the much loved brushed metal appearance that was all the rage back then. There was also a new companion [Dashboard Widget](#) which had the same core code, but a user interface written in HTML and javascript. Widgets were the *future*.

I didn't charge for the update though - I felt bad that I'd not done a release in ages.

In 2006, it was the perfect sized app to port to Intel and learn about that - I got one of the prototype Intel based Macs, and had a universal binary for Intel and PowerPC ready to release by the middle of January. Many updates to the Mac version have followed in the years since.

But 2007 brought us the iPhone, and then 2008 bought us the App Store, and guess what was the ideal app to port to this new platform?

I took the code I'd written for the Dashboard Widget version of PCalc, and got that running within a day or two on the iPhone. From there, I wrote a completely new interface around it, this time in Cocoa. PCalc was the perfect app to have on a touchscreen portable device - it had turned from an imitation of a calculator on a screen where you pressed the buttons with a mouse, into an actual calculator in your hand. It felt like it wasn't pretending any more.



PCalc was in the App Store on day one with around 400 other apps and it did really well. Eventually, a lot of our income was coming from PCalc rather than DragThing, and from iOS rather than Mac OS, and so a lot of the effort went into the iOS version first and then was ported back to the Mac afterwards. I even ported the theme engine from DragThing on the Mac to PCalc on the iPhone. That seemed like an insane thing at the time, that you could take a fairly sophisticated drawing engine running on a Mac Pro and put it on a thing that fits in your hand. And then came iPads, Retina displays, more iPads, taller iPhones, and... well, you know the rest. And now we have PCalc in the Mac App Store with Retina display support too, and lots of features from the iOS version.

Let's draw a veil over [5318008-gate](#) for the sake of my dignity, as well as the *other* news story connected to PCalc Lite.

I think it's a pretty safe assumption that I'm going to rewrite PCalc again and again, as long as I code. And I hope you've enjoyed using it over the decades as much as I have too!

You can find PCalc for iOS on the App Store [here](#), and PCalc for Mac [here](#).

Some of the screenshots in this article were produced using [Basilisk II](#), a Mac emulator, running Mac OS 7.5.3 and 8.0.

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