



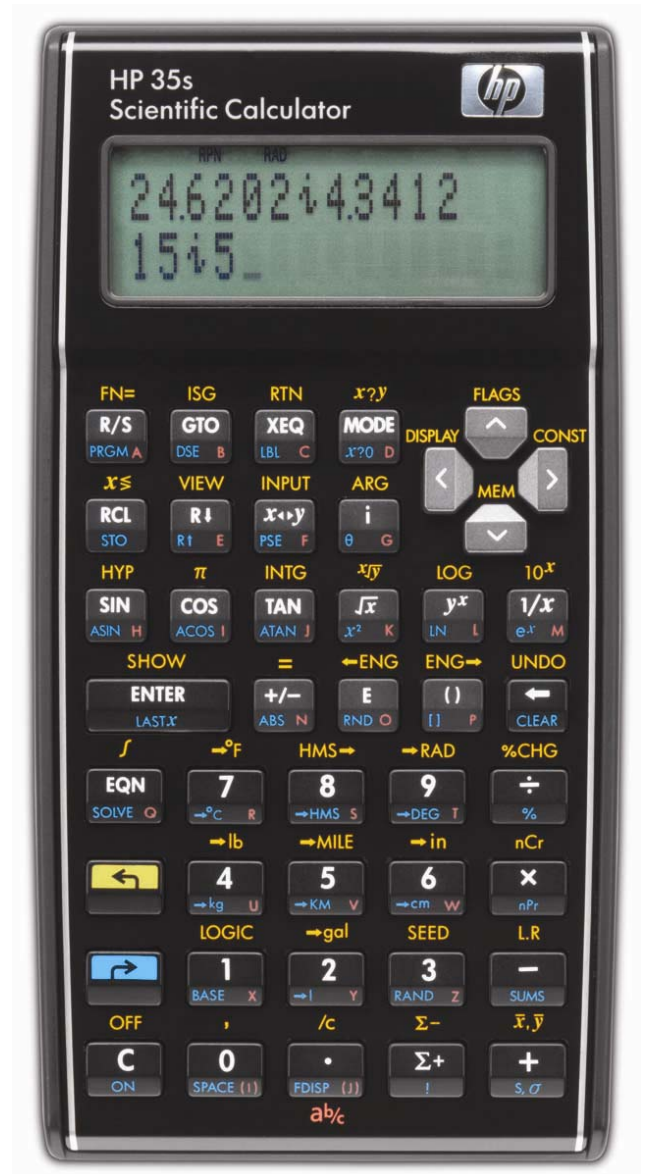
hp calculators

HP 35s Working with Fractions

Simple Examples Using Fractions

Fractions in Programs and Equations

Exact Control of Fraction Display



### Simple Examples Using Fractions

The HP 35s allows the user to enter numbers as fractions of the form “a b/c”, to view results as fractions, and to control the way fractions are displayed. The symbol “a b/c” is written below the decimal point on the keyboard as a reminder that this key is used for most operations with fractions. Four simple examples will show the basics.

Example 1: Add  $1 \frac{3}{4}$  to  $2 \frac{5}{8}$

Solution: The decimal point is used for fraction entry as follows.

In RPN mode, type the number 1 and press the decimal point key to separate the fractional part from the integer part. Then type 3, and the calculator will display 1.3. Press the decimal point key again and the calculator will recognize that a fraction is being entered. Press the number 4 and the calculator will display the fraction, as in Figure 1.



Figure 1

Now press then press the **ENTER** key, then type the number  $2 \frac{5}{8}$  in the same way. Finally add the two. The keystrokes for the whole calculation are as below.

**1** **.** **3** **.** **4** **ENTER** **2** **.** **5** **.** **8** **+**



Figure 2

In algebraic mode, enter the numbers in the same way, but press the plus key between the two numbers.

**1** **.** **3** **.** **4** **+** **2** **.** **5** **.** **8** **ENTER**

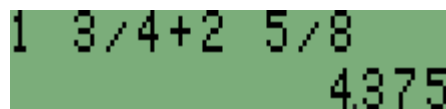


Figure 3

Answer: The result is  $4 \frac{3}{8}$  and is displayed as a decimal number; the HP 35s recognizes numbers that are entered as fractions, but displays numbers as decimals unless told to display them as fractions.

Example 2: Display the result of the above calculation as a fraction.

Solution: Both in RPN mode and in algebraic mode, press **FDISP** for fractional display of numbers.

**FDISP**

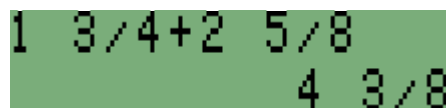


Figure 4

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**Answer:** The result,  $4 \frac{3}{8}$  is now displayed as a fraction; the display of Figure 3 will change to that in Figure 4. **FDISP** is on the front of the decimal point key, which is also used for entering fractions.

**Example 3:** Display the result using only halves, thirds or quarters.

**Solution:** The **1/c** key allows the user to select the largest value allowable for the “/c” part of a fraction “a b/c”. If the number 4 is stored in **1/c** then only fractions with 2, 3 or 4 on the lower part (the denominator) will be displayed.

In RPN mode, type 4 and then press **1/c** **1/c** to see the previous result displayed as a fraction using only halves, thirds, or quarters.

**4** **1/c** **1/c**

The image shows a close-up of a calculator's LCD display. The display is green and shows the number '4' on the top line and '4 1/3' on the bottom line. The fraction '1/3' is positioned to the right of the '4' on the bottom line.

Figure 5

The number  $4 \frac{3}{8}$  is displayed, rounded to  $4 \frac{1}{3}$ .

**Answer:** If the fraction  $\frac{3}{8}$  must be approximated as the nearest fraction with 2, 3 or 4 in the denominator, then the closest value is  $\frac{1}{3}$ . A small up-arrow symbol is shown at the right of the display, informing the user that the real answer is slightly larger than the answer displayed. The number  $4 \frac{1}{3}$  is  $4.3333333333$  to the accuracy of the HP 35s, but the true number is  $4 \frac{3}{8}$ , or  $4.375$  exactly. To show the exact value, **1/c** **SHOW** must be pressed. Like **FDISP**, **1/c** is above the decimal point key, which is also used for entering fractions.

**Example 4:** Round the actual result to be the result displayed.

**Solution:** As the example above showed, the value is not altered when the fraction display is changed. **FDISP** is a display mode, much like **FIX** or **ENG**, which also change the way a number is displayed, but not its true value. To change the true value to be as close as possible to that displayed, the **RND** (number round) command must be used.

Type **1/c** **RND** to round the result to the decimal representation of the fraction being displayed. Do not confuse **RND** with the **RAND** (random number) command.

**1/c** **RND**

The image shows a close-up of a calculator's LCD display. The display is green and shows the number '4' on the top line and '4 1/3' on the bottom line. The fraction '1/3' is positioned to the right of the '4' on the bottom line.

Figure 6

**Answer:** Pressing **1/c** **SHOW** shows that the decimal value has been rounded to  $4.3333333333$ , which is the closest possible value to  $4 \frac{1}{3}$ .

The small arrow now points down, to show that the exact decimal value is smaller than the fraction displayed. This is because  $4.3333333333$  is just smaller than  $4 \frac{1}{3}$ .

To restore  $\boxed{\frac{1}{c}}$  to its largest possible value, press  $\boxed{0} \boxed{\leftarrow} \boxed{\frac{1}{c}}$ . The largest possible value is 4095.

To stop showing numbers as fractions, press  $\boxed{\rightarrow} \boxed{\text{FDISP}}$  a second time.

### Fractions in Programs and Equations

When an equation is typed in, numbers cannot be typed as fractions. Instead, they should be typed using the division symbol. For example,  $1 \frac{1}{3}$  can be typed as  $(1 + 1 \div 3)$ . Better still is to type it as  $4 \div 3$ .

Example 6: Enter the equation  $D + 1 \frac{1}{3}$

Solution: As explained,  $1 \frac{1}{3}$  is best typed into an equation as  $4/3$ .

$\boxed{\text{EQN}} \boxed{\text{RCL}} \boxed{\text{D}} \boxed{+} \boxed{4} \boxed{\div} \boxed{3} \boxed{\text{ENTER}}$

The calculator display shows two lines of text. The first line is '3\*3 lin. solve' and the second line is 'D+4÷3\_'. The text is displayed in a green monospace font on a dark background.

Figure 7

Answer: The expression  $D + 1 \frac{1}{3}$  is entered as the equation  $D + 4 \div 3$ .

**Note:** the command  $\boxed{\text{FDISP}}$  cannot be stored in a program. Instead of this, flag 7 should be set to display fractions, and cleared to return to normal display of numbers. See below for information about flags.

### Exact Control of Fraction Display

Example 4 showed that  $\boxed{\frac{1}{c}}$  can be used to control how fractions are displayed, through control of the denominator.

Normally, in  $\boxed{\text{FDISP}}$  mode, fractions are displayed to be as close as possible to the true value. The only limitation is that the denominator "c" can be no larger than 4095.

If a number smaller than 4095 is stored in  $\boxed{\frac{1}{c}}$  then the largest possible value of "c" is that number, but any possible value of "c" can be used.

If flag 8 is set, then the numerator must be exactly "c", but the fraction can be simplified. If flag 8 is set and flag 9 is set too, then the numerator must be exactly "c", and there is no simplification.

Example 7: Display the fraction  $179/3000$  using the different flag settings combined with  $\boxed{\frac{1}{c}}$ .

Solution: This example will be shown in RPN mode. The same steps work in algebraic mode, but that  $\boxed{\rightarrow} \boxed{\text{LASTx}}$  is needed after each step when a flag is changed, as in example 3 above. First enter the fraction, and make sure  $\boxed{\frac{1}{c}}$  is set to 4095, which is its usual value.

$\boxed{0} \boxed{\cdot} \boxed{1} \boxed{7} \boxed{9} \boxed{\cdot} \boxed{3} \boxed{0} \boxed{0} \boxed{0} \boxed{\text{ENTER}} \boxed{0} \boxed{\leftarrow} \boxed{\frac{1}{c}}$

The calculator display shows two lines of text. The first line is '0' and the second line is '0 179/3000'. The text is displayed in a green monospace font on a dark background.

Figure 8



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With flags 8 and 9 set, fractions will always be displayed as multiples of the denominator in  $\frac{\square}{\square}$ . This can be very useful in some cases. For example, if a design is being drawn with a ruler marked in  $\frac{1}{16}$  of an inch, it is helpful to put 16 in  $\frac{\square}{\square}$ , then set flags 8 and 9, and see the results of all calculations as multiples of one-sixteenth.

Finally, to return to the normal display, store 0 in  $\frac{\square}{\square}$ , and clear flags 8 and 9. Clear flag 7 as well, to see that clearing flag 7 does the same as pressing **FDISP** to cancel fraction display mode.

**0** **↵**  $\frac{\square}{\square}$  **↵** **FLAGS** **2** **7** **↵** **FLAGS** **2** **8** **↵** **FLAGS** **2** **9**

The image shows a close-up of the HP 33S calculator's LCD display. The top line displays '0.000' and the bottom line displays '0.060'. The display is set to show two lines of digits. The background of the display area is a solid green color.

Figure 13

Answer: When all the fraction settings are reset to normal, and flag 7 is cleared to cancel fraction display, the fraction  $\frac{179}{3000}$  is displayed as the decimal number 0.060 to three decimal places.

**Note:** for more information about flags, see the training aid on flags.