



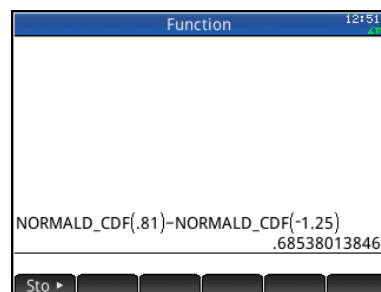
TECHNOLOGY CORNER

5. From Z-Scores to Area, and Vice Versa

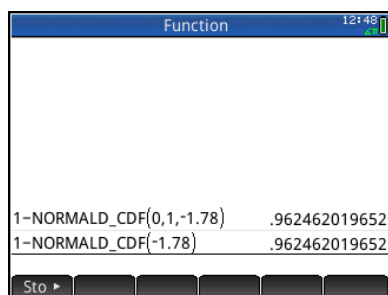
Finding areas: The `NORMALD_CDF()` command on the HP Prime can be used to find lower-tail areas under a Normal curve. The syntax is `NORMALD_CDF(mean, standard deviation, value)` and it returns the area to the left of *value* under a Normal cumulative density function with the given *mean* and *standard deviation*.

- What proportion of observations from the standard Normal distribution are greater than -1.78 ? Recall that the standard Normal distribution has mean 0 and standard deviation 1. Since this calculation involves the area to the right of $z = -1.78$, we use `1-NORMALD_CDF(0,1,-1.78)`.
 - Press to go to the Home view
 - Type 1-, then press , tap *Probability*, tap *Cumulative*, and tap *Normal* to select the Normal cumulative density function
`NORMALD_CDF(μ , σ , x)`
 - Complete the command
`1-NORMALD_CDF(0, 1, -1.78)` and press .
- What proportion of observations from the standard Normal distribution is between -1.25 and 0.81 ? In this case, we subtract two areas to find the area between the two values.
 - Enter `NORMALD_CDF(.81)` and then subtract from it `NORMALD_CDF(-1.25)`

The screen shot below confirms our earlier result of 0.6854 using Table A.





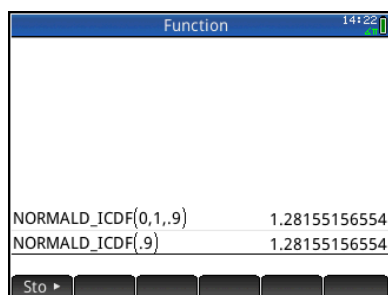
The mean and standard deviation are optional for the standard Normal curve, so `1-NORMALD_CDF(-1.78)` returns the same result.




Working backward: The HP Prime `NORMALD_ICDF()` function calculates the z-value corresponding to a given percentile in a Normal distribution. For this command, the syntax is `NORMALD_ICDF (mean, standard deviation, area to the left)`, and it returns a z-value.

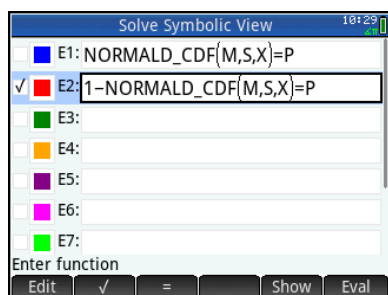
3. What is the 90th percentile of the standard Normal distribution?

- Press , tap *Probability*, tap *Inverse*, and tap *Normal* to select the Normal inverse cumulative density function `NORMALD_ICDF(μ , σ , x)`
- Complete the formula `NORMALD_ICDF(0, 1, 0.9)` and press .
- For the standard Normal distribution, you can omit the mean and standard deviation and just enter `NORMALD_ICDF(0.9)` as shown below.




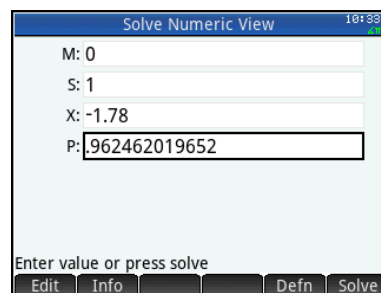
The results match our work with Table A.


4. Use the Solve app to work forwards or backwards.
- Press  and tap the Solve app icon
 - In E1, enter `NORMALD_CDF(M, S, X)=P` to solve problems with area to the left
 - In E2, enter `1-NORMALD_CDF(M, S, X)=P` to solve problems with area to the right

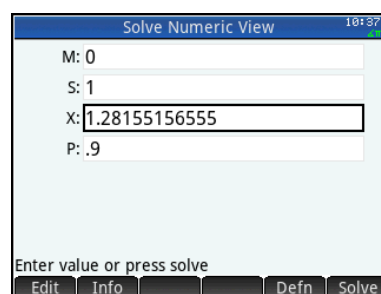


- Check either E1 or E2, but not both, depending on the type of problem you wish to solve
- Use the Numeric view to enter the values you know and solve for the missing value

To find the proportion of observations to the right of -1.78, check E2. Then go to the Numeric view and enter `M=0`, `S=1`, `X=-1.78`. Highlight **P** and tap . The answer agrees with our previous calculation.



To find the 90th percentile of the standard Normal distribution, return to the Symbolic view and uncheck E2 and check E1. Return to the Numeric view and enter `P=0.9`. Highlight **X** and tap . Again, the answer agrees with our previous work.



You can now save this app with a name you'll remember and use it anytime you need it.