# Statistics on the TI-86

These functions are already "built-in" to the TI-86, except for the "extra programs". Extra programs are available in the TI-86 APPENDIX of this book.

## regular TI-86 Contents



## "Enhanced (p. 70)" TI-86 Contents

**To make the screen darker & easier to read, Adjust the Contrast:**

1) Quickly alternate between [2nd] UpArrow [2nd] UpArrow ...
2) If the screen gets too dark, then use [2nd] DownArrow ...
3) If the number flashing in the top-right corner is "9"
   then the battery is almost out. Change all 4 batteries at once.

**'Deep Recall' memory feature :**

On the home screen, previous commands can be recalled for re-execution with optional variations.
As needed, press [2nd] [ENTER] [2nd] [ENTER] [2nd] [ENTER] ...

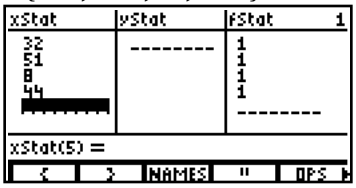
**Entering data into the STAT editor :**

We will only use "xStat" and "yStat" and "fStat" for this class.

1) Press [2nd] [+] (STAT)
2) Choose F2 (EDIT)
3) To clear out any old data, move to the very top of a list, highlight the list name (xStat for example), press [CLEAR]

   and move the cursor back down again.
4) For example, in "xStat(1)", press the first datum and then [ENTER]
5) Continue with each other datum, one-at-a-time.
6) On the TI-86, it is essential to fill the "fStat" list with all "1"s.
   This can be done either manually one "1" at a time,
   or by specifying the name "xStat" on the home screen after any command using it ("OneVar xStat" for example).

For example, the single list {32, 51, 8, 44} is entered:



**Finding the mean, median, Q1, Q3 & standard deviation**
**for 1-variable "raw" data**
**{ (xStat = data) & (fStat = 1) } :**

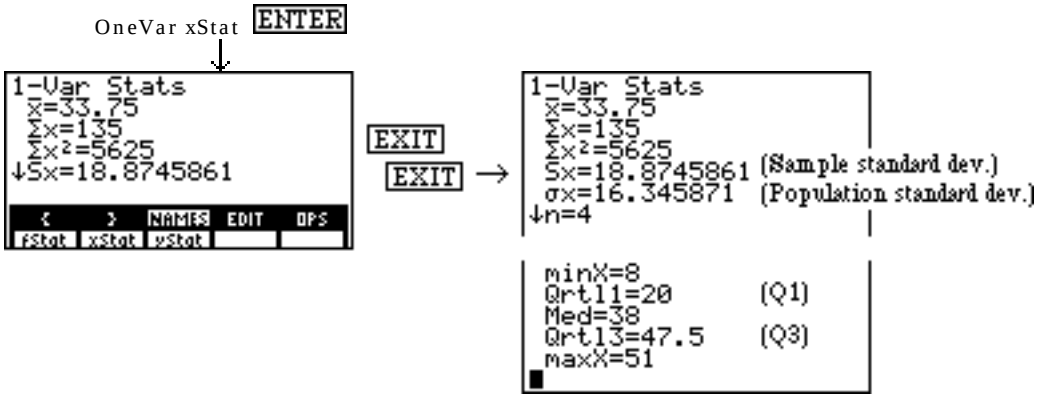
After the data have been entered into both "xStat" and "fStat" , then

1) Start on a clear line of the home screen.
2) Press [2nd] [+] (STAT)
3) Press F1 (CALC)
4) Press F1 (OneVar)
5) If "fStat" is already filled with "1"s , then you are ready for step 6.

OR If "fStat" has not yet been filled with "1"s , then
press [2nd] [−] (LIST)
press F3 (NAMES)
find "xStat" and choose it

6) Press [ENTER]
7) Press [EXIT] [EXIT] in order to view more lines at once.
8) Scroll with the DownArrow in order to see everything.

For example, use the list {32, 51, 8, 44} to get:




Note: [2nd] [+] (STAT) F2 (EDIT) is the same as
[2nd] [−] (LIST) F4 (EDIT)

**Finding the mean, median, Q1, Q3 & standard deviation**
**for 1-variable "grouped" data**
**{ (xStat = data) & (fStat ≠ 1) } :**

After the data have been entered into both "xStat" and "fStat" , then

1) Start on a clear line of the home screen.
2) Press [2nd] [+] (STAT)
3) Press F1 (CALC)
4) Press F1 (OneVar)
5) Make sure that the "frequencies" are already entered into "fStat"
6) Press [ENTER]
7) Press [EXIT] [EXIT] in order to view more lines at once.

Note: the sample size "n" is now the sum of the products of "xStat" & "fStat". "n" is not the same as length of the "xStat" list.

8) Scroll with the DownArrow in order to see everything.

**Finding the means, medians & standard deviations**
**for 2-variable "raw" data**
**{ [ (xStat, yStat) = data pairs ] & (fStat = 1) } :**

After the data have been entered into "xStat" & "yStat" & "fStat" , then

1) Start on a clear line of the home screen.
2) Press [2nd] [+] (STAT)
3) Press F1 (CALC)
4) Press F2 (TwoVar)
5) If "fStat" is already filled with "1"s , then you are ready for step 6.
OR If "fStat" has not yet been filled with "1"s , then
press [2nd] [−] (LIST)
press F3 (NAMES)
find "xStat" and choose it
press [,]
find "yStat" and choose it
6) Press [ENTER]
7) Press [EXIT] [EXIT] in order to view more lines at once.
8) Scroll with the DownArrow in order to see everything.

**Drawing a histogram:**

After the data have been entered into "xStat" & "fStat", then

1) Press [2nd] [+] (STAT)
2) Choose F3 (Plot)
3) We will not need all 3 of them, but just F1 (PLOT1)
4) Be sure that On stays highlighted
5) DownArrow and select Type: F4 ( HIST )
6) We will always use Xlist Name="xStat"
7) If using raw data, Freq=1 & if using grouped data, Freq="fStat"

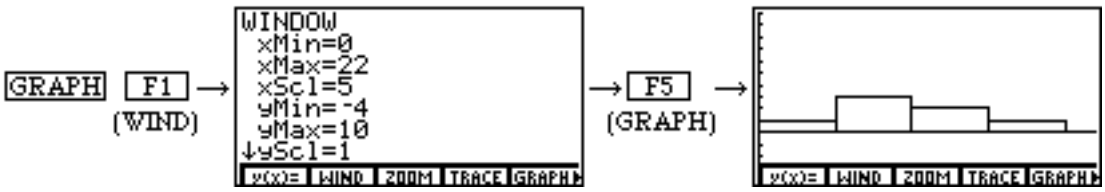
Note: remember to turn "Off" regular [Y(x)=] functions for "Stat Plots".

Note: remember to turn "Off" a "Stat Plot" for regular [Y(x)=] graphing.

**Adjustments to a histogram ( in [GRAPH] [WINDOW] ) :**

1) xMin is the starting point for the first class. Ex. let it be 0 .
2) xMax should be bigger than the largest datum.
   For example, let xMax = 100 if the highest # in the data is 98.
3) xScl is the width of the classes (rectangles).
   For example, if xScl = 5 , then classes will be: 0-4 , 5-9 , 10-14, ...
   Or if xScl = 10 , then classes will be: 0-9 , 10-19 , 20-29, ...
4) yMin should start at -4. Adjust as needed.
5) yMax should start at 10. Adjust as needed.
6) yScl does not affect the histogram, but yScl = 1 is recommended.

For example, enter these into "xStat" : { 8, 7, 2, 11, 9, 16, 12 } ( n=7 )
and let each "fStat"=1 . Then,

**Drawing an xyLine (or a non-connected scatterplot):**

After the data have been entered into "xStat" & "yStat", then

1) Press 2nd + (STAT)
2) Choose F3 (Plot)
3) We will not need all 3 of them, but just F1 (PLOT1)
4) Be sure that On stays highlighted
5) DownArrow and select Type:
   either F1 ( SCAT ⁘ ) OR F2 ( xyLINE ⁘ )
6) We will always use ( Xlist Name=xStat ) & ( Ylist Name=yStat )

Note: "fStat" is ignored for both a scatterplot and for an xyLine.
Only 1 of each point is plotted.

7) Choose any of the 3 available Marks ( box or cross or dot )
8) If the Window is not set, press GRAPH F3 (ZOOM) MORE F5 (DATA)
   ( XMax should be bigger than the largest x-value
   & YMin should be smaller than the smallest y-value & so on ).

Note: remember to turn "Off" regular Y(x)= functions for "Stat Plots".

Note: remember to turn "Off" a "Stat Plot" for regular Y(x)= graphing.

**Drawing a BoxPlot:**

After the data have been entered into "xStat" & "yStat", then

1) Press 2nd + (STAT)
2) Choose F3 (Plot)
3) We will not need all 3 of them, but just F1 (PLOT1)
4) Be sure that On stays highlighted
5) DownArrow and select Type: F5 ( BOX ⊟ )
6) We will always use Xlist Name="xStat"
7) If using raw data, Freq=1 & if using grouped data, Freq="fStat"
8) If the Window is not set, press GRAPH F3 (ZOOM) MORE F5 (DATA)
   ( XMin should be smaller than the smallest x-value )
   & XMax should be bigger than the largest x-value ).

**Finding a Regression Equation :**

**or**

**Finding the <u>corr</u>elation coefficient (r) :**

After the data have been entered into "xStat" & "yStat" & "fStat" , then

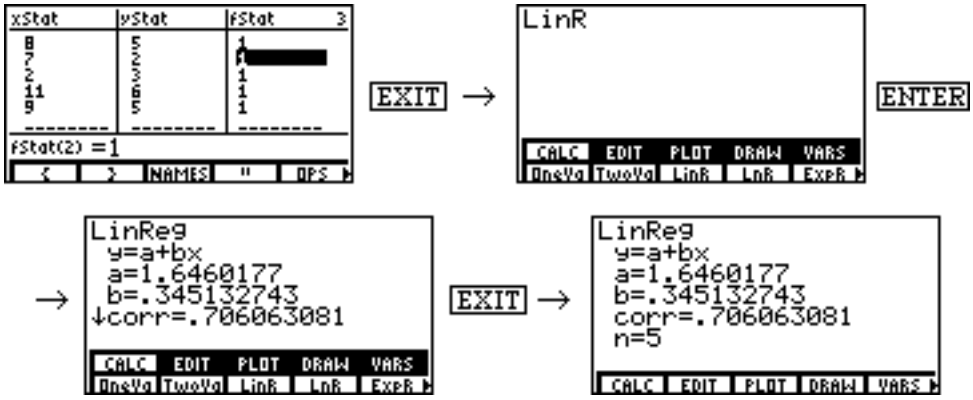
1) Start on a clear line of the home screen.
2) Press [2nd] [+] (STAT)
3) Choose F1 (CALC)
4) For this class, choose F3 (LinearReg)
5) If "fStat" is already filled with "1"s , then you are ready for step 6.

OR If "fStat" has not yet been filled with "1"s , then

press [2nd] [−] (LIST)
press F3 (NAMES)
find "xStat" and choose it
press [,]
find "yStat" and choose it

6) Press [ENTER]
7) Press [EXIT] in order to view more lines at once.

For example,



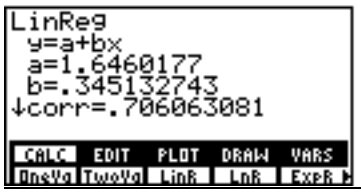

<u>Note</u>: "corr" is the same as "r".

<u>Note</u>: full credit on any exam will not be given for simply copying these numbers as they are currently presented.
A proper "equation" looks like this: y = 1.646 + 0.345x

**Graphing a Regression Equation by hand :**

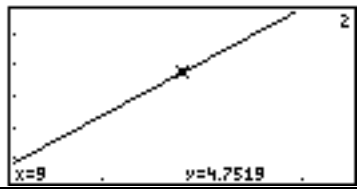
1) Press [GRAPH] F1 ( y(x)= ) and choose a function (for example, y1 ).
2) If necessary, then de-Select or [CLEAR] out any old functions.
3) Enter the numbers and symbols and x-variable in the function.
4) Either [GRAPH] F2 ( Window ) to adjust by hand
   OR [GRAPH] F3 ( ZOOM ) [MORE] F5 (DATA) to adjust automatically.
5) Optionally [TRACE] on y2 moving left & right.

For example,




Steps 1, 2, 3:


Step 5 (after ZoomData)




Note: an option is to turn "On" a "Stat Plot" (e.g. scattergram) for viewing simultaneously with the regular [y(x)=] function.

**Graphing a Regression Equation automatically :**

After the data have been entered into "xStat" & "yStat" & "fStat" , then

1) Start on a clear line of the home screen.
2) Press [2nd] [+] (STAT)
3) Choose F1 (CALC)
4) For this class, choose F3 (LinearReg)
5) If "fStat" is already filled with "1"s , then you are ready for step 6.
   OR If "fStat" has not yet been filled with "1"s , then
   press [2nd] [−] (LIST)
   press F3 (NAMES)
   find "xStat" and choose it
   press [,]
   find "yStat" and choose it
6) Press [,]
7) Press [2nd] [ALPHA] [0] (y) [1] [ENTER]
8) Either [GRAPH] F2 ( Window ) to adjust by hand
   OR [GRAPH] F3 ( ZOOM ) [MORE] F5 (DATA) to adjust automatically.
9) Optionally [TRACE] on y1 moving left & right.

For example:

LinR xStat, yStat, y1

**Operations on LISTs :**

For example, 3*xStat [ENTER] on the "Home Screen" will create a new list with each value of xStat tripled.

There are 2 ways to type "xStat":

either 1) One-letter-at-a-time: [2nd] [ALPHA] [+] (x) [ALPHA] [6] (S)
[2nd] [ALPHA] [ALPHA] [−] (t) [LOG] (a) [−] (t)

or 2) From a menu: [2nd] [−] (LIST) F3 (NAMES)
& then look for "xStat" (use the [MORE] key if necessary)

**Random number between 0 & 1 :**

1) Start on a clear line of the "home screen".
2) Press [2nd] [X] (MATH)
3) Choose F2 for the PROB menu.
4) Choose F4 (rand)
5) Press [ENTER]

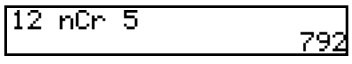
**Random number between 0 & 7 (or for some number other than 7) :**

do the same as above, except multiply 7*rand before pressing [ENTER]
(or use some number other than 7)

**Permutations ( nPr or $P_{n,r}$ ) :**

1) On a clear line of the "home screen", press the first number (n)
2) Press [2nd] [X] (MATH)
3) Choose F2 for the PROB menu.
4) Choose F2 (nPr)
5) Press the 2nd. number (r)
6) Press [ENTER]

For example,




**Combinations ( nCr or $C_{n,r}$ ) :**

do the same as with Permutations (nPr), except choose F3 (nCr)

**Enhanced Statistics on the TI-86 :**

Check whether or not your TI-86 has already been "enhanced":

1) press [2nd] [×] (MATH) [MORE]

2) if the menu choice looks like this: [ENTER] [STAT]
   then you are already set to go.

OR if the menu choice looks like this: [ENTER]
   then you need to improve your calculator.
   Your success in this class depends
   on your calculator's ability to use enhanced statistics.

See the "TI-86 APPENDIX" at the end of this book for details on how to enhance the TI-86 Statistics features.

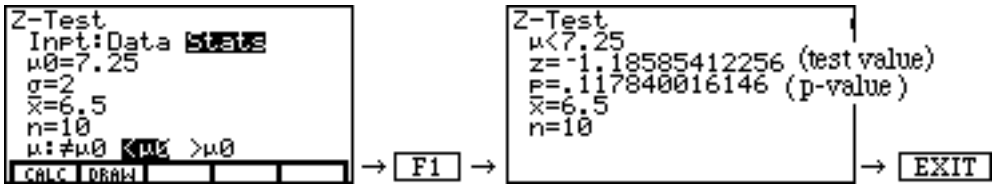
**To find the pvalue for a hypothesis test**
**for a <u>single mean</u> with a <u>large</u> sample size :**

1) Press [2nd] [×] (MATH) [MORE] F2 (STAT)
2) Choose F1 (TESTS)
3) Choose F1 (Z-Test...)
4) If necessary, RightArrow to (Stats) and [ENTER]

<u>Note</u>: DownArrow between each line, one-at-a-time.

5) Press the number for $\mu_o$ ( given in the "claim" $H_o$ )
6) Press the number for $\sigma$ ( or use s if necessary )
7) Press the number for $\bar{x}$ ( from the "sample" )
8) Press the number for n ( the sample size )
9) If necessary, use the LeftArrow & RightArrow & [ENTER] to choose $H_1$
10) Choose F1 to (CALCulate)
11) Press [EXIT] to return to an active home screen

For example,



**To find the pvalue for a hypothesis test**
**for a <u>single mean</u> with a <u>small</u> sample size :**

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F1 (TESTS)
3) Choose F2 (T-Test...)

<u>Note</u>: DownArrow between each line, one-at-a-time.

4) Proceed the same as with the "Z-Test..." .

<u>Special Note</u> about using pvalues with a 2-tail test ($H_1$ with $\neq$) :

In this case, (pvalue) = 2·(Probability of being in one tail)
So when solving these problems by hand, it is necessary to multiply by 2.
But when using the TI-83, do not multiply anything by 2.
Always simply compare the "pvalue" directly to "$\alpha$" .

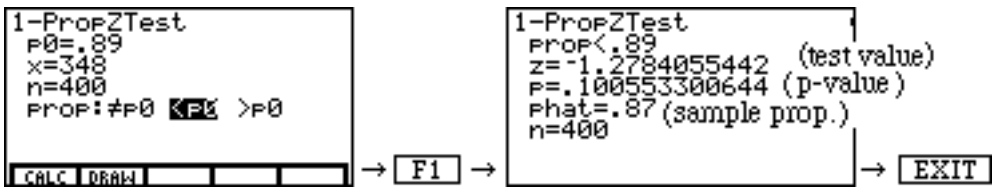
**To find the pvalue for a hypothesis test**
**for a <u>single proportion</u> (only a large sample in this class) :**

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F1 (TESTS)
3) Choose F5 (1-Proportion Z Test...)

<u>Note</u>: DownArrow between each line, one-at-a-time.

4) Press the number for $p_o$ ( given in the "claim" $H_o$ )
5) Press the number for x ( number of "successes" )
6) Press the number for n ( total number of events in the sample )
7) If necessary, use the LeftArrow & RightArrow & [ENTER] to choose $H_1$
8) Choose F1 to (CALCulate)
9) Press [EXIT] to return to an active home screen

For example,



**To find the pvalue for a hypothesis test for the difference between 2 means (only large samples in this class) :**

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F1 (TESTS)
3) Choose F3 (2-Sample Z Test...)

Note: DownArrow between each line, one-at-a-time.

4) Proceed the same as with the "Z-Test..." .

**To find the pvalue for a hypothesis test for the difference between 2 proportions (only large samples in this class):**

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F1 (TESTS)
3) Choose [MORE] F1 (2-Proportion Z Test...)

Note: DownArrow between each line, one-at-a-time.

4) Proceed the same as with the "1-Prop Z Test..." .

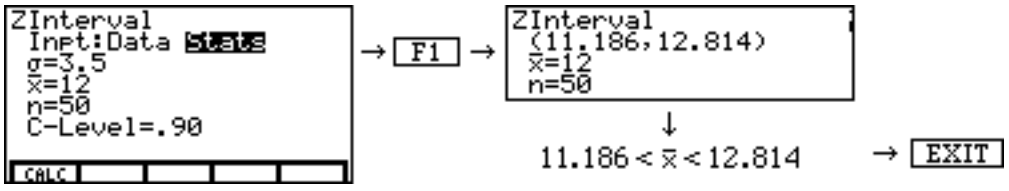
**To find a "confidence interval" for a single mean with a large sample size :**

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F1 (TESTS)
3) Choose [MORE] F2 (Z Interval...)
4) If necessary, RightArrow to (Stats) and [ENTER]

Note: DownArrow between each line, one-at-a-time.

5) Press the number for $\sigma$ ( or use s if necessary )
6) Press the number for $\bar{x}$ ( from the "sample" )
7) Press the number for n ( the sample size )
8) Press the Confidence-Level ( for example: 0.90 or 0.95 or 0.99 )
9) Choose F1 to (CALCulate)
10) Press [EXIT] to return to an active home screen

For example,



**To find a "confidence interval"**
**for a single mean with a small sample size :**

Proceed the same as above, except: Choose MORE F3 (T Interval...)

**To find a "confidence interval"**
**for 2 means (only large samples in this class) :**

The same as above, except: Choose MORE F4 (2-Samp Z Interval...)

**To find a "confidence interval"**
**for a single proportion (only large samples in this class) :**

The same as above, except: Choose MORE MORE F1 (1-Prop Z Int...)

**To find a "confidence interval"**
**for 2 proportions (only large samples in this class) :**

The same as above, except: Choose MORE MORE F2 (2-Prop Z Int...)

**Finding the Area under a normal curve between 2 z-axis numbers :**

Start on a clear line of the home screen. Then

1) Press 2nd X (MATH) MORE F2 (STAT)
2) Choose F2 (DISTRibutions)
3) Choose F2 [ normalcdf( ] ( z cumulative distribution function)
4) Press the left-end z axis number (lower bound)
5) Press the , key
6) Press the right-end z axis number (upper bound)
7) Press ) ENTER

For example, find P( 0 < z < 3 ) with

```
normcdf(0,3)
        .498650032253
```

Note: if necessary, create an arbitrary upper bound.

For example, find P( z > 2.6 ) with either of these:

```
normcdf(2.6,5)
        .004660934674
```

or

```
normcdf(2.6,8)
        .004661221779
```

Since there is no upper bound given, then we could choose any sufficiently large upper bound. If we are rounding to 5 decimal places, we have gone "far enough", already to say that the answer is .00466

Do this "twice" in order to assure that we have gone "far enough".

**Finding the Area under a normal curve between 2 x-axis numbers :**

Start on a clear line of the home screen. Then

1) Press 2nd [ X ] (MATH) MORE F2 (STAT)
2) Choose F2 (DISTRibutions)
3) Choose F2 [ normalcdf( ] ( z cumulative distribution function)
4) Press the left-end z axis number (lower bound)
5) Press the [ , ] key
6) Press the right-end z axis number (upper bound)
6) Press the [ , ] key.
7) Press the population mean (μ)
8) Press the [ , ] key.
9) Depending on the question, press either just σ OR σ÷√n
10) Press ENTER

For example, let μ=5 pounds , σ=2.8 pounds & n=35
then find P( 2 < $\bar{x}$ < 6 ) with:

```
nmcdf(2,6,5,2.8/√35)
          .982694782798
```

**Finding the z-axis number (critical z) for a given Area :**

Start on a clear line of the home screen. Then

1) Press 2nd [ X ] (MATH) MORE F2 (STAT)
2) Choose F2 (DISTRibutions)
2) Choose F3 [ invNorm( ]
3) Press the tail area ( which must be between 0.00 & 1.00 )
4) Press [ ) ] ENTER

For ex, solve for k given P ( z < k ) = .01 with

```
invnm(.01)
        -2.32634787712
```

For ex, solve for k given P ( z > k ) = .01 with

```
invnm(.99)
         2.32634787712
```

**Finding the Area under a (t) curve between 2 t-axis numbers:**

Start on a clear line of the home screen. Then

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F2 (DISTRibutions)
3) Choose F5 [ tcdf( ] ( t cumulative distribution function)
4) Press the right-end t axis number (lower bound)
5) Press the [,] key
6) Press the left-end t axis number (upper bound)
7) Press the degrees of freedom (always n-1 for this class)
8) Press [)] [ENTER]

For example, let n=9 & find P( 0 < t < 3 ) with

```
tcdf(0,3,8)
        .491464159394
```

**Finding the Area under a $\chi^2$ (chi square) curve between 2 axis #s:**

Start on a clear line of the home screen. Then

... do the same as above with "t", except:

4) Choose [MORE] F2 [ chicdf( ] ( $\chi^2$ cumulative distribution function)

For example, let n=9 & find P( 0 < $\chi^2$ < 3 ) with:

```
chicdf(0,3,8)
        .065642454371
```

**Finding one exact binomial probability:**

Start on a clear line of the home screen. Then

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F2 (DISTRibutions)
3) Choose [MORE] F5 [ bipdf( ] (binomial probability dist. function)
4) Press the number of trials (n)
5) Press [,]
6) Press the probability of success on 1 trial (p)
7) Press [,]
8) Press the number of successes (r)
9) Press [)] [ENTER]

For example, let p=0.4

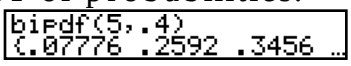
then P ( 3 successes out of 6 trials ) is

```
bipdf(6,.4,3)
        .27648
```

**Finding all exact binomial probabilities from 0 to n:**

Start either on a clear line of the home screen or in the "STAT editor"

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F2 (DISTRibutions)
3) Choose [MORE] F5 [ bipdf( ] (binomial probability dist. function)
4) Press the # of trials (n)
5) Press [,]
6) Press the probability of success on 1 trial (p)
7) Press [ENTER]
8) RightArrow to see the complete LIST of probabilities.

For example, let p=0.4 then this result 

means that P ( 0 successes out of 5 trials ) is 0.07776
and P ( 1 success out of 5 trials ) is 0.25920

Also for example, press [2nd] [+] (STAT) F2 (EDIT) and enter {0, 1, 2, 3} into "xStat" manually (and just ignore "fStat"). Then use the above method to show the entire distribution all at once:


**Finding all sums of binomial probabilities from 0 to r:**

Start either on a clear line of the home screen or in the "STAT editor"

1) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
2) Choose F2 (DISTRibutions)
3) Choose [MORE] [MORE] F1 [ bicdf( ] (binomial cumulative dist. func.)
4) Press the # of trials (n) [,] the probability of success on 1 trial (p)
5) Press [ENTER]
6) RightArrow to see the complete LIST of probabilities.

For example, let p=0.4 then this result 

means that P(at most 1 success out of 5 trials) is 0.33696
and P(at most 2 successes out of 5 trials) is 0.68256

**Graphing the Area under a normal (z) curve between 2 axis #s :**

3 steps: Prepare the window & clear old drawings & ShadeNorm(

**To prepare the window,**

1) Press GRAPH F1 ( y(x)= )
2) De-select (turn off) any functions & "stat plots".
3) Press GRAPH F2 ( Window )
4) Let Xmin=-4, Xmax=4, Xscl=1, Ymin=-0.1, Ymax=0.4

Note: do not ZOOM since that will change the WINDOW settings.

**To clear old drawings from the graph,**

1) Start on a clear line of the home screen.
2) Then press 2nd CUSTOM (CATALOG) F1 (CATALOG)
3) move to ClrDrw by pressing COS (C) and DownArrow
4) Press ENTER once to return to the home screen.

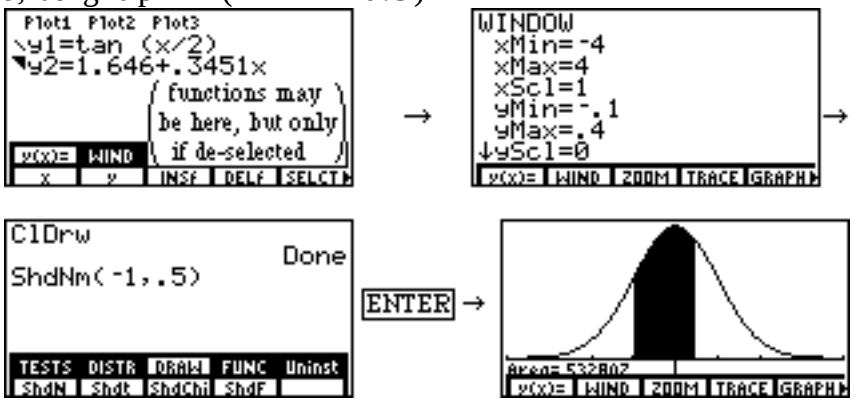
Note: if you have done these previous 4 steps recently, an option is to press 2nd ENTER 2nd ENTER ... often enough to bring back the "Entry"

5) Press ENTER again on the home screen to execute the command.

**After preparing the window and clearing old drawings, then**

1) Press EXIT to get to a clear line of the home screen.
2) Press 2nd X (MATH) MORE F2 (STAT)
3) Choose F3 (DRAW)
4) Choose F1 [ ShadeNorm( ]
5) Press (the lower bound) , (the upper bound)
6) Press ENTER
7) Use EXIT to return to the home screen when finished.

For example, to graph P(-1< z < 0.5)



**Graphing the Area under a (t) curve between 2 axis #s :**

To prepare the window, do the same as with a (z) curve.
To clear old drawings from the graph, do the same as with a (z) curve.

After preparing the window and clearing old drawings, then
1) Press [EXIT] to get to a clear line of the home screen.
2) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
3) Choose F3 (DRAW)
4) Choose F2 [ Shadet( ]
5) (the lower bound) [,] (the upper bound) [,] (degrees of freedom)

Note: degrees of freedom always equals n−1 for this class.

6) Press [ENTER]
7) Use [2nd] [MODE] (QUIT) to return to the home screen when finished.

**Finding (& graph) the Area under a $\chi^2$ (chi square) curve b/w 2 axis #s:**

To prepare the window,
1) Press [Y=] & de-select (turn off) any functions & "stat plots".
2) For the [WINDOW], let Xmin=0, Xmax=30, Ymin=-0.05, Ymax=0.15
To clear old drawings from the graph, do the same as with a (z) curve.

After preparing the window and clearing old drawings, then
1) Press [EXIT] to get to a clear line of the home screen.
2) Press [2nd] [X] (MATH) [MORE] F2 (STAT)
3) Choose F3 (DRAW)
4) Choose F3 [ Shade $\chi^2$( ]
5) (the lower bound) [,] (the upper bound) [,] (degrees of freedom)

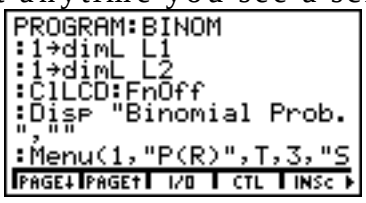
Note: degrees of freedom always equals n−1 for this class.

6) Press [ENTER]
7) Use [2nd] [MODE] (QUIT) to return to the home screen when finished.

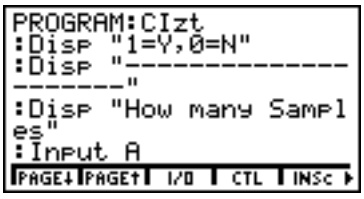
**How to run an "extra program" :**

1) Start on a clear line of the "home screen".
2) Press the PRGM key.
3) Press F1 (NAMES)
4) Choose which program you want (use MORE if necessary).
5) Press ENTER

** Note: if at anytime you see a screen like this **




or this




**
** then you want to get back to the "home screen" right away before **
** your program is destroyed. The safest way to get out of the **
** "program editor" and on to the "home screen" is to press 2nd QUIT **

**Extra program: DEFAULTS**

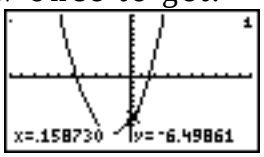
* Every calculator owner should put this program on their calculator! *
This is used as a "sub-program" at the beginning of some "regular" programs, such as prgmBELL . So if prgmDEFAULTS is missing from your calculator, then prgmBELL (for example) will not work.

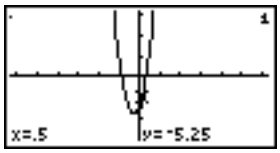
These are some of the modes that it sets:


&

**Extra program: FRNDLYWN**

When using the TRACE feature on a Y(X)= function, this program makes the numbers nice and FRIENDLY in the WINDOW. For example,
let Y1=X²+3 X−7 . Then ZOOM F4 (Standard) and TRACE and RightArrow once to get:



, instead of this: 

which used the program
( center x = 0 , center y = 0 , x-factor = .5 , y-factor = .5 ) .

**Extra program: PolyDiv**

We will not use this in Statistics class. But if you ever need to DIVIDE a POLYNOMIAL again in a math class, then try this.
For example, if you are given $\frac{2n^3 + 9n^2 - 2}{2n + 1}$ , then input {2, 9, 0, -2} and {2,1} to get these 2 outputs:

{1, 4, -2} (quotient)
{0, 0, 0, 0} (remainder)

In this example, the reduces completely to the answer: $n^2 + 4n - 2$ .

**Extra program: PolyMult**

( Use the same instructions as with PolyDiv ).

## TI-86 APPENDIX

Note on "enhancing" TI-86 Statistics features:

Somebody using a TI-83 has everything for statistics already built-in. They need not use the PRGM key in order to find pvalues and confidence intervals.

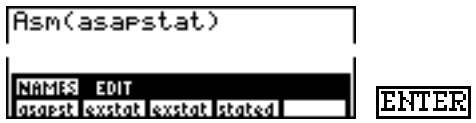
But someone using a TI-82 or TI-85 does use the PRGM key every time they want to do advanced statistics.

On the TI-86, a group of 4 extra programs ( asapstat exstat exstat statad ) can duplicate the features of the TI-83. But unlike the programs for the TI-82 or TI-85, these TI-86 ones need to be run only once in order to make them work. After that first run, then everything is built-in to the TI-86, as if it were a TI-83.

Step-by-step:

1) Follow the below intstructions to get asapstat exstat exstat statad onto your TI-86.
2) On a clear line of the home screen,
   press ALPHA LOG (A) 2nd ALPHA 6 (s) 2nd ALPHA 8 (m) (
3) Press PRGM F1 (NAMES)
4) Find and select asapstat
5) Press ) ENTER

For example:




ENTER

6) Observe the warning that the basic memory of the calculator will be overwritten. When ready, press ENTER
7) Press 2nd × (MATH) MORE
8) Observe that the menu now looks like this: INTER STAT
   instead of how it used to look ( INTER ).
9) Your TI-86 is now enhanced. Unless the batteries die, you will never need to run these asapstat exstat exstat statad programs again.

**There are 4 ways to get "extra programs" onto your TI-86**

From:

- another TI-86 that already has the programs.
- a math department computer that has them on disk.
- either email or the internet to your personal computer.
- manually entering each line of the program from this Appendix.

**Sending programs from a TI-86 to another TI-86 :**

1) Link the 2 calculators with a black cable provided with purchase.
Note: push the cable in FAR , not just in a little bit.

On the receiving calculator:

2) Press [2nd] [x-VAR] (LINK)
3) F2 to RECEIVE

On the sending calculator:

4) Press [2nd] [x-VAR] (LINK)
5) F1 to SEND
6) F2 for PRGMs
7) Observe that nothing has been selected yet:


8) DownArrow & UpArrow as necessary to each program to be sent, pressing F2 (SELECT) at each one chosen. For example:

only AreaT & Binom are selected


9) F1 to TRANSMIT
10) Press [EXIT] to return to the home screen.

**Sending programs from a computer to a TI-86 :**

1) Link the calculator the the computer with a big grey "LINK" cable, sold separately from the calculator. Call for details: 1-800-TI-CARES (It's different than the small black calc-to-calc cable).

Note: push the cable in FAR , not just in a little bit.

On the receiving calculator:

** Do nothing. Simply stay on the home screen. **
Do not use the "LINK" key for computer-to-TI-86 transfer.

On the sending computer (Macintosh) :

2) Open the "TI-GRAPH LINK (86)" software.
3) Ignore the "create a new" window that pops up by pressing Cancel
4) Move the mouse pointer to: Connection
5) Click-&-Drag the mouse pointer to: TI-86
6) If the connection looks good, then press OK
7) On the computer, a window pops up which says "TI-86" and contains headings such as "Equation", "GDB", "List", ... , "Programs".
8) In that new window, click on the triangle next to "Programs" to display which programs are currently on the TI-86.
9) Somewhere elso on the computer, now find the programs to be sent.
Look in a file called "programs.86"
10) If you can see the programs that you want and can see the "TI-86" window at the same time, then click and drag the programs from the "programs.86" file and into the "TI-86" window.
11) Click on the "TI-86" window
12) Observe the updated list of programs now on the TI-86 calculator, according to the "TI-86" window on the computer.

**Obtaining programs from email or the internet :**

1) Write the author (Mark Harbison): mhfractal@aol.com
(Please allow up to 2 weeks for a response. Thank you.)
OR point a web browser to: http://www.ti.com/calc
and go to the "program archive".
2) If necessary, use "File" "Utilities..." "UUDecode File..." to translate the file from email-friendly code into calculator code.

**Manually entering each line of the program from this Appendix.**

This should be a last-resort method only. Any of the 3 previous methods is preferrable to this. Editing programs is not recommended, except for experienced programmers.

Note: the "asapstat & exstats & exstats2 & statedit" program group ( asapst exstat exstat statedi ) is not available for editing line-by-line. This group is designed to overwrite the basic memory of the calculator. So editing one of these "assembly language" programs will ruin your calculator. Don't do it.

However, the "Programming" chapter of the TI-86 Owner's Manual can get you started with these regular (non-assembly-language) programs, if you are interested. Good luck.

```
DEFAULTS          • program.86
  :Normal:Float
  :Radian:Dec
  :RectC:Func
  :RectGC:CoordOn
  :DrawLine:FnOff
  :Seqg:GridOff
  :AxesOn:LabelOff
  :RK:SlpFld
  :4→xFact
  :4→yFact
  :1→ΔTbl
  :0→TblStart
  :ClLCD
```

```
PolyDiv           • program.86
  :ClLCD
  :Disp " POLYNOMIAL DIVISION"
  :Disp "","TO ENTER
    COEFFICIENTS"
  :Disp "{A,B} PRESS  2nd
    LIST",""
  :Input "L1=",L1
  :Input "L2=",L2
  :dimL L1→S:dimL L2→T:S-T+1→A
  :A→dimL L3
  :L2→L4
  :S→dimL L4
  :L1→L5
  :For(I,1,A,1)
  :L5(I)/L2(1)→M
  :M→L3(I)
  :L5-(M*L4)→L5
  :Fill(0,L4)
  :For(J,1,T,1)
  :L2(J)→L4(I+J)
  :End
  :End
  :Disp L3‹Frac,L5‹Frac
```

```
FRNDLYWN          • program.86
  :ClLCD
  :Lbl A
  :Disp "CENTER"
  :Input "X=",X:Input "Y=",Y
  :Input "X-FACTOR=",γ
  :Input "Y-FACTOR=",δ
  :X-63γ→xMin:X+63γ→xMax:10γ
    →xScl
  :Y-31δ→yMin:Y+31δ→yMax:10δ
    →yScl
  :DispG:Pause
  :Disp "","RE-SCALE?"
  :Menu(1,"YES",A,5,"NO",B)
  :Lbl B
  :Disp "":DispG:Stop
```

```
PolyMult          • program.86
  :ClLCD
  :
  :Disp "  POLYNOMIAL  MULT."
  :Disp "","TO ENTER
    COEFFICIENTS"
  :Disp "{A,B} PRESS  2nd
    LIST",""
  :Input "L1=",L1
  :Input "L2=",L2
  :dimL L1→S
  :dimL L2→T
  :S+T-1→dimL L3
  :Fill(0,L3)
  :L3→L4
  :For(I,1,T,1)
  :Fill(0,L3)
  :For(J,1,S,1)
  :L1(J)→L3(J+I-1)
  :End
  :L2(I)*L3+L4→L4
  :End
  :
  :L4
```

```
DARTS          • Program.82
:Goto 0
:EDITED BY :HARBISON 1-98

:Lbl 0
:FnOff :PlotsOff :AxesOff
:0→Xmin:4→Xmax:O→Xscl:0→Ymin:4→Ymax
:O→Ysc1
:ClrHome:ClrDraw
:Text(2,18,"THROWING DARTS"
:Text(10,20," AT YOUR TI-82"
:Text(39,12,"BY STUART MOSKOWITZ"
:Text(46,18,"AND ALLEN MARTIN"
:Pause
:Lbl 6:FnOff
:0→Xmin:4→Xmax:0→Xscl:0→Ymin:4→Ymax
:0→YSCJ
:Menu("DARTS","THROW
DARTS",A,"HELP",B,"QUIT",C)
:Lbl B
:ClrDraw
:Text(2,2,"THIS PROGRAM SIMULATES"
:Text(8,2," THE RANDOM THROWING OF"
:Text(14,2,"DARTS AT THE TI-82."
:Text(20,2,"ITS PURPOSE IS TO INVESTI-"
:Text(26,2,"GATE THE EFFECT OF SAMPLE"
:Text(32,2,"SIZE ON MEAN AND"
:Text(38,2,"STANDFIRD DEUIATION."
:Text(44,2,"THE TI-82 WILL CALCULATE"
:Text(50,2,"THE FRACTION OF THE DARTS">
:Text(56,2,"THAT LAND IN THE LOWER")
:Pause :ClrDraw
:Text(2,1,"RIGHT QUADRANT. IF THE"
:Text(8,1,"EXPERIMENT IS REPEATED"
:Text(14,1,"MORE THAN ONCE, THE MEAN"
:Text(20,1,"AND STANDARD DEV. WILL BE"
:Text(26,1,"COMPUTED AND THE RESULTING"
:Text(32,1,"BELL CURVE WILL BE
GRAPHED."
:Text(38,1 "---------- TRY THIS -------"

:Text(44,1,"1-COMPARE SMALL AND LARGE"
:Text(50,1,"SAMPLE SIZES BY THROWING"
:Text(56,1,"20 DARTS 10 TIMES EACH.
:Pause :ClrDraw
:Text(2,2,"2--REPEAT THE SIMULATION"
:Text(8,2,"WITH 100 DARTS. THE BELL"
:Text(14,2,"CURVE FOR EACH EXPERIMENT"
:Text(20,2,"WILL BE GRAPHED ON THE"
:Text(26,2,"SAME SCREEN."
:Text(34,2,"?EXPLAIN THE DIFFERENCES?"
:Text(42,2."A HANDOUT FOR THIS
ACTIVITY"
:Text(48,2,"IS AVAILABLE FROM STUART."
:Pause
:
:Lbl A
:ClrList L1:ClrList
L2:ClrHome:l→H:1→B
:Disp "HOW MANY DARTS?"
:Disp "(BEGIN WITH 20)":Input D:D→W
:
:Lbl I
:ClrDraw:Line(0,2,4,2):Line(2,0,2,4):0
→N
:
:Lbl 2
:If D=O:Goto 3
:D-1→D:4rand→X:4rand→Y:Pt-On(X,Y)
:If X<2:Goto 2
:If Y>2:Goto 2
:
:N+1→N:Goto 2
:
:Lbl 3
:DispGraph
:Pause
:
:N/W→R
:ClrHome
:Disp "DARTS IN",N
:Disp "TOTAL DARTS"
:Disp W," "
:Disp "RELATIVE FREQ."
:N/W→P
:Disp round(P,2)
:Pause
:
:ClrHome
:Disp "GAMES SO FAR",H
```

```
:Disp "PLAY AGAIN?"
:Disp "YES-1 NO-2"
:Input G
:P→L1(B):B+1→B:W→D
:If G=1
:H+1→H
:If G=1
:Goto 1
:If H=1
:Stop
:
:1-Var Stats
:CIrHome
:Disp "x̄=",round(x̄,2)
:Disp " "
:Disp "STANDARD DEV.=",round(Sx,2)
:Pause
:If D>40:Goto 5
: x̄+M:Sx→S:D→T
:Func:AxesOff
:"S√(2π))^-1*e^(-.5((X-M)/S)≥" →Y1
:.01→Xmin:.48→Xmax
: -.5→Ymin: 14→Ymax
:Input
:Goto 6
:
:Lbl 5
: x̄→Q:Sx→R:D→U
:AxesOff
: "(R√T (2π))-1*e^(-.5((X-Q)/R)^2" →Y2
:.01→Xmin:.48→Xmax
:-.5→Ymin:14→Ymax
:DispGraph
:Pause :FnOn
:Text(1,1,"Y1  N=",T)
:Text(7,1,"Y2  N=",U)
:DispGraph
:Pause :FnOn
:Input
:
:Lbl C
:Stop
```

Darts • Program.85

```
:Goto H
:by Harbison 3/98
:Lbl H
:FnOff :AxesOff:C1LCD
:0→xMin:4→xMax:0→xScl
:0→yMin:4→vMax:0→vScl
:
:Lbl Q
:C1LCD
:0→dimL JJ1:0→dimL JJ3
:1→H:1→B
:Disp "How many darts?"
:Disp "(Begin with 20)"
:Input D:D→W
:
:Lbl A
:ClDrw
:Line(0,2,4,2):Line(2,0,2,4)
:0→N
:
:Lbl B
:If D==O:Goto C
:D-1→D
:4*rand→x:4*rand→v
:PtOn(x,v)
:If x<2:Goto B
:If v>2:Goto B
:N+1→N:Goto B
:
:Lbl C
:DispG:Pause
:N/W→R:C1LCD
:Disp "Darts In",N
:Disp "Total Darts",W,""
:Disp "Relative Freq."
:N/W→P:Disp round(P,2)
:Pause :C1LCD
:Disp "Games so far",H
:Disp "Play Again?", "Yes=1 No=2"
:Input G
:P→JJI(B):B+1→B:W+D
:
:If G==1:H+1→H
:If G==1:Goto A
:If H==1:Stop
:sem(1,x,1,H,1)→JJ3
:OneVar JJ1,JJ3
:C1LCD
:Disp "x̄= ",round(x̄,2),""
```

```
:Disp "Standard Dev.= ",round(Sx,2)
:Pause
:If D>40:Goto E
:R→M:Sx→S:D→T:Func:AxesOff
:y1=(S*√(2π))^-1*e^(-.5((x-M)/S)^2)
:.01→xMin:.48→xMax:-.5→,yMin:14→yMax
:Input :Goto H
:
:Lbl E
:x̄→Q:Sx→R:D→U
:y2=(R*√(2π))^-1*e^(-.5((x-Q)/R)^2)
:.01→xMin:.48→xMax:-.5→yMin:14→yMax
:DispG:Pause :FnOn :Input :Stop
```

(note: Darts.83 is basically the same as Darts.82)

(note: Darts.86 is basically the same as Darts5.85)