Statistics and Finance

with the TI-84 plus C

BM

CALCULATORS

An advanced electronic calculator like the TI-84 could not even be imagined 50 years ago. My father was an accountant. He used a mechanical calculator for basic arithmetic. To multiply a number by 7 you turn the crank 7 times.

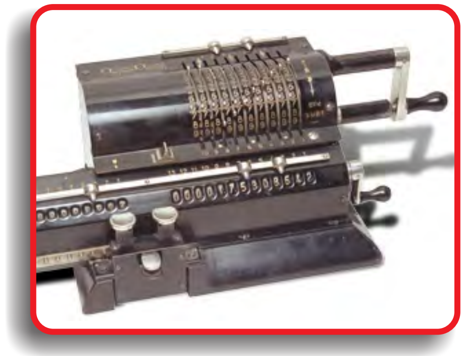
I went through college and practiced engineering on the strength of slide rules. Multiplication, division, powers, roots, logarithms, trigonometry can be calculated with 3 or 4 significant digits. Sounds limited and primitive (and it is) but everything designed and built before the seventies was accomplished mostly with slide rule calculations. This includes the rockets and space ships that went to the moon.

Mechanical calculators operate with gears and levers. The slide rule is based on very precisely engraved logarithmic scales. It takes a good eye to read (or guess) the third or fourth digit.

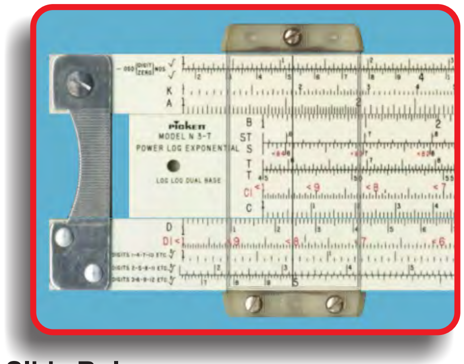
An electronic calculator is a totally different entity. Millions of miniaturized electronic components are interconnected to execute instructions and logical operations at extremely fast speeds. Since logic is the essence of mathematics, almost any basic mathematical operation or function can be accomplished in seconds by touching a few buttons.

The TI-84 graphic calculator has become the 'de facto' standard calculator for current mathematics and science courses. The C version is not only more attractive because of the graphic color capability but easier to use because of its illuminated screen and higher resolution.

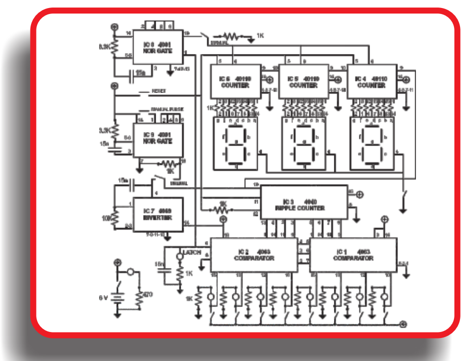
The TI-84 has a huge set of math functions accessible with a few strokes from the key board. The following pages offer a guide to the use of the calculator for solving many basic elemental statistic problems as well as TVM (time value of money) financial applications.



Mechanical Calculator.
A big help to add, subtract and multiply large numbers precisely. The alternative being pencil and paper.



Slide Rule.
Offers quick answers to many mathematical operations. But only gives 3 or 4 digits and the operator must calculate the decimal point separately.



Calculating Circuit
A circuit like this one for converting binary to decimal numbers is only a minuscule part of an electronic calculator system.

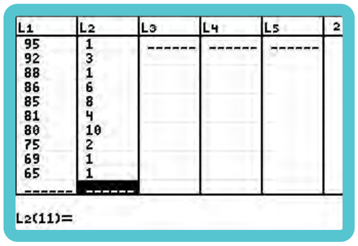
Binary to Decimal Converter
The number of electronic components in this circuit is of the order of 10,000; in the billions for a full calculator.

STATISTICS

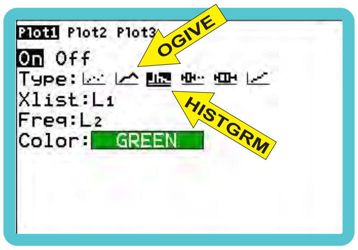
Entering and ploting data

A class of 37 students takes a math test. Enter the grades in L1 and the number of students getting each grade in L2. Show the Ogive and Histogram plots.

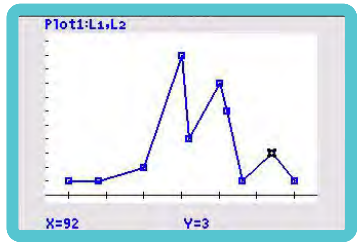
STAT **EDIT,** enter data — 2ND STATPLOT F1 Y= — ZOOM pick **9** — TRACE



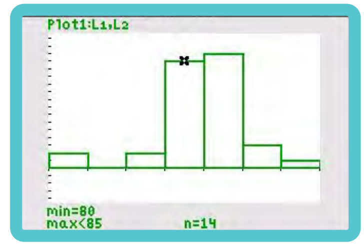
S01-1 One variable stat and frequency list: math test grades.



S01-2 Stat plot configuration. Zoom screen not shown.



S01-3 Ogive plot of S01-2. Cursor shows that 3 students scored 92 on their math test.

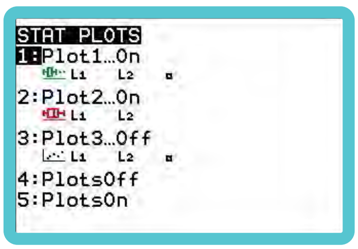


S01-4 Histogram of S01-2. Cursor shows 14 students have grades from 80 to 85 (85 excluded).

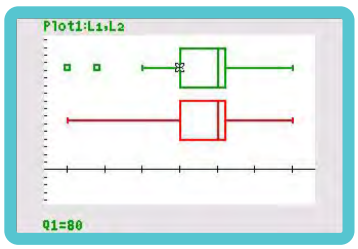
Box plots and one variable statistics

Show both box plots (with and without outliers) and the statistics measurements for the math test data.

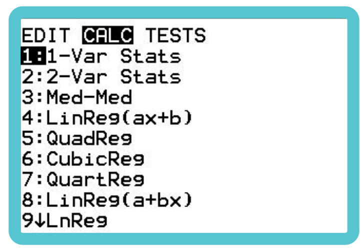
2ND STATPLOT F1 Y= — ZOOM pick **9** — TRACE — STAT **CALC,** pick **1** — **ENTER** (4 times)



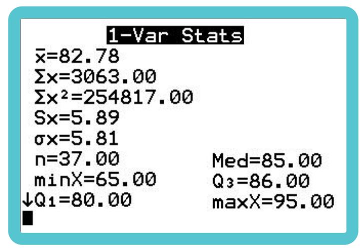
S01-5 Plot 1 set to first "box plot" and 2 to the second. Data from S01-1.



S01-6 Box plots of the math test data. The first one separates the "outliers". Cursor at the first Quartile = 80.



S01-7 On the statistics calculator, choose the 1 Var Stats.



S01-8 Statistic measurements of the math test data. (use the down arrow to see the 3 items on the right).

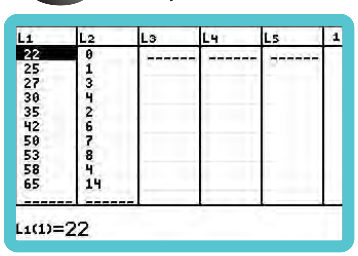
Statistical variables symbols on S01-8

$\bar{x}$: mean; Σx: data sum; Σx^2: data sum squared; **Sx**: sample standard deviation; σx: population standard deviation; **n**: number of data points; **minX**: minimum x; Q_1: first quartile; **Med**: median; Q_3: third quartile; **maxX**: maximum x.

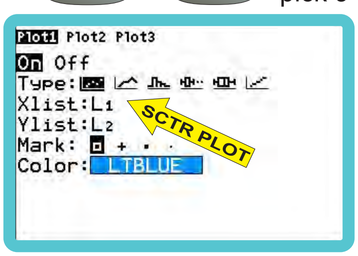
Scatter plots and paired data

Determine if the employees ages and and their absences per year have a relation.

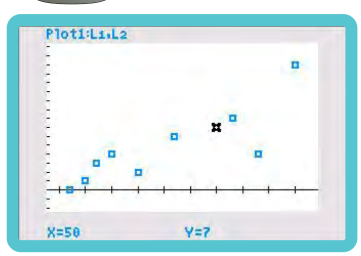
STAT **EDIT,** Enter data — 2ND STATPLOT F1 Y= — ZOOM pick **9** — TRACE — STAT **CALC,** pick **4**



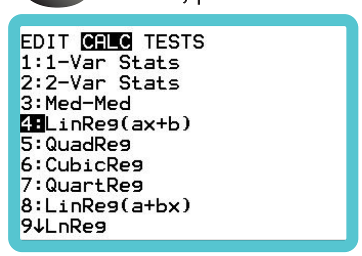
S01-9 Employees ages listed on L1 vs their yearly absences listed on L2.



S01-10 Select the scatter plot symbol.

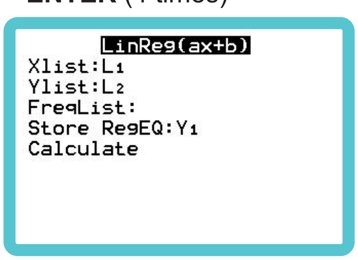


S01-11 The scatter plot of data S01-9, age and absences, appear to have a direct relation.



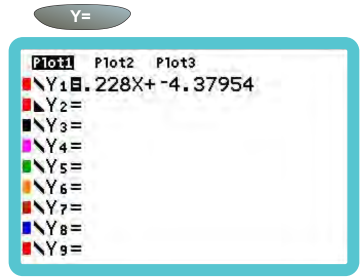
S01-12 On the statistics calculator, choose 4 to find the best linear equation in agreement with the data.

ENTER (4 times) — Y= — TRACE

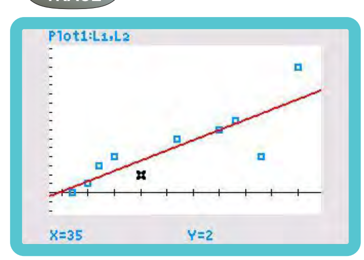


S01-13 Store the equation on Y1

S01-14 Linear equation coeficients.



S01-15 Linear equation



S01-16 Best linear fit for the paired data.

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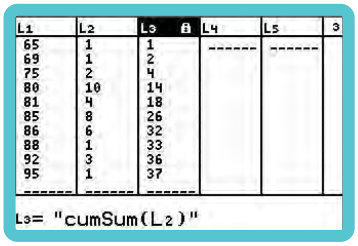
Percentile calculation and plot

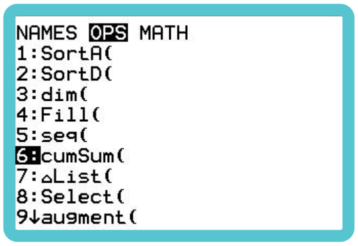
Find the percentile rank and plot of the math grade data from S01-1.

STAT **EDIT,** enter data



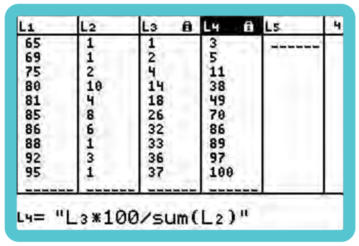
S02-1 Same L1 and L2 data of S01-1 in ascending order. Formula for L3 from next screen.

2ND LIST STAT pick **6**



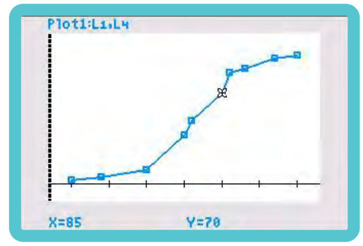
S02-2 On LIST select the cumulative sum formula.

STAT **EDIT,** enter formula



S02-3 Add the formula shown. Sum function is on LIST-MATH-5.

ZOOM pick **9** TRACE

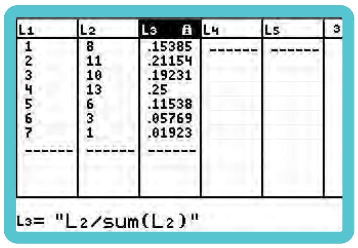


S02-4 The ogive plot of L1, L4 shows the data in percentile form. An 85 grade ranks 70%.

Relative frequency - Counting

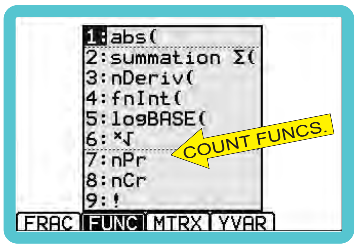
A) A car rental business tracks the number of customers (L2) that keep the cars certain number of days (L1). Dermine the relative frequency (L3). B) From a group of 10 persons, how many possibilities are there: to select president, vice president and secretary (permutation); to select a committee of 3 (combination); to arrange them in a row for a group photo (factorial).

STAT **EDIT,** enter data



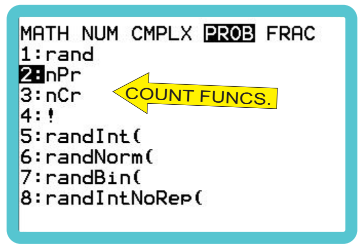
S02-5 L1: number of days rented. L2: number of customers. L3: relative frequency.

ALPHA TABLESET F2 WINDOW



S02-6 Three counting functions in the panel. Permutation, combination and factorial.

MATH **PROB**



S02-7 The counting functions also on the MATH-PROB menu.

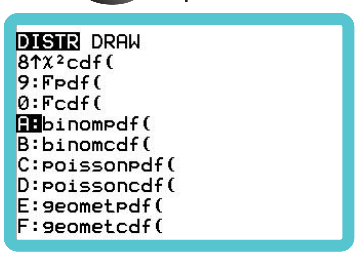
(use the functions)

S02-8 Counting results.

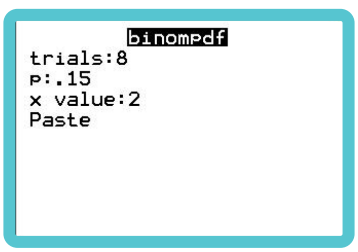
Binomial probability distribution

A factory makes candies in several colors, 15% of the candies produced are red. If you pick 8 at random, what is the probability of getting exactly two red candies? Show the probabilities table.

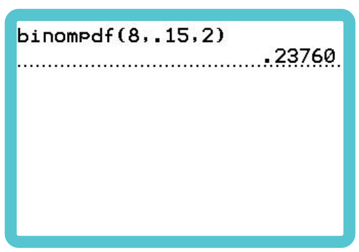
2ND DISTR VARS pick **A**



S02-9 Probability of a certain exact number.

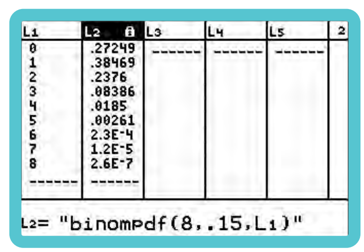


S02-10 Enter the values.



S02-11 The probability of getting exactly 2 red candies is 23.8%.

STAT **EDIT**

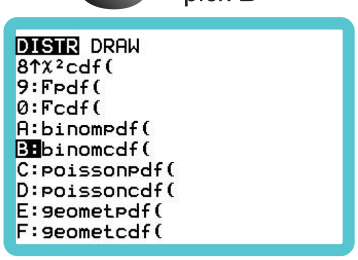


S02-12 Enter 0 to 8 in L1 and function from DISTR-A in L2.

Binomial cumulative probability distribution

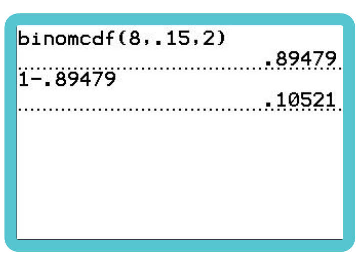
If 15% of the candies are red and you pick 8 at random. What is the probability of getting 2 or less red candies? What is the probability of getting more than 2 red candies? Show the probabilities table.

2ND DISTR VARS pick **B**

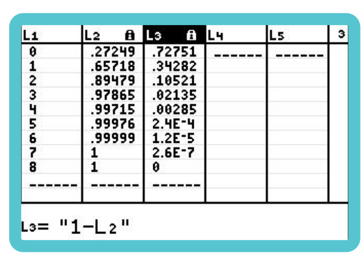


S02-13 Cumulative probability (from 0 to a number).

S02-14 Enter the values.



S02-15 Probability of 2 or less: 89.5%. Probability of more than 2: 10.5%.



S02-16 Function from DISTR-B in L2.

Standard normal distribution

Find the probability of a z value between -.3 and 1.2. Show the plot.

S03

2ND DISTR
VARS pick **2**

```
DISTR DRAW
1:normalpdf(
2:normalcdf(
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7:χ²pdf(
8:χ²cdf(
9↓Fpdf(
```

S03-1 On the DISTR menu choose the normal cumulative distribution.

```
normalcdf
lower:-.3
upper:1.2
μ:0
σ:1
Paste
```

S03-2 Enter the values.

```
normalcdf(-.3,1.2,0,1)
.5028416264
```

S03-3 The probability of z being between -.3 and 1.1 is 50.3%.

WINDOW

```
WINDOW
Xmin=-3
Xmax=3
Xscl=.5
Ymin=0
Ymax=.5
Yscl=.05
Xres=1
ΔX=.02272727272727
TraceStep=.04545454545454
```

S03-4 Enter the window settings as shown.

2ND FORMAT F3
ZOOM

```
RectGC PolarGC
CoordOn CoordOff
GridOff GridDot GridLine
GridColor: LTGRAY
Axes: BLACK
LabelOff LabelOn
ExprOn ExprOff
BorderColor: 1
Background: Off
Detect Asymptotes: On Off
```

S03-5 Format the plot as shown.

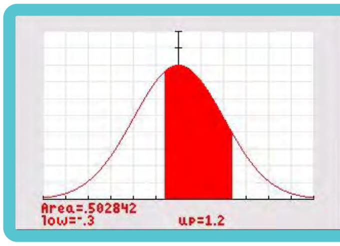
2ND DISTR
VARS **DRAW** pick **1**

```
DISTR DRAW
1:ShadeNorm(
2:Shade_t(
3:Shadeχ²(
4:ShadeF(
```

S03-6 Choose the shade normal plot.

```
ShadeNorm
lower:-.3
upper:1.2
μ:0
σ:1
Color: RED
Draw
```

S03-7 Enter the values.



S03-8 The shaded area corresponds to the z probability or 50.3%.

Normal distribution

Houses in the Woodlands development list for an average price of $280,000 with a standard deviation of $60,000. What is the probability of finding a house for less than $200,000? One between $230,000 and $270,000? Show a plot.

2ND DISTR
VARS pick **A**

```
normalcdf(0,200,280,60)
.0912097495
normalcdf(230,270,280,60)
.2314878375
```

S03-9 Insert values (in $1000) as in S03-2. P(<200)=9.1%. P(230<V<270)=23.1%

WINDOW

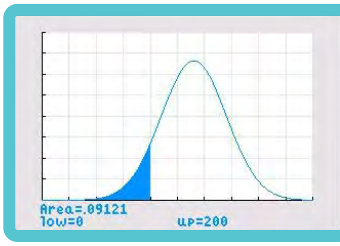
```
WINDOW
Xmin=0
Xmax=500
Xscl=50
Ymin=0
Ymax=.008
Yscl=.001
Xres=1
ΔX=1.8939393939394
TraceStep=3.7878787878788
```

S03-10 Set Xmax to about 2μ. For Ymax try 1/(2σ).

2ND DISTR
VARS **DRAW** pick **1**

```
ShadeNorm
lower:0
upper:200
μ:280
σ:60
Color: LTBLUE
Draw
```

S03-11 Enter the values (in $1,000).



S03-12 The probability of finding a house for less than $200,000 is 9.1%.

Normal distribution (count)

A police department answers emergency calls in 7 minutes average, with a standard deviation of 3 minutes. Out of 80 calls, how many are likely to be answered in less than 4 minutes? in more than 8 minutes? Show a plot.

2ND DISTR
VARS pick **2**

```
DISTR DRAW
1:normalpdf(
2:normalcdf(
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7:χ²pdf(
8:χ²cdf(
9↓Fpdf(
```

S03-13 Select normal cumulative distribution.

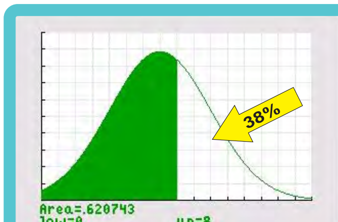
```
normalcdf
lower:0
upper:4
μ:7
σ:3
Paste
```

S03-14 Enter the values.

```
normalcdf(0,4,7,3)
.1488399527
Ans*80
11.90719622
1-normalcdf(0,8,7,3)
.3792567105
Ans*80
30.34053684
```

S03-15 Out of 80 calls,12 are answered in less than 4 minutes and 30 in more than 8 minutes.

2ND DISTR
VARS **DRAW,** pick **1**



S03-16 62% (50) of the calls were answered in less than 8 minutes, 38% (30) in more than 8 minutes.

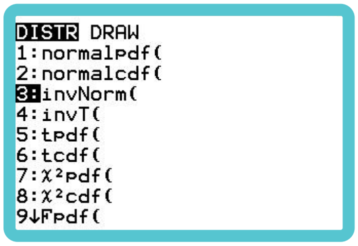
Inverse standard normal distribution

Find the z value for a standard probability of 30% and for a probability of 75%. Verify with a plot.

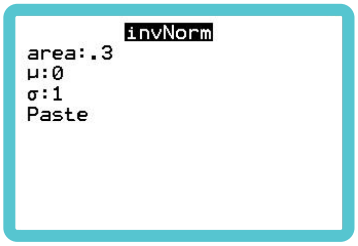
S04

2ND DISTR VARS pick **3**

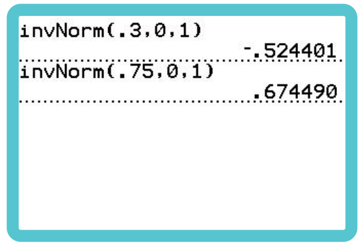
2ND DISTR VARS **DRAW,** pick **1**



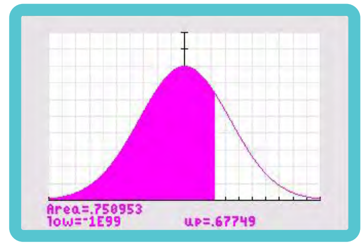
S04-1 On the DISTR menu choose the inverse normal distribution.



S04-2 Enter the probability (area).



S04-3 The z value for 30% probability is -.52440, for 75% is .67449.



S04-4 A z value of .67449 corresponds to 75% probability.

Inverse normal distribution

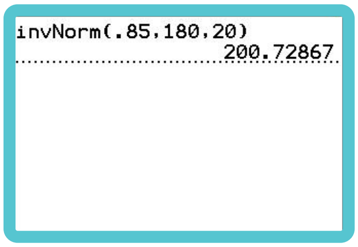
A) To qualify for a military academy, aplicants must score in the top 15% of the entrance test. The test mean is 180 and the standard deviation is 20. Find the lowest score to qualify. B) Used cars average price is $8,500, standard deviation $1120. Find the prices that bracket the middle 60%. Show the plots.

2ND DISTR VARS pick **3**

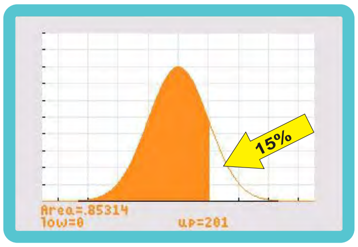
2ND DISTR VARS **DRAW,** pick **1**

2ND DISTR VARS pick **3**

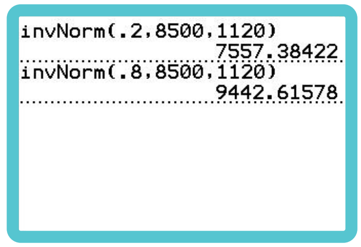
2ND DISTR VARS **DRAW,** pick **1**



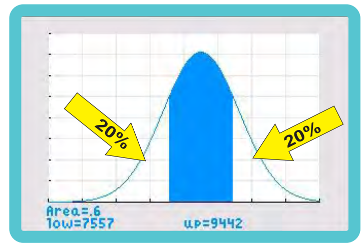
S04-5 Enter .85 (1.00-.15) as area. The score must be at least 201 to qualify.



S04-6 A test score of 201 or more is in the top 15%.



S04-7 The middle .6 is between .2 and .8. The bracketing prices are $7,557 and $9,442.



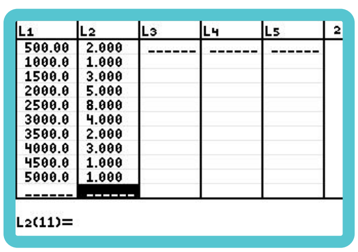
S04-8 The shaded area between the bracketing prices is 60%.

Determining normality.

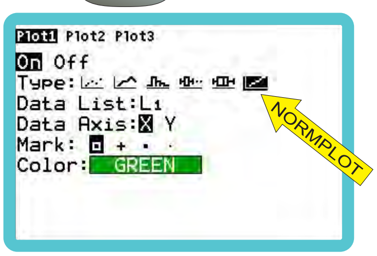
The credit card debt of 30 families is listed on L1. The frequency is listed on L2. Is this data approximately a normal distribution?

STAT **EDIT,** enter data

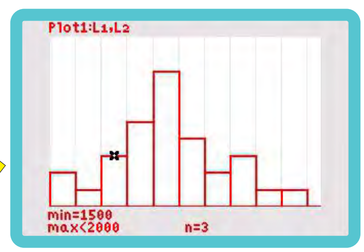
2ND STATPLOT F1 Y=



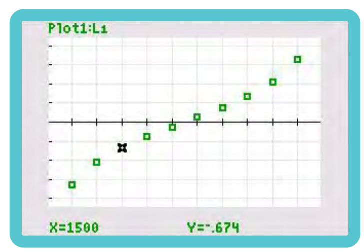
S04-9 Insert values.



S04-10 First select the histogram plot, then the NormProbPlot.



S04-11 The histogram approximates a bell shape indicating a normal distribution.

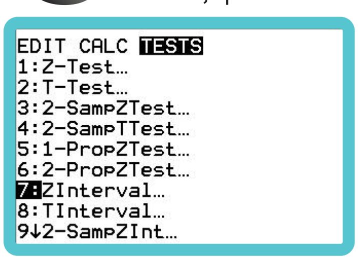


S04-12 The normprobplot is aproximately linear, confirming that the distribution is normal.

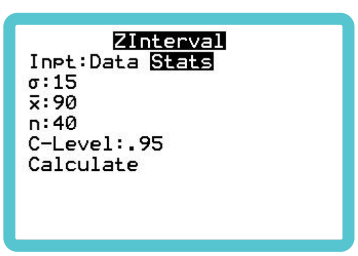
Confidence interval z, stats

A) A realtor has 40 houses in inventory, the sample mean time is 90 days, the population σ is 15 days. Find the population mean interval with a 95% confidence. B) with a 99% confidence.

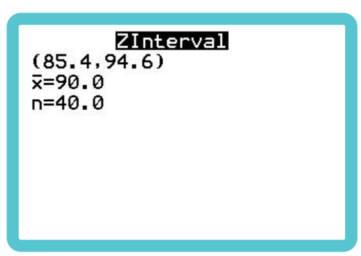
STAT **TESTS,** pick **7**



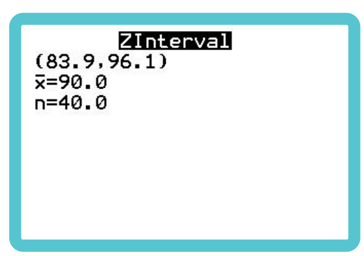
S04-13 Select Z interval.



S04-14 Select stats and enter the values.



S04-15 With 95% confidence the population mean interval is 85.4 < μ < 94.6.



S04-16 With 99% confidence the population mean interval is 83.9 < μ < 96.1.

BM

Confidence interval z, data

S05

A sample of 41 freshman SAT scores are listed in L1 with frequency in L2. The population standard deviation is known to be .51. Find the population mean interval with a 99% confidence level

STAT **EDIT,** Enter data

STAT **TESTS,** pick **7**

```
L1    L2    L3    L4    L5    2
2.0   2.0   ----- ----- -----
2.1   1.0
2.4   5.0
2.5   3.0
2.8   9.0
2.9   11.0
3.1   3.0
3.2   5.0
3.5   1.0
3.8   1.0
----- -----
L2(1)=2
```

S05-1 Enter SAT scores in L1 and frequency in L2.

```
EDIT CALC TESTS
1:Z-Test…
2:T-Test…
3:2-SampZTest…
4:2-SampTTest…
5:1-PropZTest…
6:2-PropZTest…
7:ZInterval…
8:TInterval…
9↓2-SampZInt…
```

S05-2 Select the z interval.

```
ZInterval
Inpt:Data Stats
σ:.51
List:L1
Freq:L2
C-Level:.99
Calculate
```

S05-3 Select data and enter values.

```
ZInterval
(2.61,3.02)
x̄=2.81
Sx=.37
n=41.00
```

S05-4 With 99% confidence the pop. mean interval is 2.61 < μ < 3.02.

Confidence interval t, stats

A sample of 8 college wrestlers weight an average of 270 lbs with a sample standard deviation of 13 lbs. A) Find the mean weight of all college wrestlers with a confidence interval of 90%. B) With 98%.

STAT **TESTS,** pick **8**

```
EDIT CALC TESTS
1:Z-Test…
2:T-Test…
3:2-SampZTest…
4:2-SampTTest…
5:1-PropZTest…
6:2-PropZTest…
7:ZInterval…
8:TInterval…
9↓2-SampZInt…
```

S05-5 Select the t interval.

```
TInterval
Inpt:Data Stats
x̄:270
Sx:13
n:8
C-Level:.9
Calculate
```

S05-6 Select stats and enter values.

```
TInterval
(261,279)
x̄=270
Sx=13
n=8
```

S05-7 With 90% confidence the pop. mean interval is 261 < μ < 279.

```
TInterval
(256,284)
x̄=270
Sx=13
n=8
```

S05-8 With 98% confidence the pop. mean interval is 256 < μ < 284.

Confidence interval t, data

The prices of ten cameras of different brands, all with the same features are listed on L1. Find with 95% confidence the interval of the true mean.

STAT **EDIT,** enter data

STAT **TESTS,** pick **8**

```
L1      L2    L3    L4    L5    2
250.00  ----- ----- ----- -----
230.00
210.00
240.00
215.00
193.00
225.00
205.00
195.00
220.00
------
L2(1)=
```

S05-9 Insert values.

```
EDIT CALC TESTS
1:Z-Test…
2:T-Test…
3:2-SampZTest…
4:2-SampTTest…
5:1-PropZTest…
6:2-PropZTest…
7:ZInterval…
8:TInterval…
9↓2-SampZInt…
```

S05-10 Select the t interval.

```
TInterval
Inpt:Data Stats
List:L1
Freq:1
C-Level:.95
Calculate
```

S05-11 Select data and enter values.

```
TInterval
(205,232)
x̄=218
Sx=19
n=10
```

S05-12 The 95% confidence interval of the true mean is 205 < μ < 232.

Proportion confidence interval

A) A survey of 280 people found that 125 voted in the last election. Estimate the true proportion of voters with 95% confidence. B) A survey of 256 medical doctors found that 25% of them were women. Estimate the true proportion of women doctors with 95% confidence. (Convert the percentage to an integer to enter in "x")

STAT **TESTS,** pick **A**

```
EDIT CALC TESTS
0↑2-SampTInt…
A:1-PropZInt…
B:2-PropZInt…
C:χ²-Test…
D:χ²GOF-Test…
E:2-SampFTest…
F:LinRegTTest…
G:LinRegTInt…
H:ANOVA(
```

S05-13 Select the 1 proportion interval.

```
1-PropZInt
x:125
n:280
C-Level:.95
Calculate
```

S05-14 Enter the values.

```
1-PropZInt
(.388,.505)
p̂=.446
n=280.000
```

S05-15 With 95% confidence the percentage of voters is between 39% and 51%.

```
1-PropZInt
(.197,.303)
p̂=.250
n=256.000
```

S05-16 With 95% confidence the proportion of women doctors is between 20% and 30%.

Hypothesis testing

S06

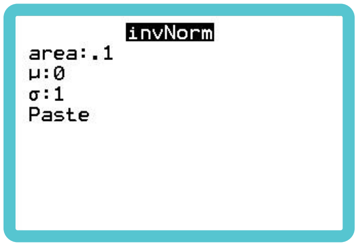
Obtain the z values for one tail α = .1 and one tail α = .025. Draw the plot for two tails α = .10.

	Ho true	Ho false
Do not reject Ho	Correct decision	Type II Error P(II) = β
Reject Ho (power)	Type I Error P(I) = α	Correct decision

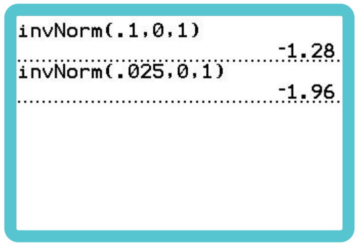
CRITICAL VALUES					
Confidence intervals	80%	90%	95%	98%	99%
One tail α	0.10	0.05	0.025	0.01	0.005
Two tails α	0.20	0.10	0.05	0.02	0.01
Z values	1.282	1.645	1.960	2.326	2.576

2ND DISTR VARS pick **3**

2ND DISTR VARS **DRAW**

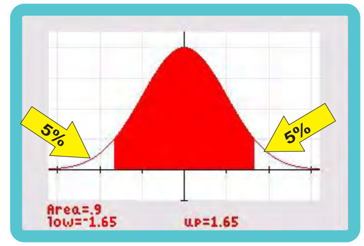


S06-1 Enter the values.



S06-2 Z values shown negative because they are on the left side.

S06-3 Enter the z values.



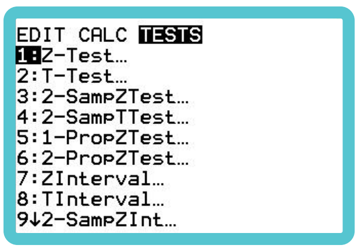
S06-4 Plot for 90% interval. Two tails α = .10

Hypothesis test for μ and z distribution, one tail

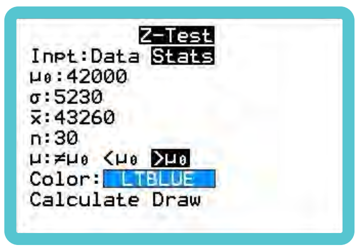
A group of 30 teachers mean salary is $43,260. At α = .05 test the claim that they earn more than the population mean of $42,000 with σ = $5,230. Show the plot.

STAT **TESTS,** pick **1**

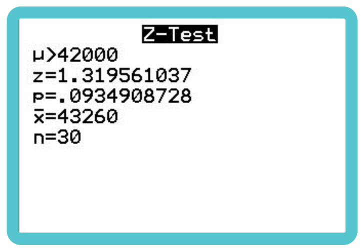
STAT **TESTS,** pick **7**



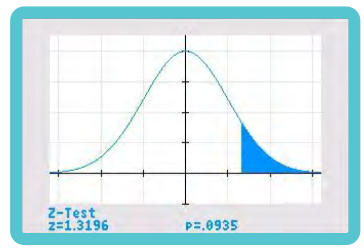
S06-5 Select the z test.



S06-6 Enter the stats values, select calculate. Then repeat and select draw.



S06-7 Do not reject the null hypothesis that μ = $42,000 because p > .05 or z < 1.65.

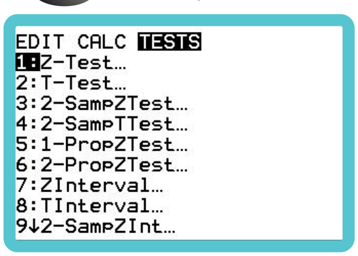


S06-8 Plot confirms the p and z values.

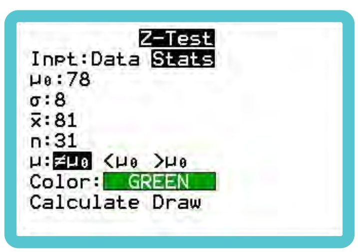
Hypothesis test for μ and z distribution, two tails

The mean May temperature in Pensacola is claimed to be 78°F with σ = 8°F. The average of 31 May 2013 measurements is 81°F. At α = .05 is there enough evidence to reject the claim?

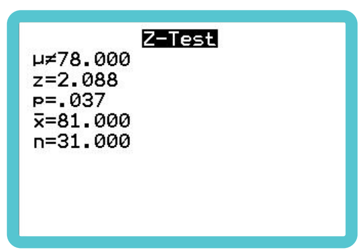
STAT **TEST,** pick 1



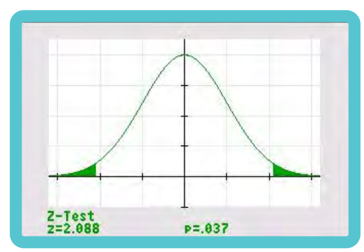
S06-9 Select the z test.



S06-10 Enter the values.



S06-11 Reject the claim that μ = 78°F because p < .05 or z > 1.96.



S06-12 Plot confirms the p and z values.

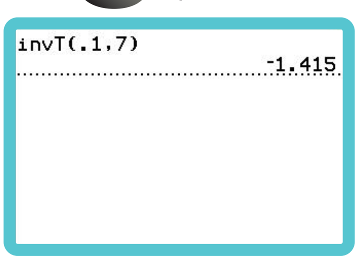
Hypothesis test for t distribution

A) A daycare worker claims her $60 a day pay is less than other daycare places in the state. L1 lists pay at 8 daycare places in the state. At α = .10 is there evidence to support the claim? Find the t test value.

2ND DISTR VARS pick **4**

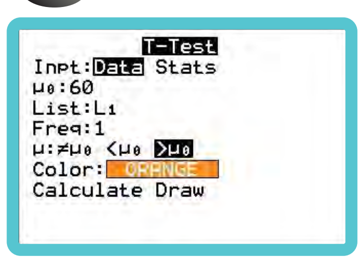
STAT **EDIT**

STAT **TEST,** pick 2

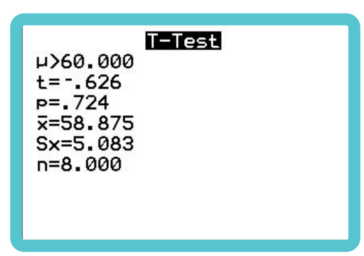


S06-13 Select inverse t and enter values. The t test value for α = .10 is -1.42.

S06-14 Enter the values.



S06-15 Select data and make entries as shown.



S06-16 Do not reject the claim. T is to the right of the test value and p > α.

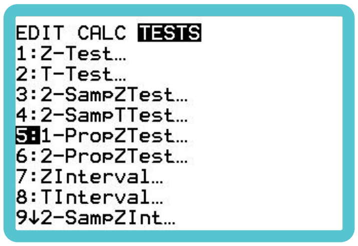
BM

Z test for a proportion

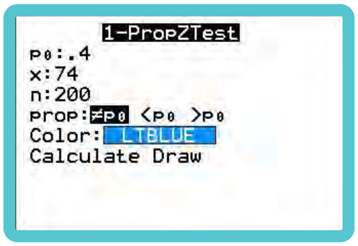
S07

A cable company estimates that 40% of its customers subscribe to telephone service. A sample of 200 customers found that 74 have telephone service. At α = .05, is there enough evidence to reject the estimate? Show the plot.

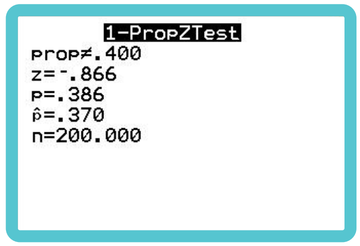
STAT **TESTS,** pick **5**



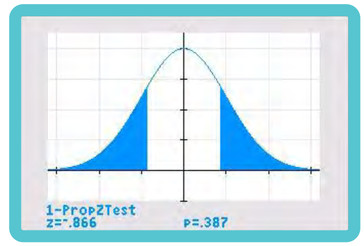
S07-1 Select one proportion z test.



S07-2 Enter the stats values, select calculate. Then repeat and select draw.



S07-3 Do not reject the estimate. z < 1.96 and p > .05.

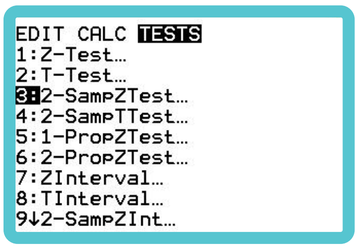


S07-4 Plot confirms the results.

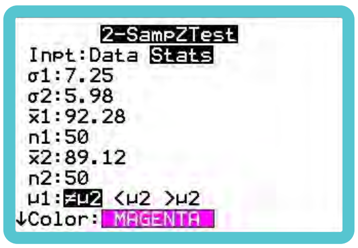
Difference between two means, z test

The average hotel room rate in Dallas is $92.28 at σ = $7.25. The average rate in Houston is $89.12 at σ = $5.98. At α = .05, are the rates significantly different? Show the plot.

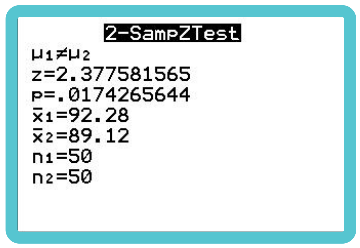
STAT **TESTS,** pick **3**



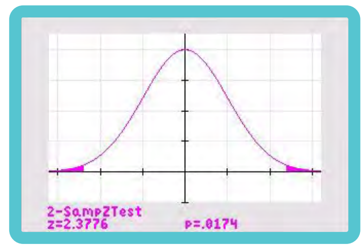
S07-5 Select the 2 sample z test.



S07-6 Enter the stats values, select calculate. Then repeat and select draw.



S07-7 There is significant difference between the rates because p < .05 or z > 1.96.

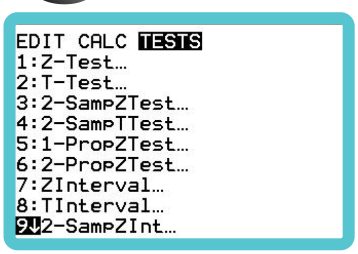


S06-8 Plot confirms the p and z values.

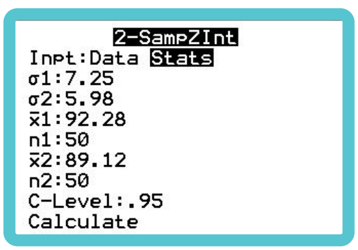
Interval between two means, z test

On the same problem above (S07-5...) find the 95% confidence interval between the two means. Repeat the calculation with 99% confidence.

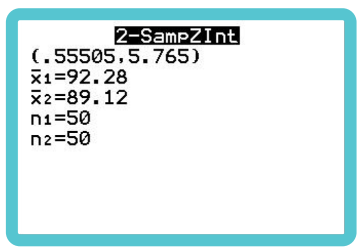
STAT **TEST,** pick **9**



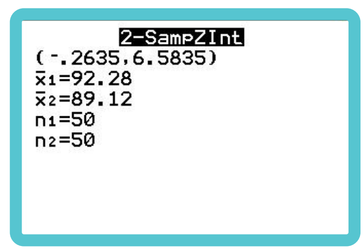
S07-9 Select the 2 sample z interval.



S07-10 Enter the values, first with .95 confidence level, then .99.



S07-11 With 95% confidence, the rates are different because "0" is not in the interval.



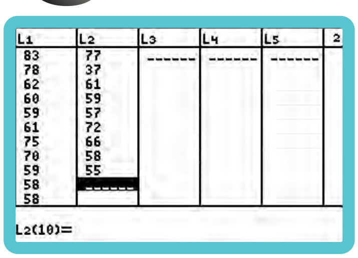
S07-12 With 99% confidence, the rates are not different because "0" is in the interval.

Difference between two means, t test

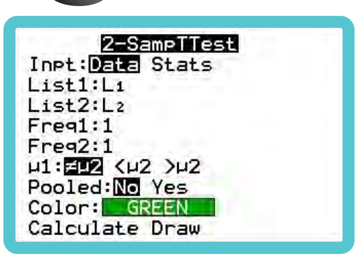
A sample of the highest scorers of the NHL Eastern Conference is listed in L1. Similarly for the Western Conference in L2. At α = .05. is there a difference in the means of these data? Show the plot.

STAT **EDIT**

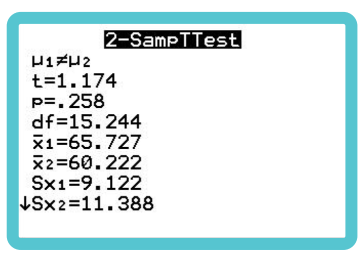
STAT **TEST,** pick **4**



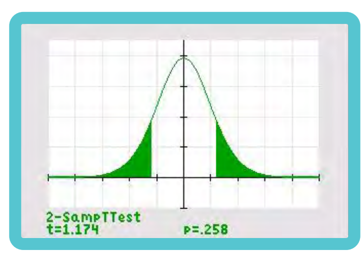
S07-13 Enter data.



S07-14 Select data. First calculate, then draw. Not pooled means the variances are not equal.



S07-15 At α = .05 it can not be concluded that the means are different. p value > .05



S07-16 Plot confirms the claim. Critical t value (from tables) is 2.37 > 1.17

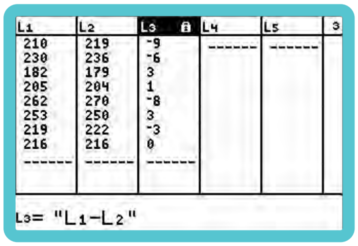
Difference of dependent samples, t test (or match pair test)

A new strength enhancing vitamin is tested in a group of athletes. The number of pounds they lift before (L1) and after (L2) is recorded. The difference is tabulated in L3. At α = .05 is there evidence that the athletes are stronger after taking the vitamin? Show the plot.

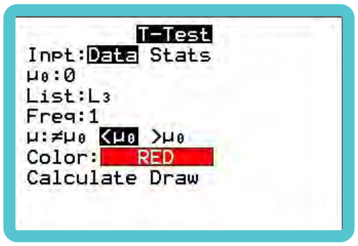
S08

STAT EDIT

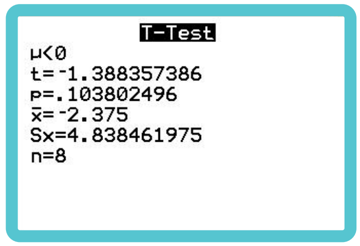
STAT TEST pick **2**



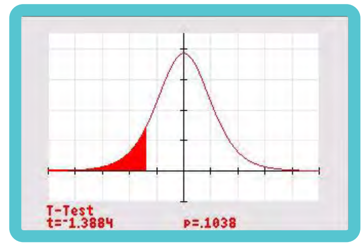
S08-1 Insert the data in L1 and L2. The formula in L3 gives the difference.



S08-2 Enter data, select calculate. Then repeat and select draw.



S08-3 Do not reject the null hypothesis. t < 1.89 (invT at 95% and df: 7) and p > .05.



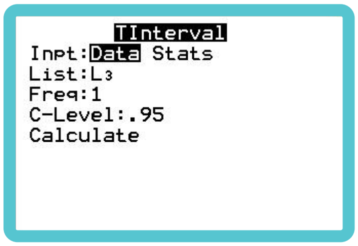
S08-4 Plot confirms the results. There is no difference before and after.

Interval between two means, t test

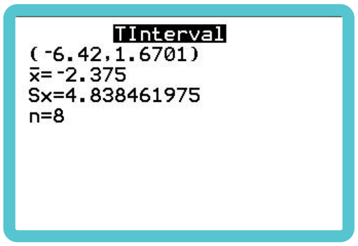
On the same problem above (S08-1...) find the confidence interval at 95% and at 75%.

STAT TESTS, pick **8**

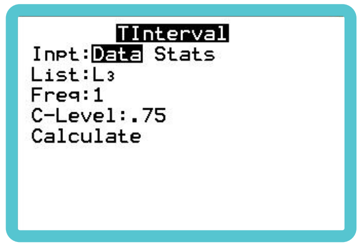
STAT TESTS, pick **8**



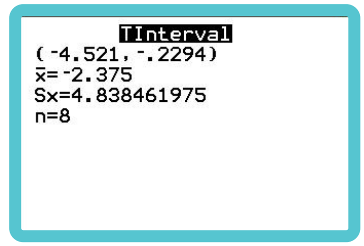
S08-5 Enter values, and 95% confidence.



S08-6 Zero is included in the interval. At 95% confidence there is no difference between the means.



S08-7 Enter values, and 75% confidence.

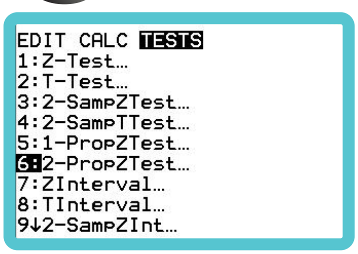


S08-8 Zero is not included in the interval. At 75% confidence it can be concluded that the means are different.

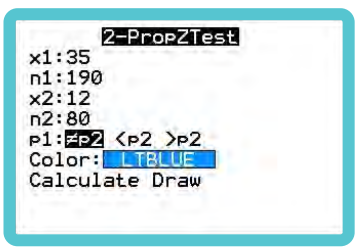
Difference between two proportions, z test

A company plant in the city reports 35 out of 190 workers missed work due to illness while at the plant in the countryside the proportion is 12 out of 80. At 95% confidence, is there a difference in illness absences between the two plants?

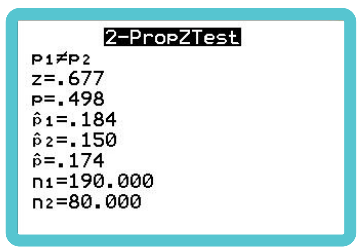
STAT TEST, pick **6**



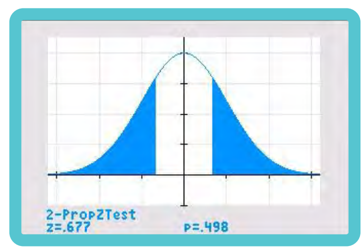
S08-9 Select the 2 proportion z test.



S08-10 Enter the values, first calculate, then draw.



S08-11 With 95% confidence, there is no difference between the two plants. z < 1.96 and p > .05.



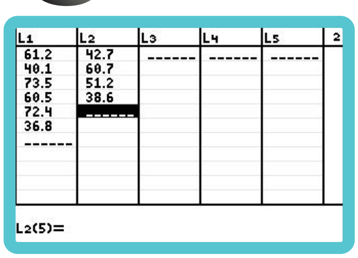
S08-12 The plot confirms the result

Difference between two variances, F test

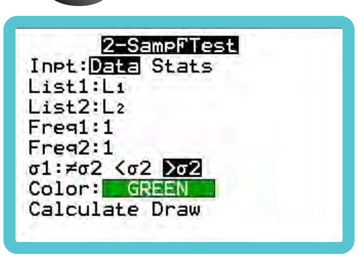
A business analysts claims that the variance in the number of passengers at bus stations in New York (L1, in thousands) is greater than the variance at bus stations in California (L2). At α = .10, is there enough evidence to support the claim?

STAT EDIT

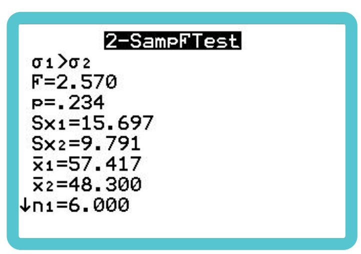
STAT TEST, pick **E**



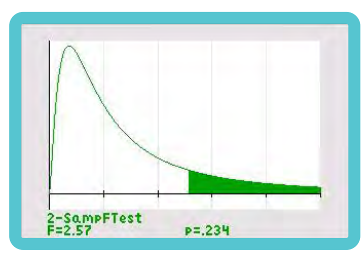
S08-13 Enter data.



S08-14 Select data. First calculate, then draw.



S08-15 At α = .10 it can not be concluded that the variances are different. p value > .10.



S08-16 Plot confirms that the claim is not supported. p value .234 > .10.

BM

χ^2 pdf distribution

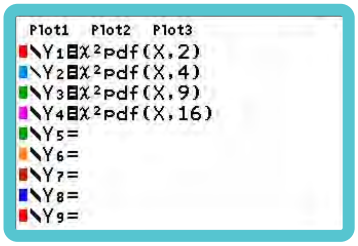
Plot the $\chi 2$ probability density function (pdf) distributions for the following degrees of freedom: 2, 4, 9, 16.

Y =

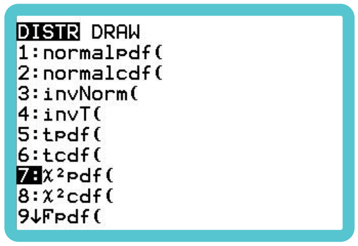
2ND DISTR VARS pick **7**

X,T,Θ,n

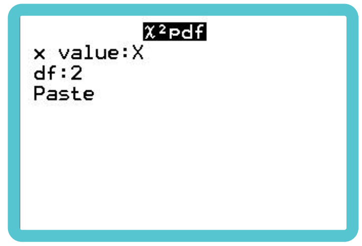
TRACE



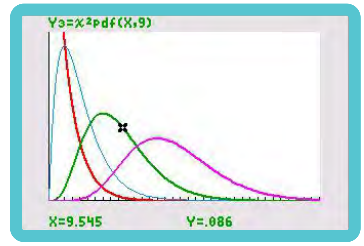
S09-1 Paste each function from the following S09-3 screen.



S09-2 Select the χ^2 pdf(



S09-3 Enter the independent variable X and the df value.



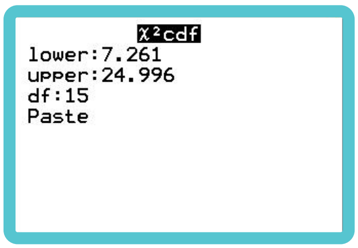
S09-4 Plots of χ^2 pdf at various degrees of freedom.

χ^2 cdf distribution probability

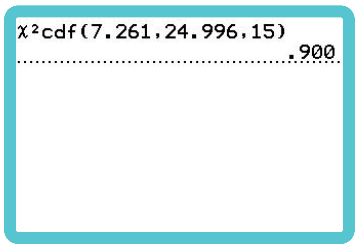
Find and plot the $\chi 2$ distribution probability between $\chi 2$ = 7.261 and $\chi 2$ = 24.996 with 15 degrees of freedom.

2ND DISTR VARS **DISTR** pick **8**

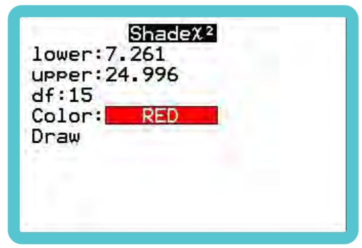
2ND DISTR VARS **DRAW** pick **3**



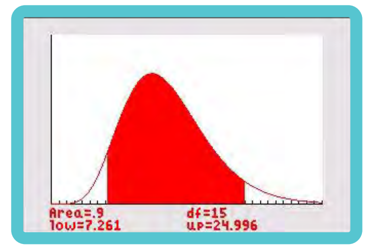
S09-5 Enter values.



S09-6 The values given provide a variance distribution probability of 90%.



S09-7 Enter the values.



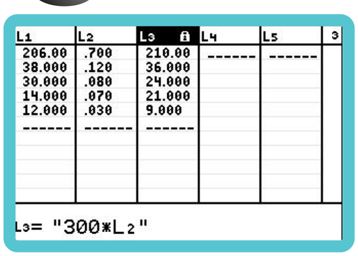
S09-8 $\chi 2$ distribution plot.

χ^2 GOF (goodness of fit) test

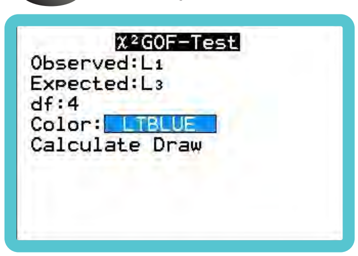
A survey of 300 flights found that 206 arrived on time and the rest were delayed: 38 (weather), 30 (system), 14 (crew) and 12 (maintenance). These are listed in L1. The related government percentages are listed on L2. With 90% certainty, test the claim that the survey and the government percentages are the same. Show the plot.

STAT **EDIT**

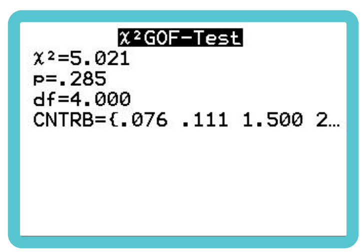
STAT **TEST** pick **D**



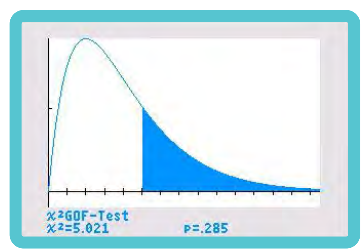
S09-9 Enter data.



S09-10 Enter the values, first calculate, then draw.



S09-11 With 90% confidence, there is no difference between the two statistics. p = .285 > .10.



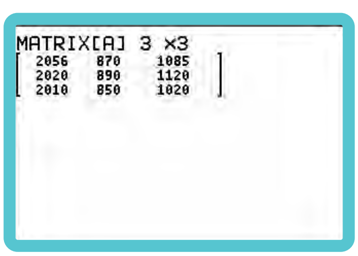
S09-12 The plot confirms the result.

χ^2 independence or homogeneity test

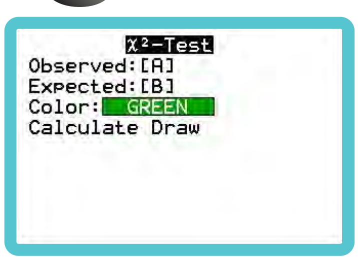
A store sells 3 types of music records: pop, classical and country. The manager keeps track of the sales during 3 consecutive years. The matrix columns correspond to the type of music and the rows to the yearly sales. With 90% confidence, is the music type sales related to the year?

2ND MATRIX x^{-1} **EDIT** pick **1**

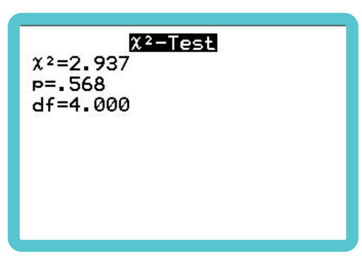
STAT **TEST,** pick **C**



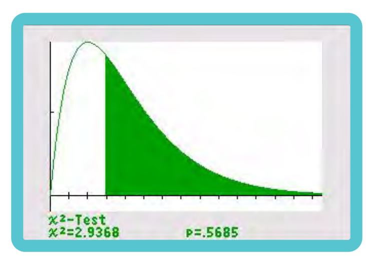
S09-13 Enter data on matrix [A].



S09-14 First calculate, then draw. Matrix [B] is generated automatically from [A].



S09-15 At α = .10 it can not be concluded that the sales vary by year. p value > .10.



S09-16 Plot confirms that there is no relation between sales and year. p value .568 > .10.

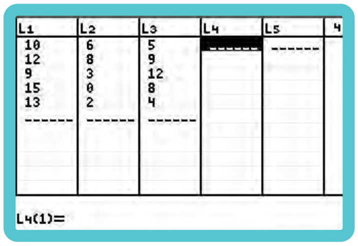
Analysis of variance (ANOVA)

S10

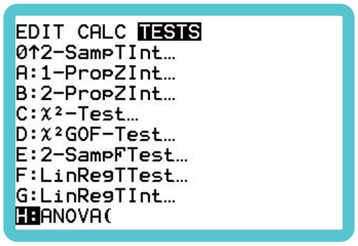
Three different blood pressure reduction medicines are tested on 3 random groups. The reductions are tabulated. At α = .05 test the claim that there is no difference among the means.

STAT **EDIT**

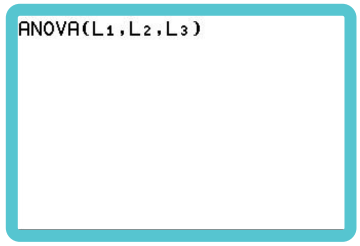
STAT **TEST** pick **H**



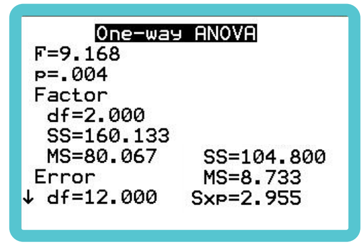
S10-1 Enter data.



S10-2 Select ANOVA.



S10-3 Enter the lists.



S10-4 There is evidence that the means are different. $p < .05$. (Lower screen shown on right side)

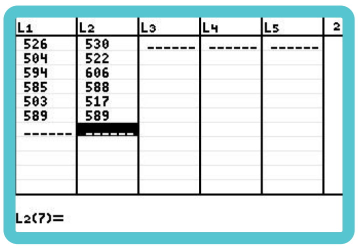
Regression and correlation T test

With 95% confidence, is there a correlation between verbal and math scores in SAT tests? Average verbal (L1) and math (L2) SAT scores from 6 states are listed.

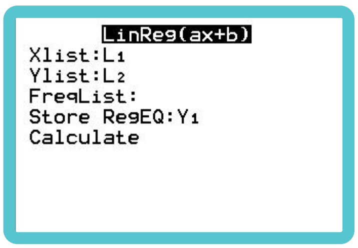
STAT **EDIT**

STAT **CALC** pick **4**

Y=

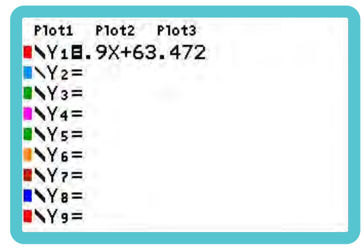


S10-5 Enter values.



S10-6 Enter the lists and Y1 equation.

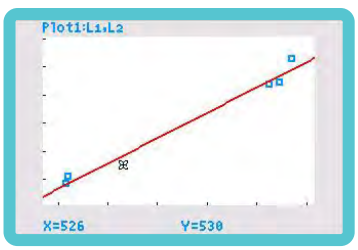
S10-7 Equation coefficients. r value close to 1, indicates strong correlation.



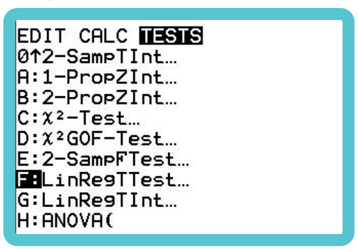
S10-8 Linear equation.

TRACE

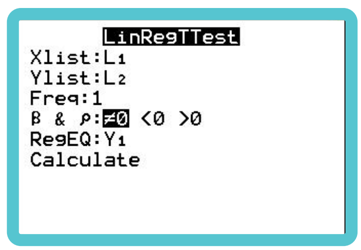
STAT **TEST** pick **F**



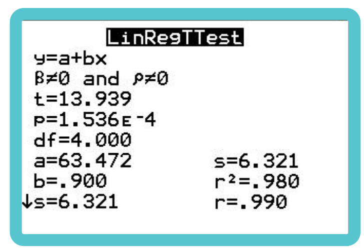
S10-9 Scatter and linear plot. (Follow steps similar to S01-9...)



S10-10 Select linear regression t test.



S10-11 Enter lists and Y1 equation. Hypothesis ρ = 0, would indicate no correlation.



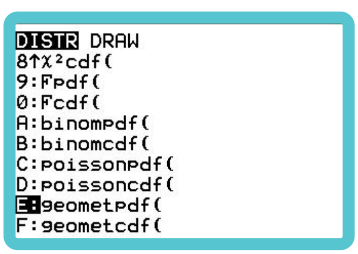
S10-12 The hypothesis is rejected. $p < .05$. There is a correlation between verbal and math scores.

Geometric distribution

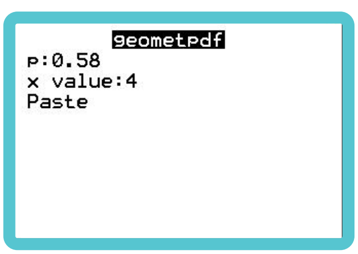
A basketball star player has an average of 58% on free throws. A) What is the probability that he will score on the fourth throw (not on the first 3)? B) What is the probability of scoring ONCE in the four throws?

2ND DISTR

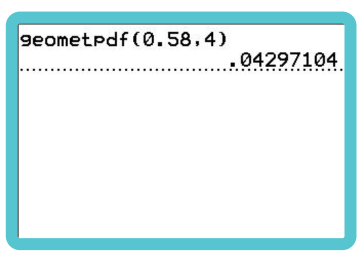
VARS pick **E**



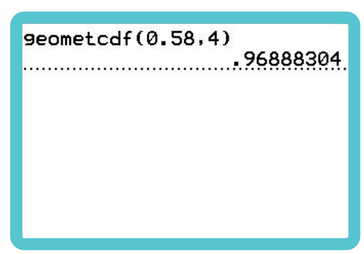
S10-13 On the DISTR menu, choose the geometric p distribution.



S10-14 Enter the values.



S10-15 The probability of scoring on the fourth throw is 4.3%.



S10-16 Choose DISTR **F**. The probability of scoring once in four throws is 97%.

BM

S11

Poisson probability distribution

2ND DISTR
VARS pick **C**

An insurance agency receives an average of 3 car accident claims a month. What is the probability of getting A) exactly 5 claims in one month, B) exactly 1 claim in two months?

```
DISTR DRAW
8↑χ²cdf(
9:Fpdf(
0:Fcdf(
A:binompdf(
B:binomcdf(
C:poissonpdf(
D:poissoncdf(
E:geometpdf(
F:geometcdf(
```

S11-1 Select poissonpdf.

```
poissonpdf
λ:3
x value:5
Paste
```

S11-2 Enter values.

```
poissonpdf(3,5)
                .10082
```

S11-3 The probability of 5 claims in one month is 10.1%.

```
poissonpdf(6,1)
                .01487
```

S11-4 The probability of 1 claim in two months is 1.5%. (λ = 3*2 = 6)

Poisson cumulative distribution

On the same problem above, what is the probability of receiving A) less than 2 claims in one month, B) 7 or more claims in three months?

2ND DISTR
VARS pick **D**

```
DISTR DRAW
8↑χ²cdf(
9:Fpdf(
0:Fcdf(
A:binompdf(
B:binomcdf(
C:poissonpdf(
D:poissoncdf(
E:geometpdf(
F:geometcdf(
```

S11-5 Select poissoncdf.

```
poissoncdf
λ:3
x value:1
Paste
```

S11-6 Enter values.

```
poissoncdf(3,1)
                .19915
```

S11-7 The probability of less than 2 claims in a month is 19.9%.

```
poissoncdf(9,6)
                .20678
1-.20678
                .79322
```

S11-8 The probability of 7 or more claims in 3 months is 79.3%.

χ^2 test for population σ

A national bank says the standard deviation of customer waiting times should be no more than 3 minutes. On a bank branch a sample of 25 customers shows σ = 4 minutes. At α= 0.05, is this unusual?

2ND DISTR
VARS pick **8**

$$\frac{(25-1)4^2}{3^2}$$
```
                42.667
```

S11-9 Use the formula $\chi^2 = (n-1)s^2/\sigma^2$.

```
DISTR DRAW
1:normalpdf(
2:normalcdf(
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7:χ²pdf(
8:χ²cdf(
9↓Fpdf(
```

S11-10 Choose χ^2 cumulative distribution.

```
χ²cdf
lower:0
upper:42.667
df:24
Paste
```

S11-11 Enter the χ^2 and degrees of freedom.

```
χ²cdf(0,42.667,24)
                .989
1-.989
                .011
```

S11-12 P value is 0.011 < α. Therefore the branch waiting time standard deviation is unusual.

Hypergeometric distribution

A class of 18 boys and 11 girls wants to set a commitee of 3 students selected at random. What are the probabilities of selecting a) no girls, b) one girl, c) two girls or d) three girls.

ALPHA STATPLOT F1
Y= pick **1**

ALPHA TABLESET F2
WINDOW pick **8**

```
1:abs(
2:summation Σ(
3:nDeriv(
4:fnInt(
5:logBASE(
6:ˣ√
7:nPr
8:nCr
9:!
FRAC FUNC MTRX YVAR
```

S11-13 Select the fraction and combination templates, as shown.

$$\frac{{}_{\square}C_{\square} * {}_{\square}C_{\square}}{{}_{\square}C_{\square}}$$

S11-14 The product of two combinations over one.

$$\frac{{}_{11}C_0 * {}_{18}C_3}{{}_{29}C_3} \quad .223$$
$$\frac{{}_{11}C_1 * {}_{18}C_2}{{}_{29}C_3} \quad .461$$

S11-15 Fill the values. P(no girls)=0.223, P(one girl)=0.461.

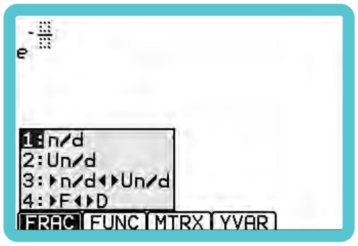
$$\frac{{}_{11}C_2 * {}_{18}C_1}{{}_{29}C_3} \quad .271$$
$$\frac{{}_{11}C_3 * {}_{18}C_0}{{}_{29}C_3} \quad .045$$

S11-16 P(two girls)=0.271, P(three girls)=0.045.

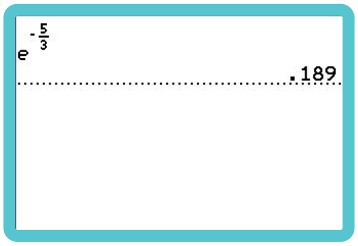
Exponential probability distribution

2ND e^x LN ALPHA STATPLOT F1 Y= pick **1**

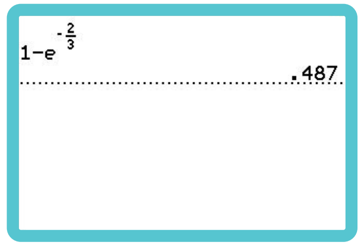
A brand of light bulbs has a mean life of 3 months. What is the propability that it will last: a) more than 5 months? b) less than 2 months c) between 4 and 7 months?



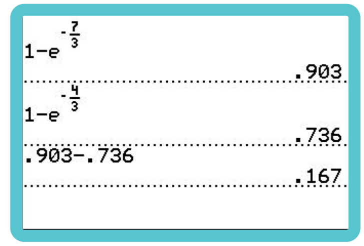
S12-1 Use the formula: P(>x) = e^-(x/μ)



S12-2 Enter values. Probability that it will last more than 5 months is 19%.



S12-3 The probability of lasting less than 2 months is 49%.

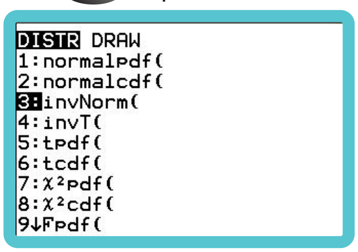


S12-4 The probability of lasting between 4 and 7 months is 17%.

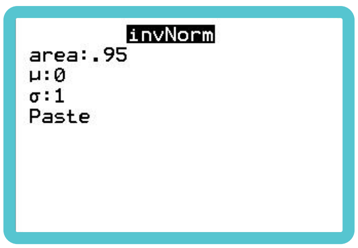
Sample size for population proportion estimate

2ND DISTR VARS pick **3**

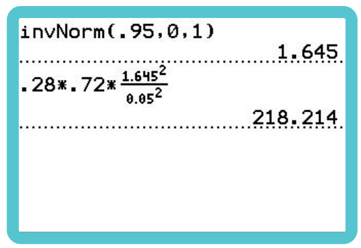
A previous estimate shows 28% of adult men ride motorcycles. a) How many should be sampled to estimate the population proportion with 90% confidence and 5% error? b) If there was no previous estimate?



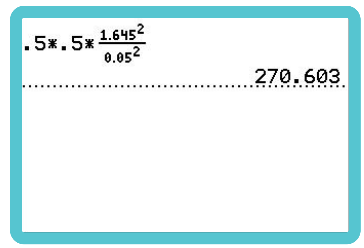
S12-5 To find the z value select the invNorm distribution.



S12-6 Area = 0.95 (1 tail)



S12-7 Use the formula: p*q*(z/E)^2. Sample 219 men.

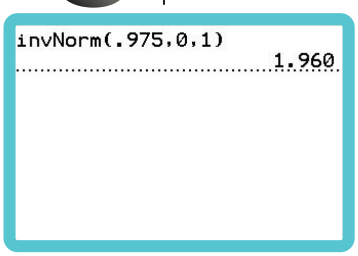


S12-8 For unknown p, use p = 0.5. Sample 271 men.

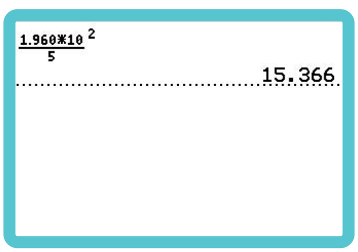
Sample size for population estimate

2ND DISTR VARS pick **3**

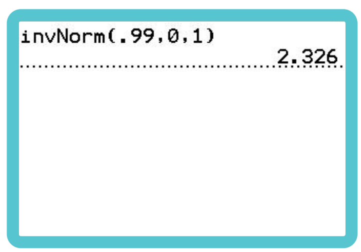
A large company wants to determine their employee's average commuting time. Known σ = 10 minutes. What sample size should be used to estimate it with a) 95% confidence and 5 minutes margin of error? b) 98% and 3 minutes?



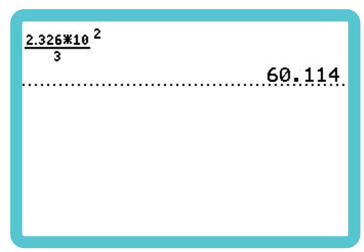
S12-9 Find the z value for 95% confidence. Area = 0.975 (1 tail).



S12-10 Use the formula: n = (z*σ/E)^2. Sample 16 employees.



S12-11 Find the z value for 98% confidence. Area = 0.99



S12-12 Sample 61 employees.

FINANCE APPLICATIONS

Financing a car

A new car's price is $15,200. What are the monthly payments if the interest rate is 5.5% and the car is to be paid in 3 years. Display the results on a graph and table.

APPS **FINANCE,** pick **1** — **PMT** ALPHA ENTRY SOLVE ENTER

```
CALC VARS
1:TVM Solver…
2:tvm_Pmt
3:tvm_I%
4:tvm_PV
5:tvm_N
6:tvm_FV
7:npv(
8:irr(
9↓bal(
```

F01-1 Select finance and TVM solver.

```
N=0.00
I%=0.00
PV=0.00
PMT=0.00
FV=0.00
P/Y=1.00
C/Y=1.00
PMT:END BEGIN
```

F01-2 TVM solver screen.

```
N=36
I%=5.5
PV=15200
PMT=0
FV=0
P/Y=12
C/Y=12
PMT:END BEGIN
```

F01-3 Enter the values. Leave payment and future values at 0.

```
N=36.00
I%=5.50
PV=15200.00
▪PMT=-458.98   ← PAYMENT
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

F01-4 Move cursor to PMT and solve. The monthly payment is $458.98.

MODE

```
MATHPRINT CLASSIC
NORMAL SCI ENG
FLOAT 0 1 2 3 4 5 6 7 8 9
RADIAN DEGREE
FUNCTION PARAMETRIC POLAR SEQ
THICK DOT-THICK THIN DOT-THIN
SEQUENTIAL SIMUL
REAL a+bi re^(θi)
FULL HORIZONTAL GRAPH-TABLE
FRACTION TYPE: n/d Un/d
ANSWERS: AUTO DEC FRAC-APPROX
GO TO 2ND FORMAT GRAPH: NO YES
STAT DIAGNOSTICS: OFF ON
STAT WIZARDS: ON OFF
SET CLOCK 05/14/14 8:50AM
```

F01-5 Set mode to parametric and graph-table.

Y= X,T,Θ,n

```
Plot1 Plot2 Plot3
\X1T ▪T
 Y1T ▪bal(T)
\X2T =
 Y2T =
\X3T =
 Y3T =
\X4T =
 Y4T =
\X5T =
```

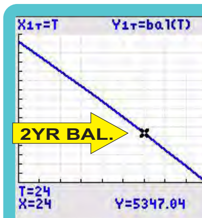
F01-6 Enter values as shown. "bal(" is on Finance... CALC-9, see F01-1 above.

WINDOW

```
WINDOW
Tmin=0
Tmax=36
Tstep=4
Xmin=0
Xmax=36
Xscl=4
Ymin=0
Ymax=16000
Yscl=1000
```

F01-7 Enter window settings as shown.

TRACE



X1T	Y1T
0.00	15200
4.00	13632
8.00	12035
12.00	10409
16.00	8752.2
20.00	7065.2
24.00	5347.0
28.00	3597.2
32.00	1815.0
36.00	-.08
40.00	-1849

F01-8 Plot and balance table at 4 month intervals.

Compound interest

What are the monthly payments if you want to accumulate $500,000 in 40 years at 6% interest? Show a plot and table, and determine the value in 30 years.

APPS **FINANCE,** pick **1**

```
N=480.00
I%=6.00
PV=0.00
PMT=0
FV=-500000.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

F01-9 Enter values. Leave PV and PMT at 0.

PMT ALPHA ENTRY SOLVE ENTER

```
N=480.00
I%=6.00
PV=0.00
▪PMT=249.82   ← PAYMENT
FV=-500000.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

F01-10 Solve for payment.

WINDOW

```
WINDOW
Tmin=0
Tmax=480
Tstep=12
Xmin=0
Xmax=480
Xscl=50
Ymin=0
Ymax=500000
Yscl=50000
```

F01-11 Window settings.

TRACE

X1T	Y1T
324.00	201492
336.00	217001
348.00	233467
360.00	250948
372.00	269508
384.00	289212
396.00	310132
408.00	332342
420.00	355921
432.00	380955
444.00	407534

F01-12 Plot and accumulated value table.

Annuity - Savings

A) An annuity is funded with $300,000 at an interest rate of 4.5%. For how many years will it provide $1,800 monthly payments until the fund is exhausted? B) What is the value of $2,500 at 6.5% after 8 years?

APPS **FINANCE,** pick **1**

```
N=0
I%=4.50
PV=300000.00
PMT=-1800.00
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

F01-13 Enter data.

N ALPHA ENTRY SOLVE ENTER

```
▪N=260.39   ← 21Y 8M
I%=4.50
PV=300000.00
PMT=-1800.00
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

F01-14 Solve for the number of periods.

APPS **FINANCE,** pick **1**

```
N=96.00
I%=6.50
PV=-2500.00
PMT=0.00
FV=0
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

F01-15 Enter data.

FV ALPHA ENTRY SOLVE ENTER

```
N=96.00
I%=6.50
PV=-2500.00
PMT=0.00
▪FV=4199.17   ← VAL. AT 8 Y
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

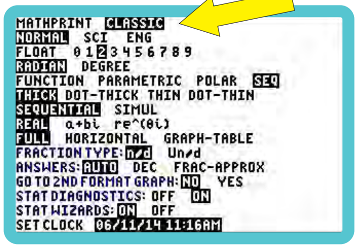
F01-16 Solve for future value.

Cash flow calculation

F02

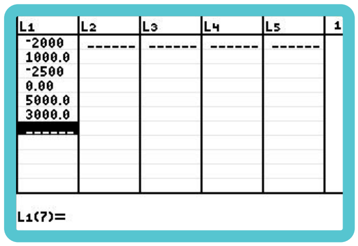
A business reports the following cash in and out transactions over equal time periods: -2100, -2000, 1000, -2500, 0, 5000, 3000. Calculate the npv (net present value) at I = 6% and the irr (internal rate of return).

MODE



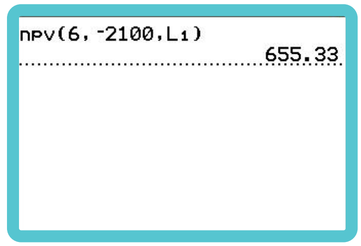
F02-1 On Mode, select classic style.

STAT **EDIT**



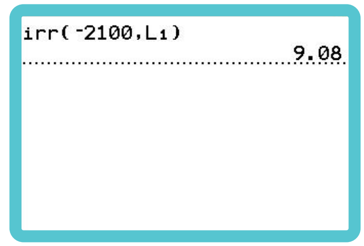
F02-2 On L1, enter the transactions except the first one.

APPS **FINANCE,** pick **1, 7**



F02-3 Enter the interest, the first transaction and L1.

APPS **FINANCE,** pick **1, 8**

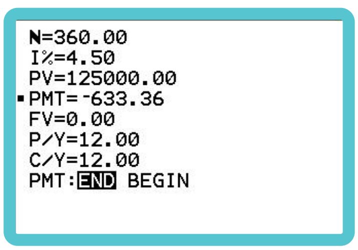


F02-4 Enter the first transaction and L1. 9.08 is the interest at which the present value is zero.

Amortization

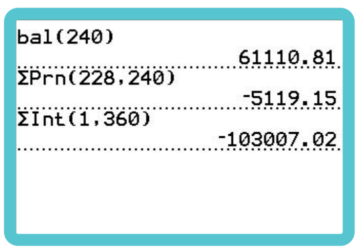
A house costing $125,000 is amortized for 30 years at 4.5% interest.
Show the plot and table. Calculate the following:
a) The monthly payments.
b) The balance in 20 years.
c) The sum of the contributions to the principal during the 19th year.
d) The total interest paid during the 30 years.

APPS **1** **PMT** ALPHA ENTRY SOLVE **ENTER**



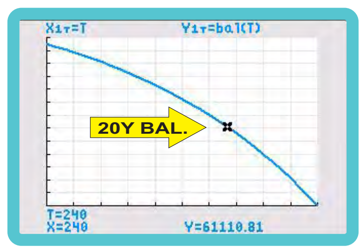
F02-5 Solve for payment, $633.36.

APPS **1 - 9 - A - B**



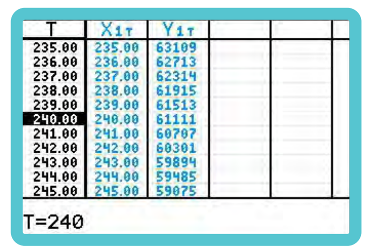
F02-6 Enter the payment numbers on each function. Balance at 20 years, $61,110.81. 19th year contribution to principal, $5,119.15. Total interest paid, $103,007.02.

TRACE



F02-7 Follow similar steps as F01-5...

2ND TABLE F5 **GRAPH**



F02-8 Table set to start at 235, ΔT = 1.