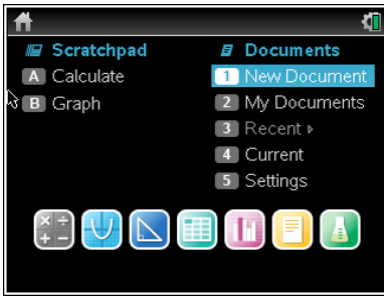


# A P S T A T I S T I C S

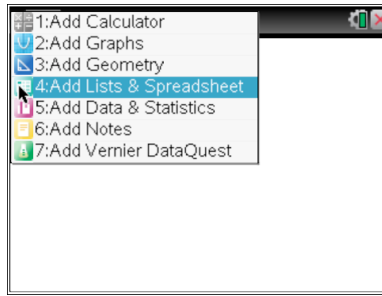
## TI-*n*spire **CX** *Calculator Skills*



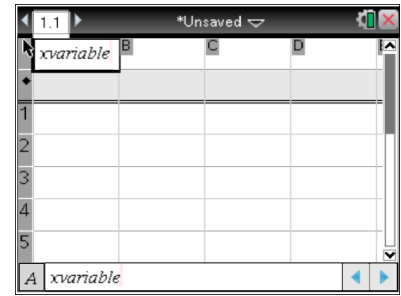
## Entering Data Lists



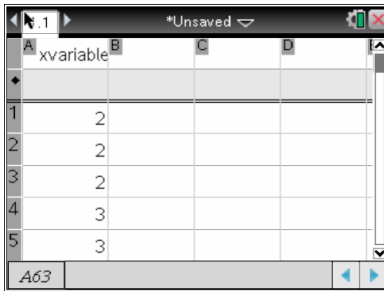
1. Open a New Document or use scratchpad 'A'



2. Add Lists & Spreadsheet

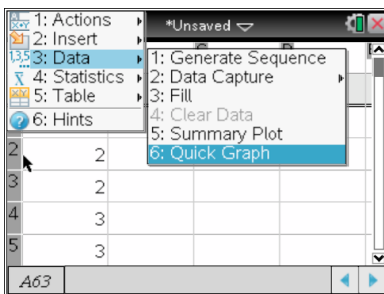


3. Name the data list. Use 'name' for categorical data

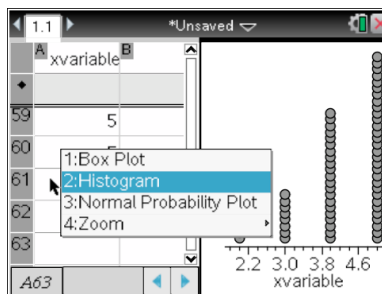


4. Input the data

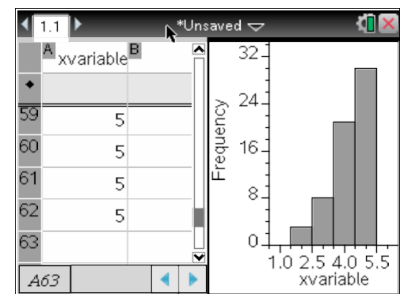
## Creating a Single Histogram / Boxplot (Quantitative Data)



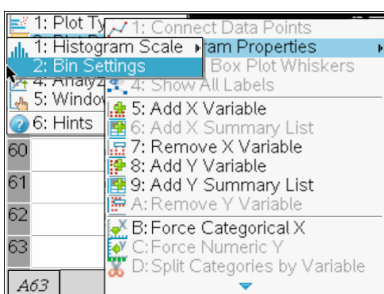
1. Menu: Data: Quick Graph



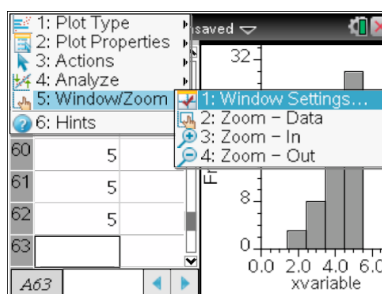
2. Right-click (Ctrl Menu): Histogram (Boxplot could be created at this stage)



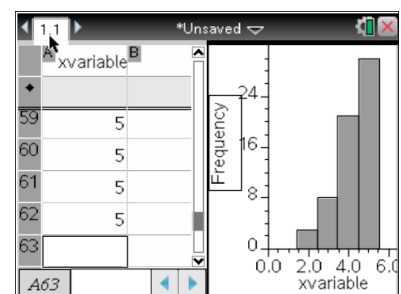
3. Adjust bin width by click and dragging a bar or..



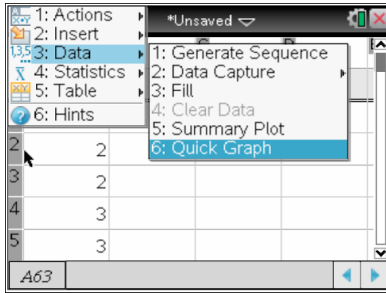
4. Click in graph: menu: Plot Properties: Histogram Properties: Bin Settings



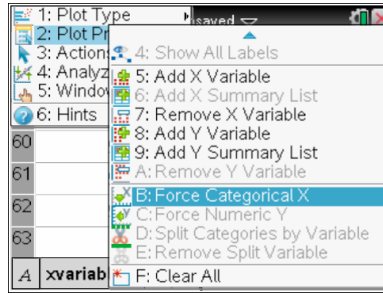
5. Adjust x-axis scale by clicking graph: menu: Window/Zoom



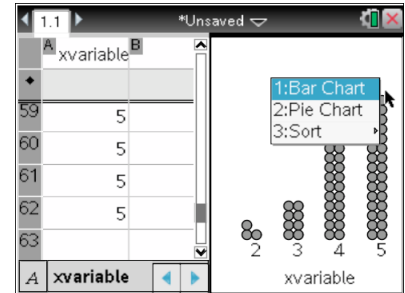
## Creating a Single Bar Chart (Categorical Data)



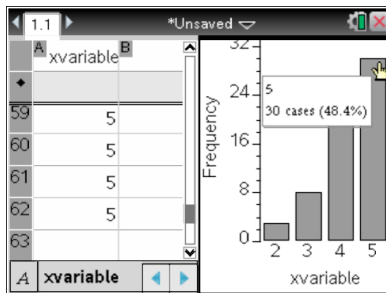
1. Menu: Data: Quick Graph



2. Menu: Plot Properties:  
Force Categorical X



3. Click in graph: Right-click:  
Bar Chart



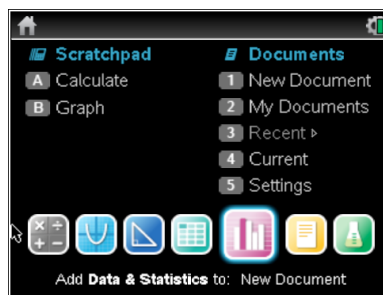
4. Trace over bars for details

## Creating Multiple Boxplots / Histograms

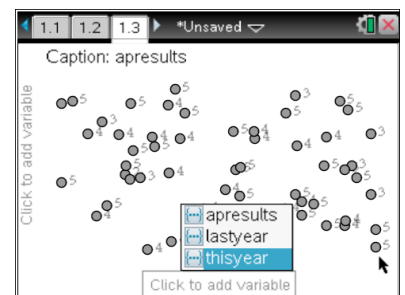
A screenshot of a data table with columns A, B, C, and D. Column A is labeled 'thisyear' and column B is labeled 'lastyear'. The data is as follows:

	A thisyear	B lastyear	C	D
1	2	1		
2	2	2		
3	2	3		
4	3	3		
5	3	3		

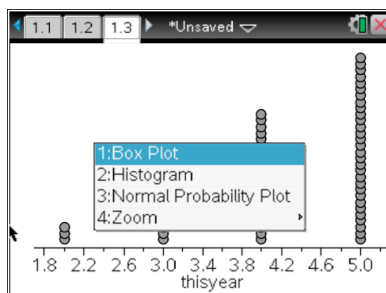
1. Begin with named data list(s)



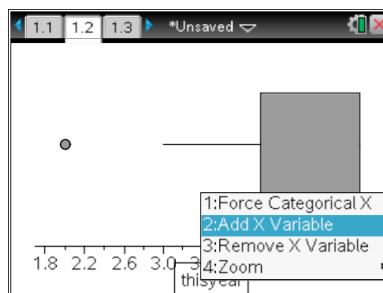
2. Home: Add Data & Stats



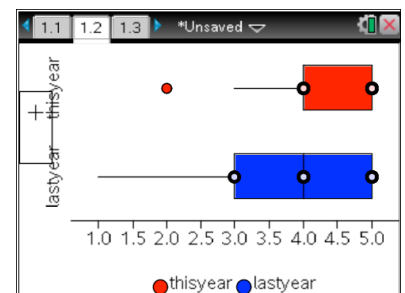
3. Click and add variable



4. Click in graph: Right click: Box Plot  
(Histogram could be created at this stage)

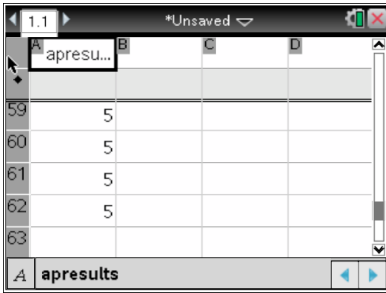


5. Click and add variable for more than  
one boxplot

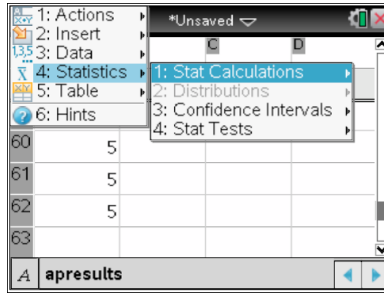


6. Color can be added by right-clicking  
in each boxplot

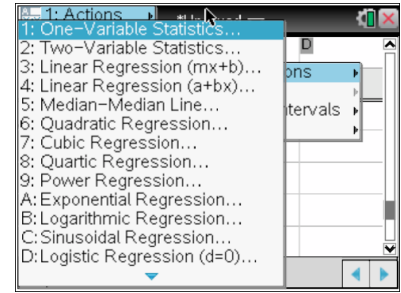
# Obtaining Summary Statistics



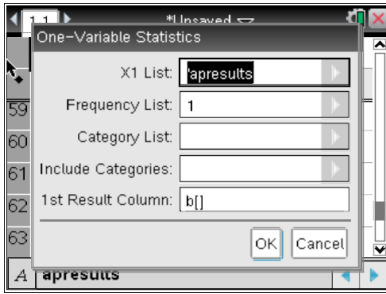
1. Begin with named data list



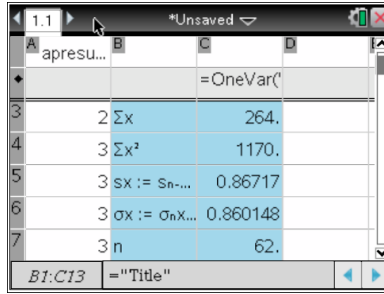
2. Menu: Statistics: Stats Calculations



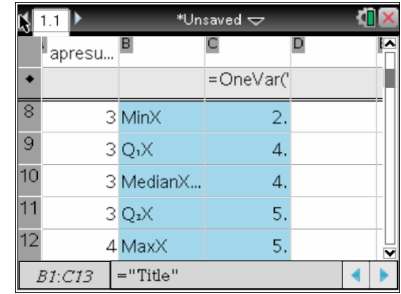
3. One-Variable Statistics



4. Choose list

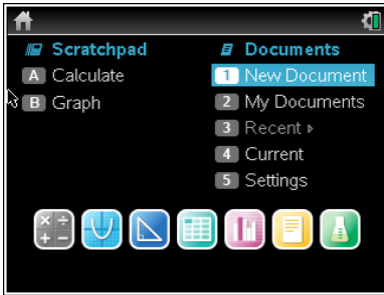


5. Scroll to top of list to view summary statistics

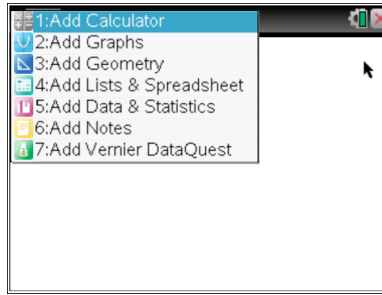


6. Scroll down list to view '5-number summary'

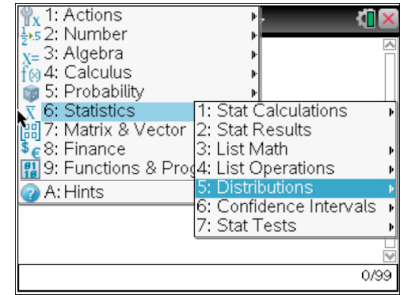
# The Normal Distribution: Area Under A Normal Curve (Calculating Probability Between Two Boundaries)



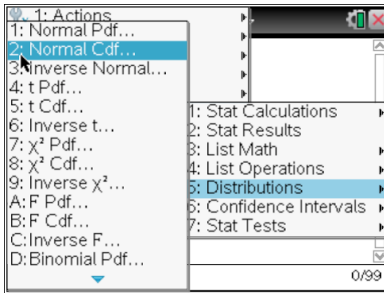
1. Open a New Document or use scratchpad 'A'



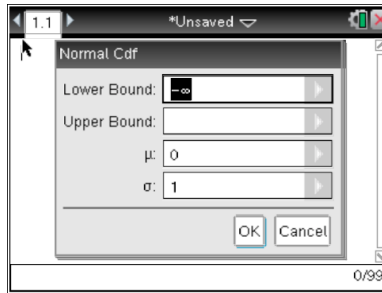
2. Add Calculator



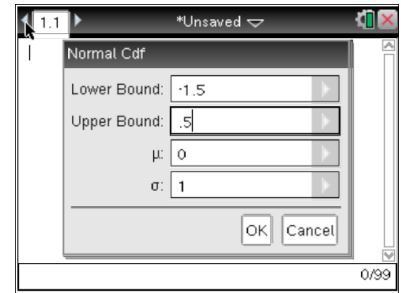
3. Menu: Statistics: Distributions



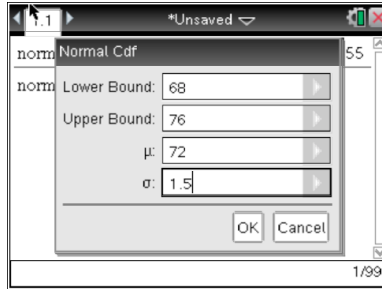
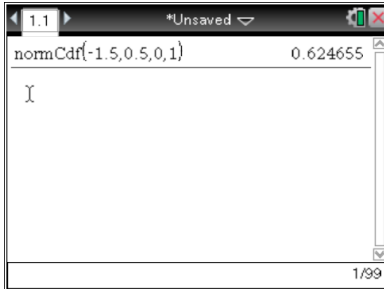
4. Normal CDF



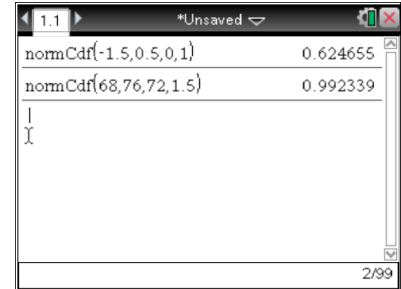
5. Enter Lower and Upper Bounds.



6. If using 'z-scores' leave  $\mu = 0$  and  $\sigma = 1$

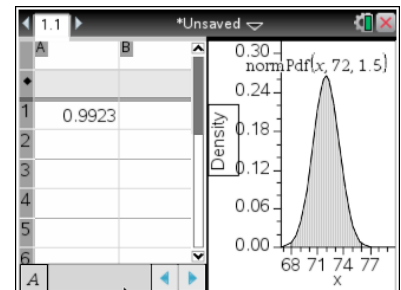
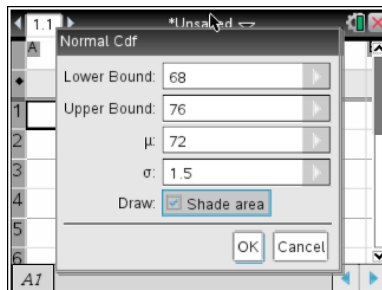


7. If calculating directly, input  $\mu$  and  $\sigma$

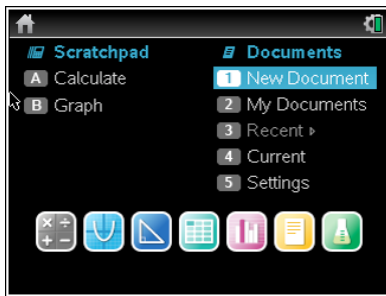


\* To obtain a graph of the Distribution, perform the required calculation on a "List & Spreadsheets" page instead of a "Calculator" page.

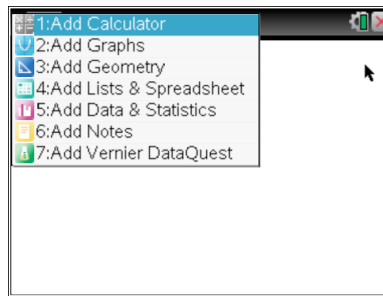
Check the "Shade Area" box.



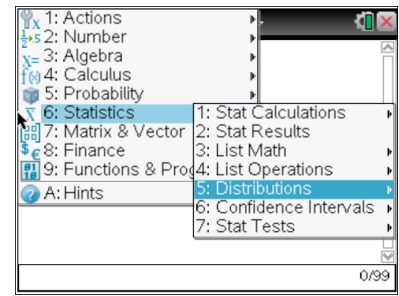
## The Normal Distribution: Inverse Normal (Calculating Percentiles Given Probability)



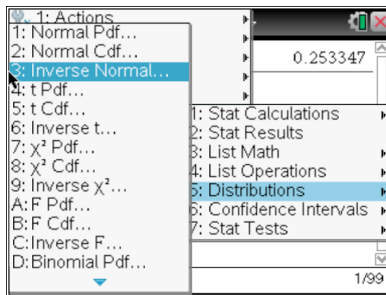
1. Open a New Document or use scratchpad 'A'



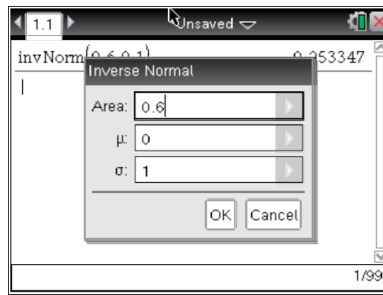
2. Add Calculator



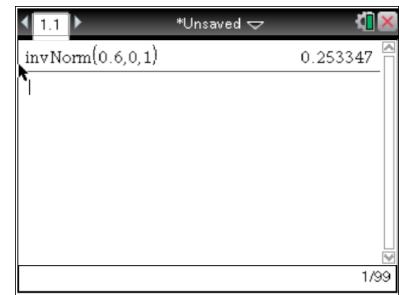
3. Menu: Statistics: Distributions



4. Inverse Normal



5. Enter Area (Probability)  
(and  $\mu$  &  $\sigma$  if necessary)

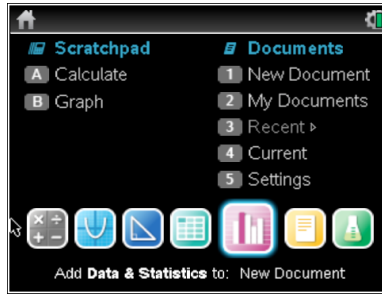


Note that **Area is always measured from the extreme left-hand side.**

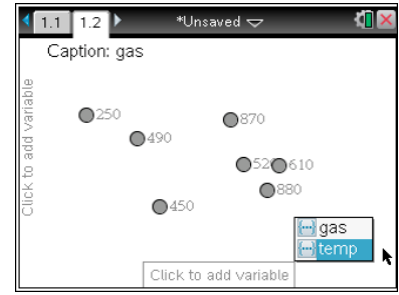
## Bivariate Data: Producing a Scatter Plot

	temp	gas
1	49.4	520
2	38.2	610
3	27.2	870
4	28.6	850
5	29.5	880

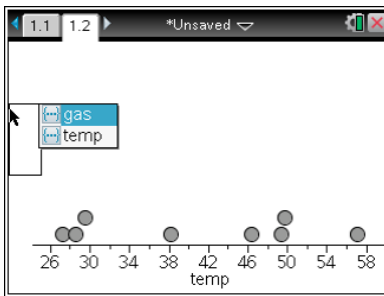
1. Begin with named data lists



2. Home: Add Data & Stats

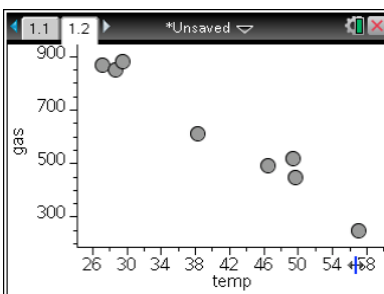


3. Click and add x-variable

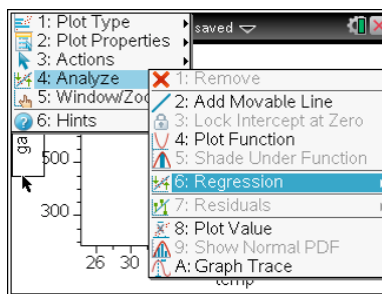


4. Click and add y-variable

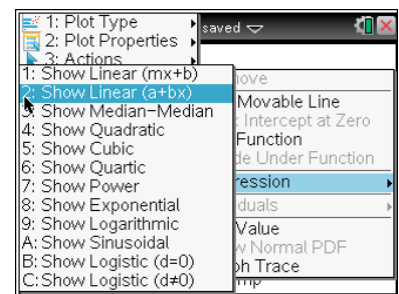
## Bivariate Data: Graphing Least-Squares Regression Line



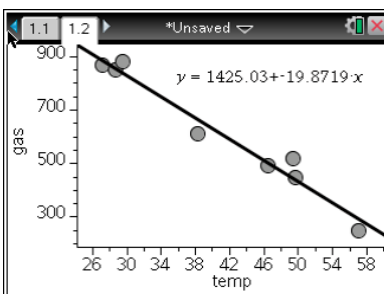
1. Begin with scatterplot



2. Menu: Analyze: Regression



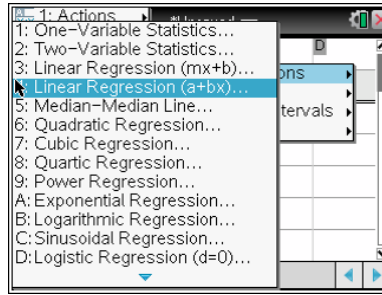
3. Show Linear (a+bx)



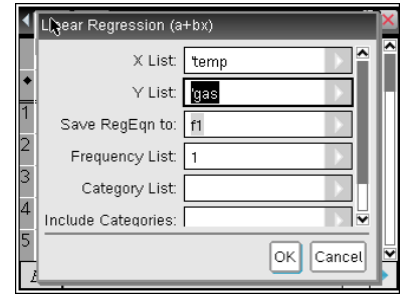
## Bivariate Data: Linear Regression

	temp	gas
1	49.4	520
2	38.2	610
3	27.2	870
4	28.6	850
5	29.5	880

1. Begin with named data lists



2. Menu: Stat Calculations:  
Linear Regression (a+bx)

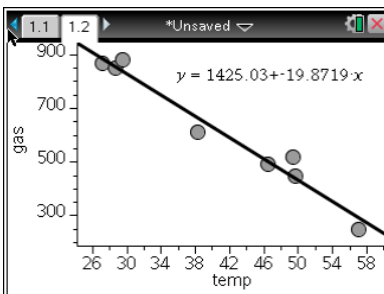


3. Enter appropriate x and y variables

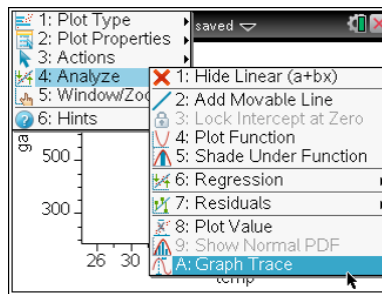
	850 b	-19.8719
5	880 r <sup>2</sup>	0.965633
6	490 r	-0.982666
7	450 Resid	4080516
8	250	

4. Scroll down to access r, r<sup>2</sup>, and residuals

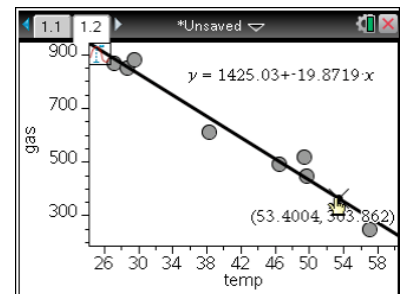
## Bivariate Data: Interpolating Data



1. Begin with Scatterplot with linear regression

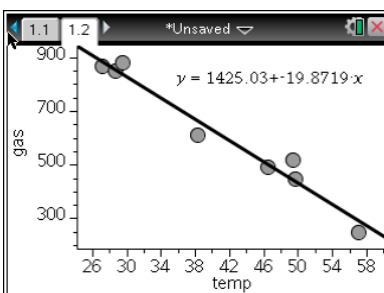


2. Menu: Analyze: Graph Trace

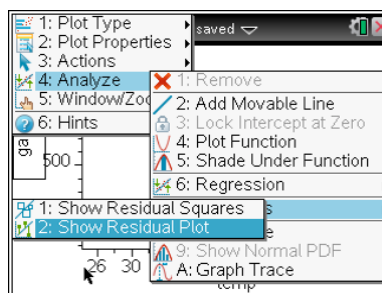


3. Move pointer along graph to interpolate

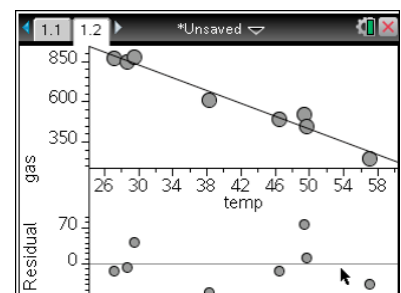
## Bivariate Data: Producing a Residual Plot



1. Begin with a Scatterplot with linear regression previously calculated on the 'Lists & Spreadsheets' page

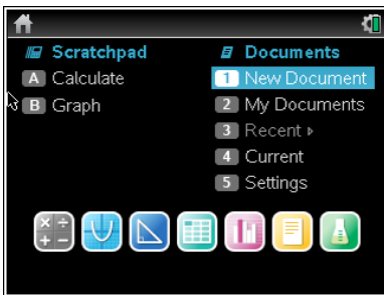


2. Menu: Analyze: Residuals:  
Show Residual Plot

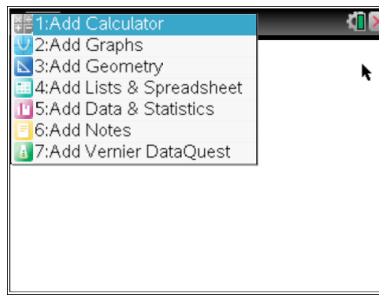




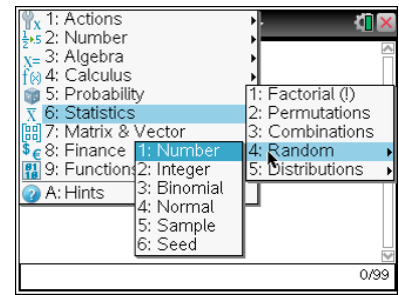
## Generating Random Numbers



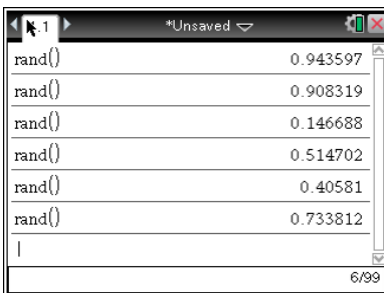
1. Open a New Document or use scratchpad 'A'



2. Add Calculator



3. Menu: Statistics: Random Number: Enter

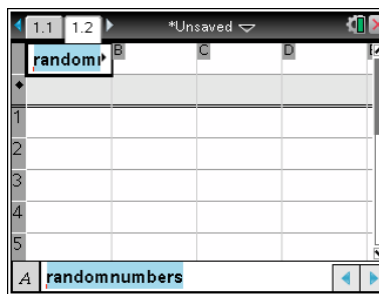


4. Repeat "Enter" for a new random number

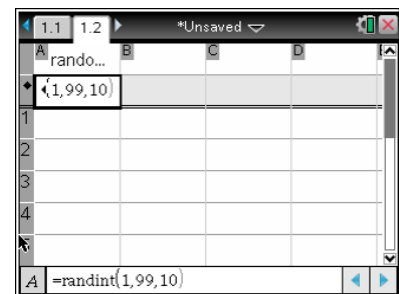
## Creating a List of Random Integers



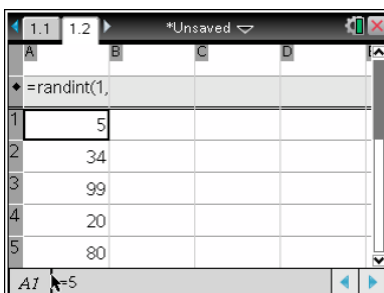
1. Home: Add Lists & Spreadsheet



2. Name the data list.



3. Type " $=\text{randint}(\text{low}, \text{high}, \# \text{ of trials})$ ", then Enter



## Creating a Random Sample From a List of Data

	A	B	C	D
		populat...		
1		1		
2		2		
3		3		
4		4		
5		5		

Formula bar: A population

1. Begin with a named data list

	A	B	C	D
		populat...		
1		=		
2		1		
3		2		
4		3		
5		4		

Formula bar: B =

2. Double click in the next list formula cell

	A	B	C	D
		populat...		
1		=rand samp		
2		1		
3		2		
4		3		
5		4		

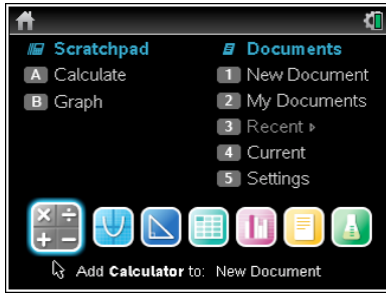
Formula bar: B =rand samp(population, 4)

3. Type “=rand samp(list, # of trials)”, then Enter

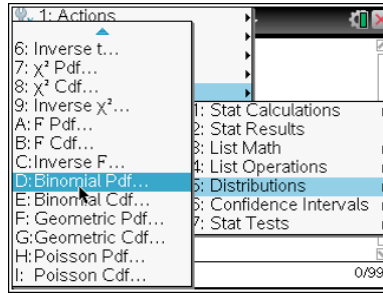
	A	B	C	D
		populat...		
1		=rand sam		
1		1	40	
2		2	20	
3		3	99	
4		4	9	
5		5		

Formula bar: B1 =40

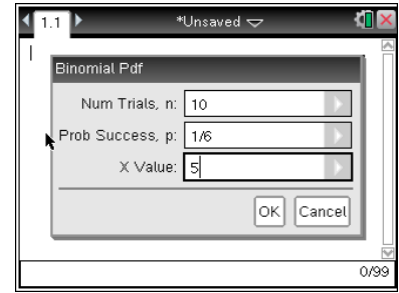
## The Binomial Distribution: $P(x) = k$ (Exactly $k$ successes)



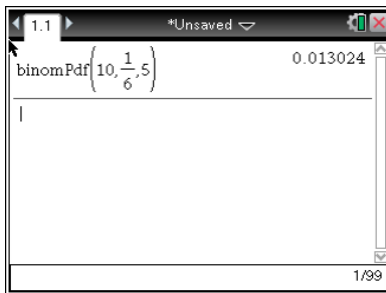
1. Home: Add Calculator



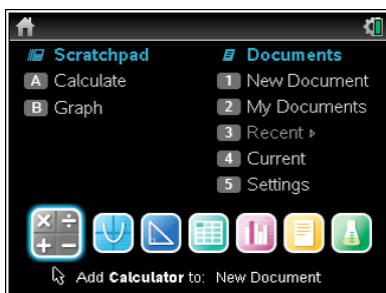
2. Menu: Probability: Distributions: BinomialPdf



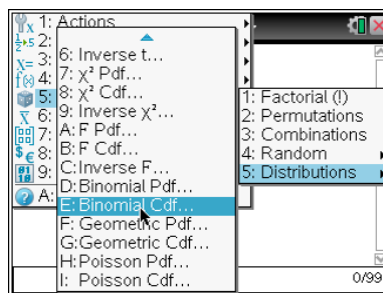
3. Input the appropriate values for problem



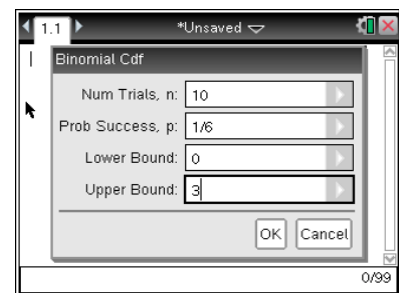
## The Binomial Distribution: $P(x) \leq k$ ( $k$ or fewer successes)



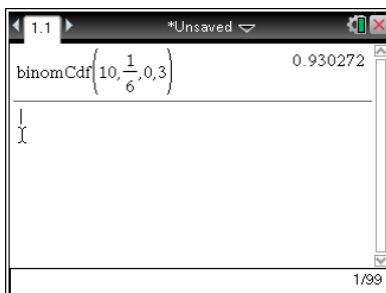
1. Home: Add Calculator



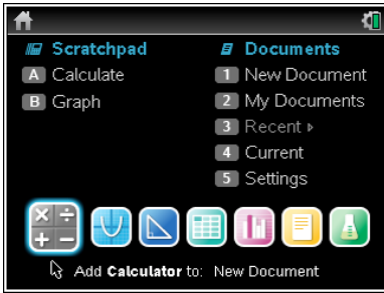
2. Menu: Probability: Distributions: BinomialCdf



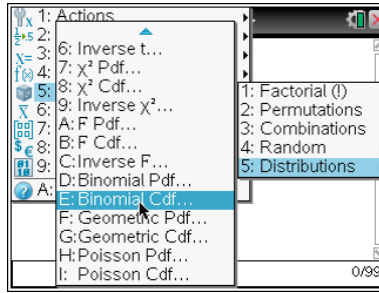
3. Input the appropriate values for problem (Lower bound = 0)



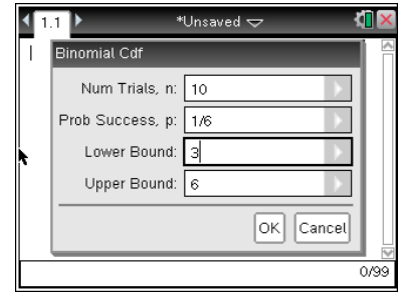
## The Binomial Distribution: $k_{low} < P(x) \leq k_{high}$



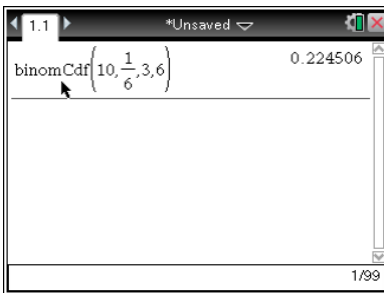
1. Home: Add Calculator



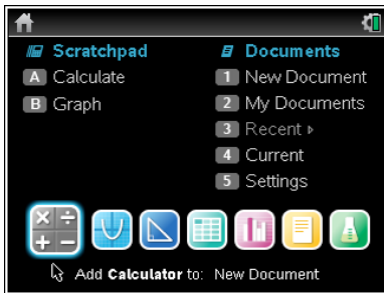
2. Menu: Probability: Distributions: BinomialCdf



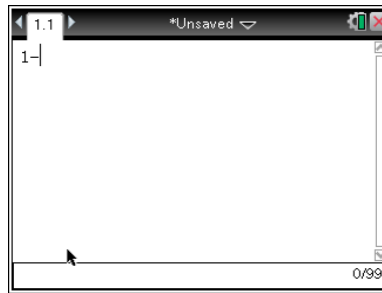
3. Input the appropriate values for problem



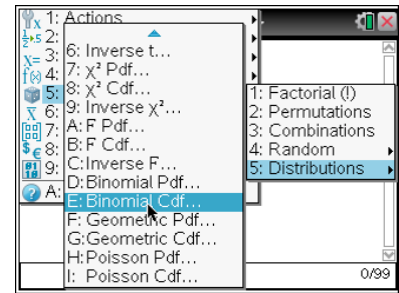
## The Binomial Distribution: $P(x) > k$ (More than $k$ successes)



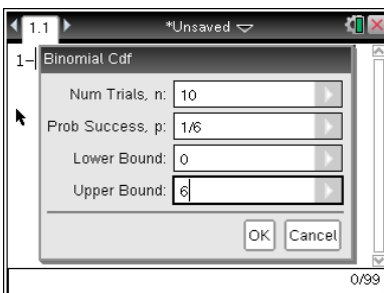
1. Home: Add Calculator



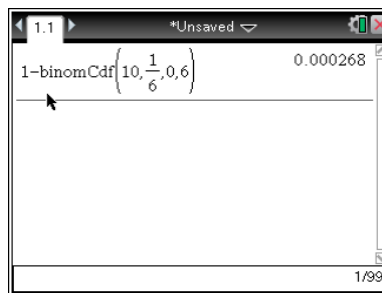
2. "1 -"



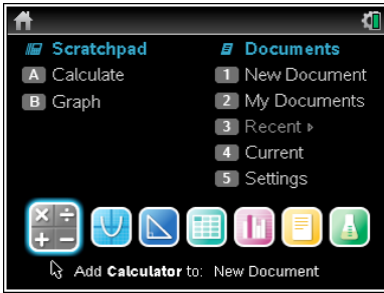
3. Menu: Probability: Distributions: BinomialCdf



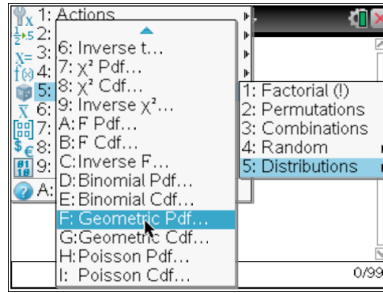
4. Input the appropriate values for problem (Lower bound = 0)



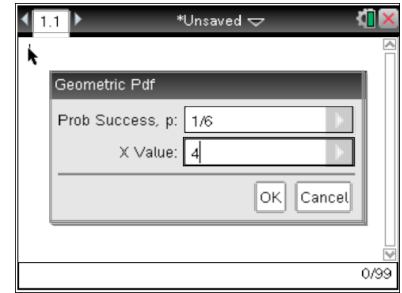
## The Geometric Distribution: First Success on $n$ th Trial



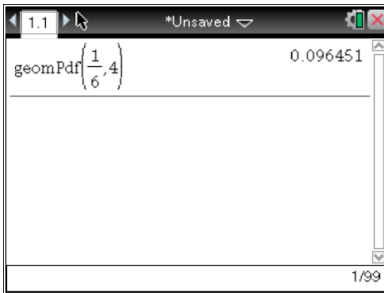
1. Home: Add Calculator



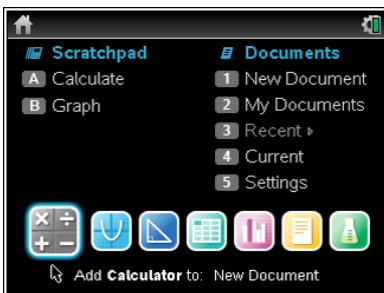
2. Menu: Probability: Distributions: GeometricPdf



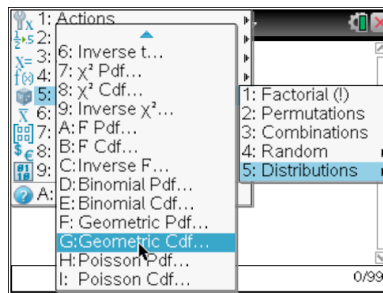
3. Input the appropriate values for problem



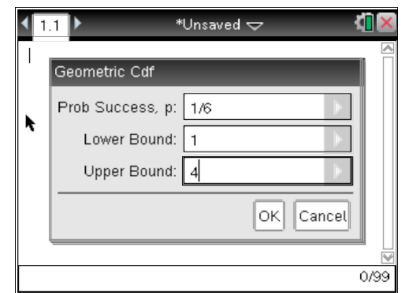
## The Geometric Distribution: First Success On or Before $n$ th Trial



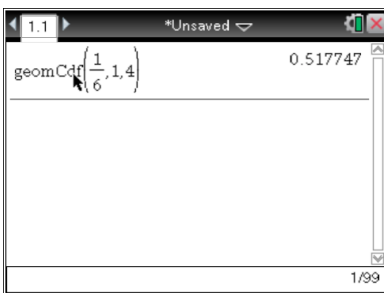
1. Home: Add Calculator



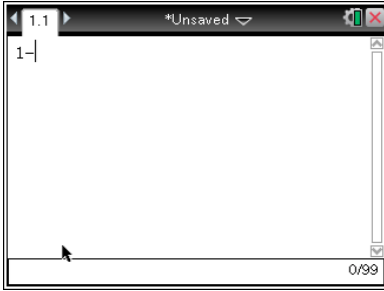
2. Menu: Probability: Distributions: GeometricCdf



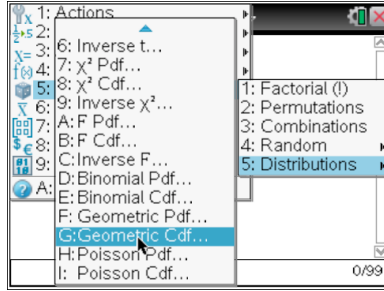
3. Input the appropriate values for problem



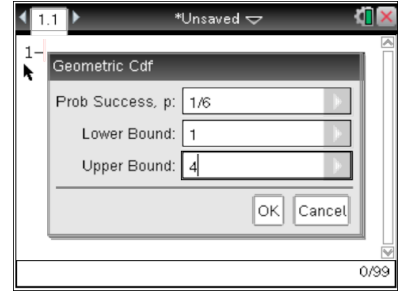
# The Geometric Distribution: First Success After the $n$ th Trial



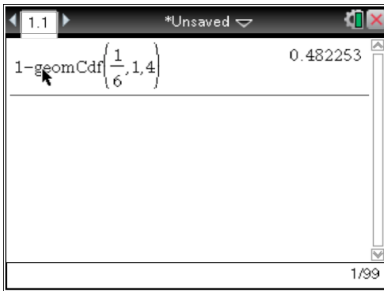
1. "1 - "



2. Menu: Probability: Distributions: GeometricCdf



3. Input the appropriate values for problem

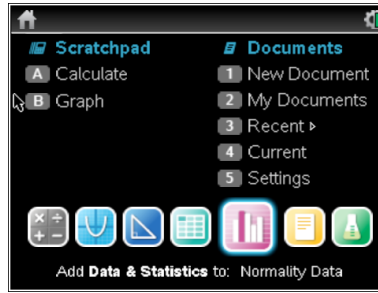


1/99

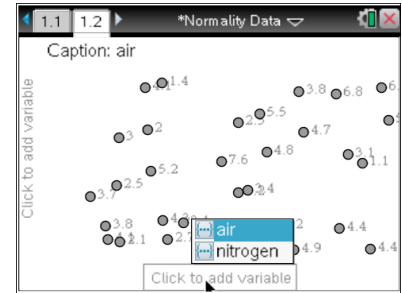
## Assessing Normality of Data: Normal Probability Plot

	air	nitrogen
1	7.6	7.2
2	3.8	2.5
3	3.7	1.6
4	4.7	1.5
5	2.1	1

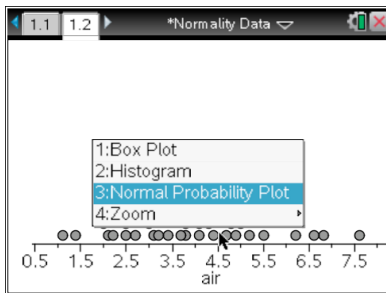
1. Begin with named data list



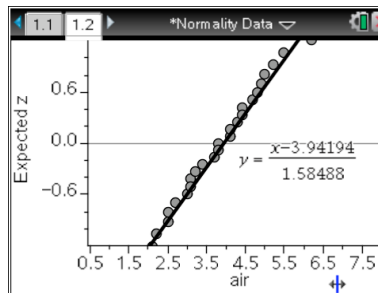
2. Home: Add Data & Statistics



3. Click and choose variable



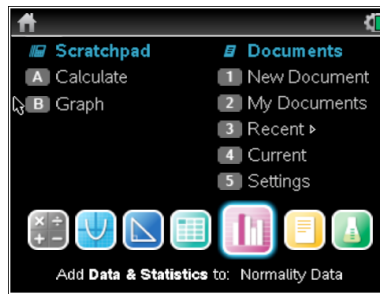
4. Right-click (Ctrl Menu): Normal Probability Plot



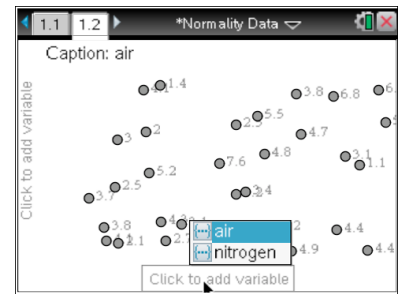
# Assessing Normality of Data: Comparing Histogram with Normal Probability Density Function

	air	nitrogen
1	7.6	7.2
2	3.8	2.5
3	3.7	1.6
4	4.7	1.5
5	2.1	1

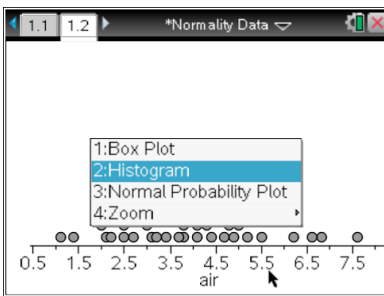
1. Begin with named data list



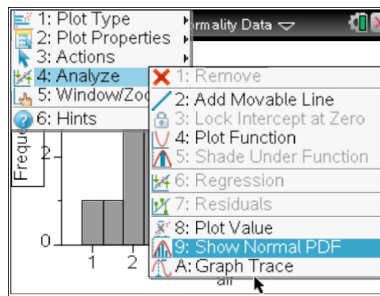
2. Home: Add Data & Statistics



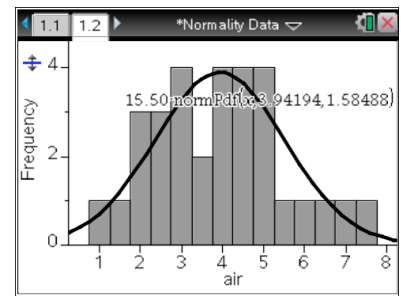
3. Click and choose variable



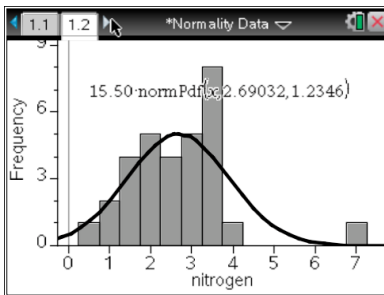
4. Right-click (Ctrl Menu):Histogram



5. Menu: Analyze: Show Normal PDF



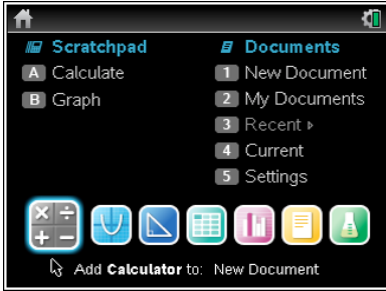
6. Overlays a normal prob. density curve based on  $\bar{x}$  and  $s$  for the given data



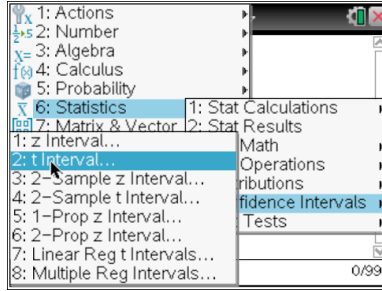
Comparison can be made to assess how 'normal' the data may be



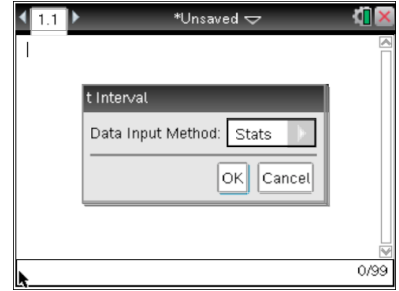
## Confidence Interval For Population Mean: (Known Statistics)



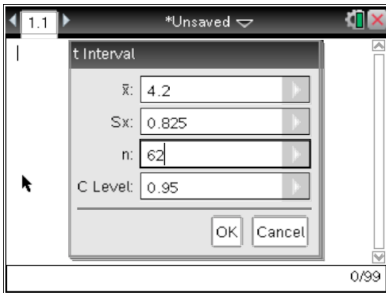
1. Home: Add Calculator: or use scratchpad 'A'



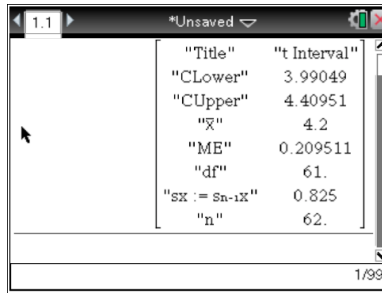
2. Menu: Statistics:  
Confidence Intervals: t Interval



3. Choose 'Stats' as Data Input Method



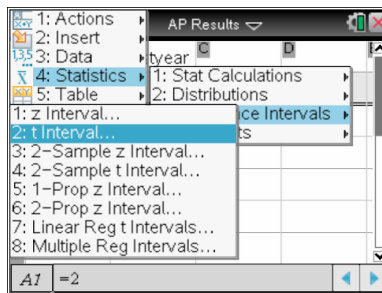
4. Enter the appropriate statistics for the problem



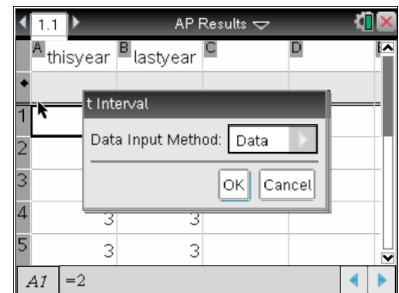
## Confidence Interval For Population Mean: (From Original Data)



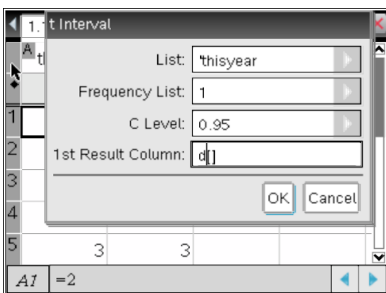
1. Home: Add Calculator: or use scratchpad 'A'



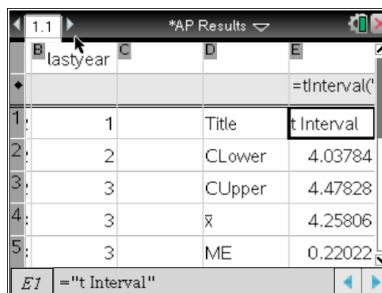
2. Menu: Statistics:  
Confidence Intervals: t Interval



3. Choose 'Data' as Data Input Method



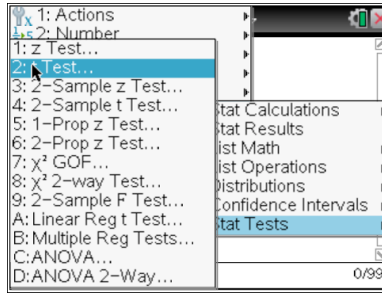
4. Enter the appropriate information for the problem



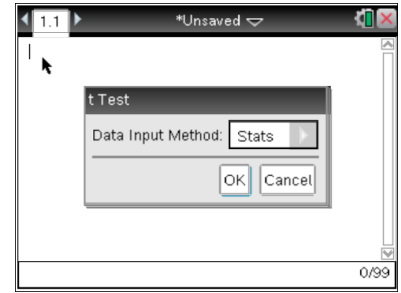
## Significance Test For Population Mean: (Known Statistics)



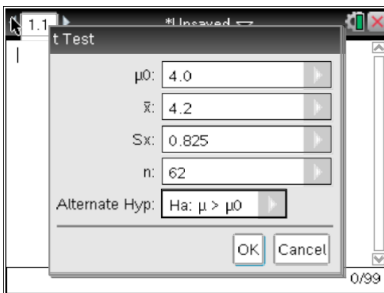
1. Home: Add Calculator: or use scratchpad 'A'



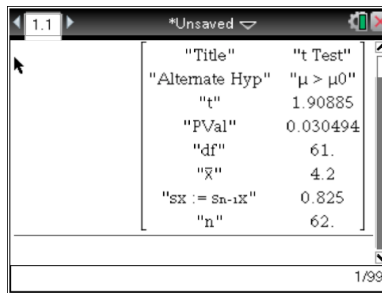
2. Menu: Statistics: Stat Tests: t Test



3. Choose 'Stats' as Data Input Method



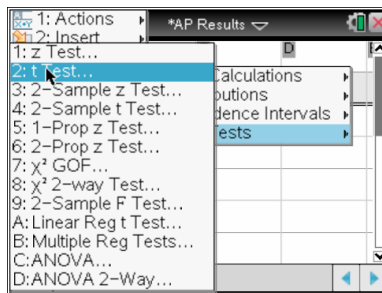
4. Enter the appropriate statistics for the problem



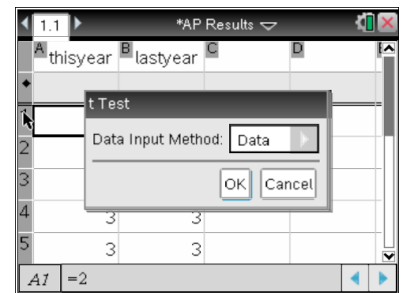
## Significance Test For Population Mean: (From Original Data)



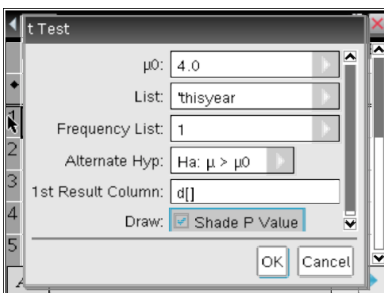
1. Begin with named list(s)



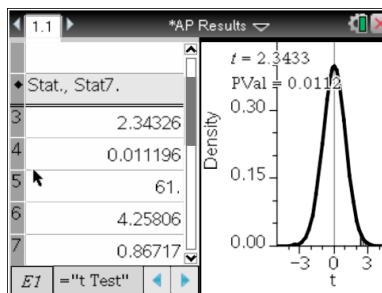
2. Menu: Statistics: Stat Tests: t Test



3. Choose 'Data' as Data Input Method



4. Enter the appropriate information.  
(Click 'Shade P Value' to obtain a graph)



## 'Matched Pairs': "Mean Difference" Confidence Interval

	before	after
1	7.6	7.2
2	3.8	2.5
3	3.7	1.6
4	4.7	1.5
5	2.1	1

1. Begin with named list(s)

	before	after	difference
1	7.6	7.2	-0.4
2	3.8	2.5	-1.3
3	3.7	1.6	-2.1
4	4.7	1.5	-3.2
5	2.1	1	-1.1

2. Compute a third list for the **differences**

3. Proceed with a **1-Sample t Interval** for the **differences**

	after	difference	CLower	CUpper	ME	df
1		=after-bef	=tInterval(			
2	2.5	-1.3	-1.69258			
3	1.6	-2.1	-0.810648			
4	1.5	-3.2	-1.25161			
5	1	-1.1	0.440965			
6	3.1	-1.8			30	

## 'Matched Pairs': "Mean Difference" Significance Test

	before	after
1	7.6	7.2
2	3.8	2.5
3	3.7	1.6
4	4.7	1.5
5	2.1	1

1. Begin with named list(s)

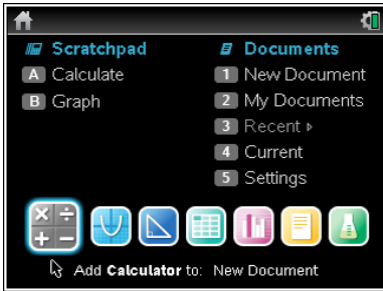
	before	after	difference
1	7.6	7.2	-0.4
2	3.8	2.5	-1.3
3	3.7	1.6	-2.1
4	4.7	1.5	-3.2
5	2.1	1	-1.1

2. Compute a third list for the **differences**

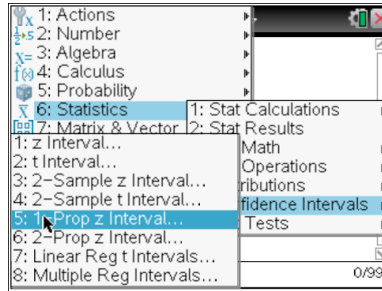
3. Proceed with a **1-Sample t Test** for the **differences**

$\mu_0$ :	0
List:	'difference'
Frequency List:	1
Alternate Hyp:	$H_a: \mu \neq \mu_0$
1st Result Column:	e[]
Draw:	<input checked="" type="checkbox"/> Shade P Value

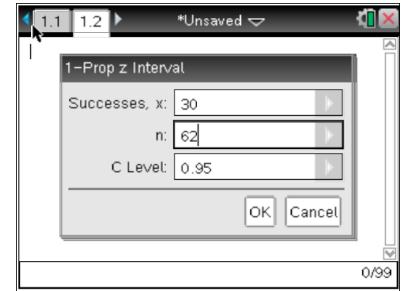
## Confidence Interval For Proportions:



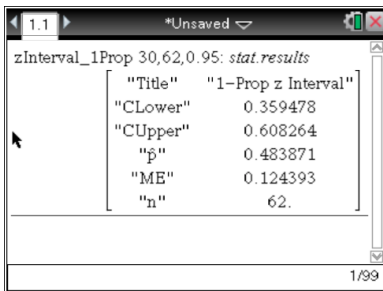
1. Home: Add Calculator: or use scratchpad 'A'



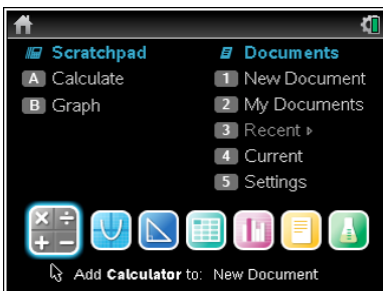
2. Menu: Statistics: Confidence Intervals: 1-Prop z Interval



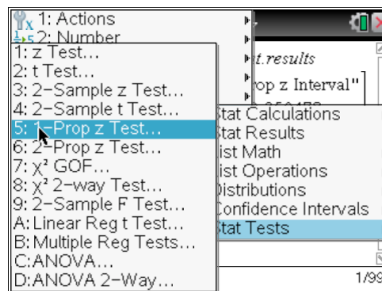
3. Enter the appropriate information for the problem



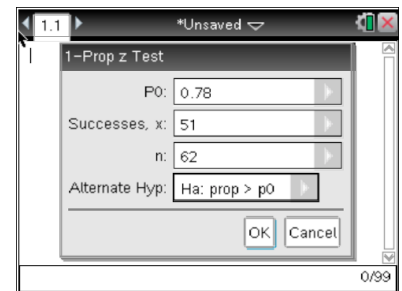
## Significance Test For Proportions:



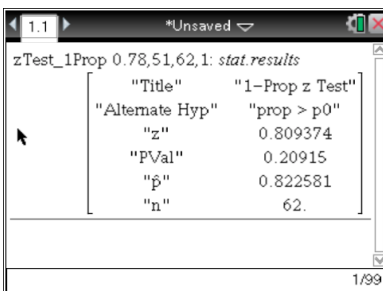
1. Home: Add Calculator: or use scratchpad 'A'



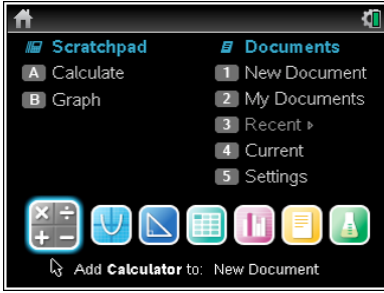
2. Menu: Statistics: Stat Tests: 1-Prop z Test



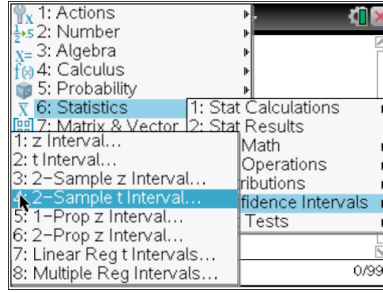
3. Enter the appropriate information for the problem



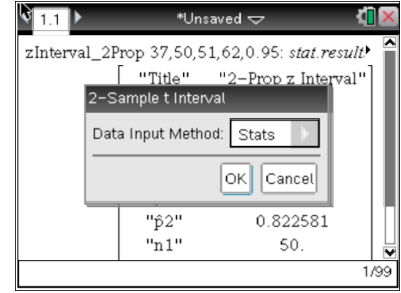
## Difference of Two Means: Confidence Interval (Known Statistics)



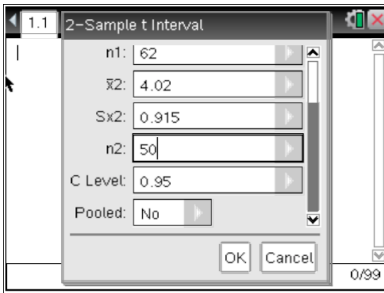
1. Home: Add Calculator: or use scratchpad 'A'



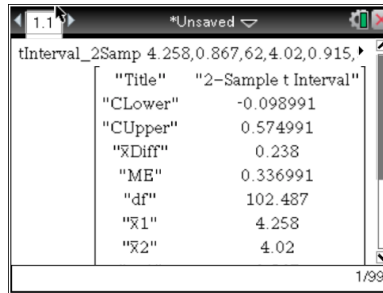
2. Menu: Statistics: Confidence Intervals: 2-Sample t Interval



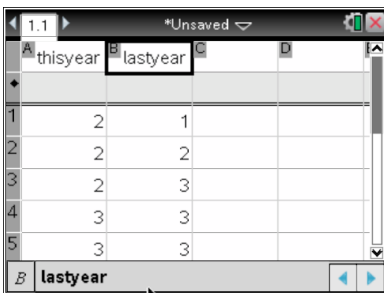
3. Choose 'Stats' as Data Input Method



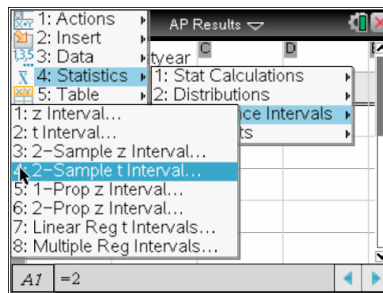
4. Enter the appropriate information for the problem



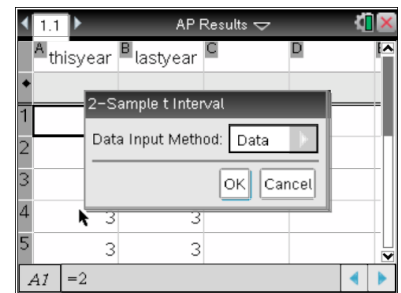
## Difference of Two Means: Confidence Interval (From Original Data)



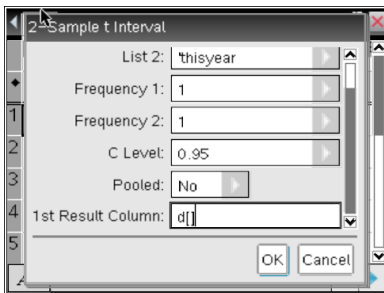
1. Home: Add Calculator: or use scratchpad 'A'



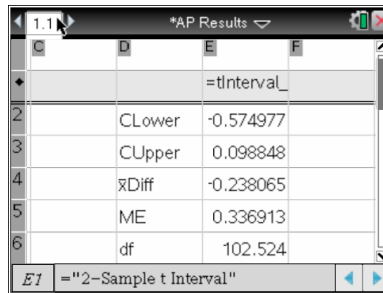
2. Menu: Statistics: Confidence Intervals: 2-Sample t Interval



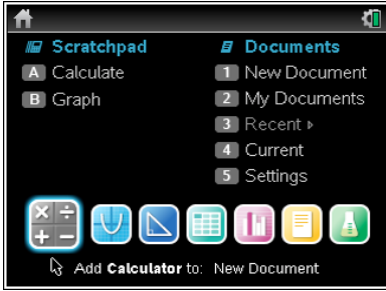
3. Choose 'Data' as Data Input Method



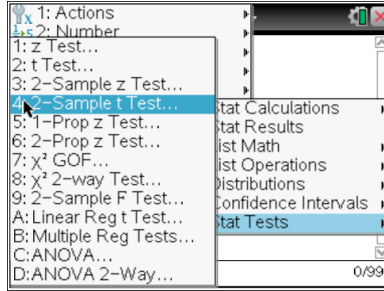
4. Enter the appropriate information for the problem



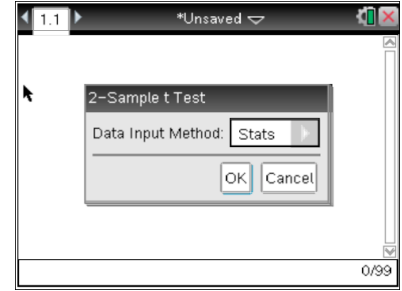
## Difference of Two Means: Significance Test (Known Statistics)



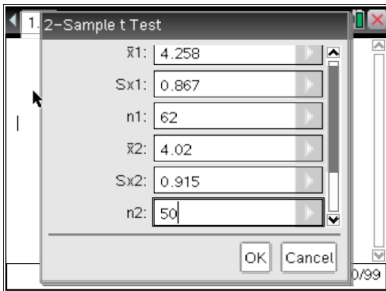
1. Home: Add Calculator: or use scratchpad 'A'



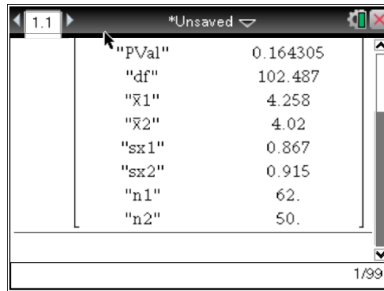
2. Menu: Statistics: Stat Tests: 2-Sample t Test



3. Choose 'stats' as Data Input Method



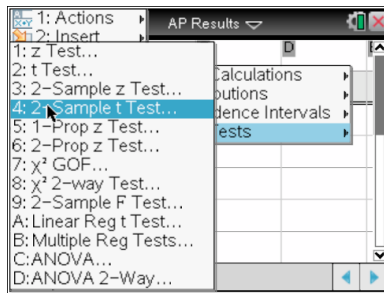
4. Enter the appropriate information for the problem



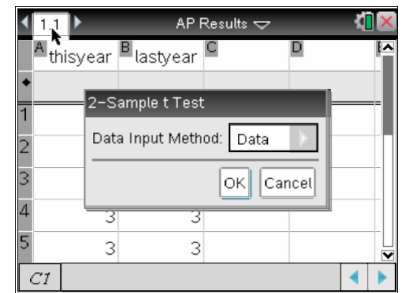
## Difference of Two Means: Significance Test (From Original Data)



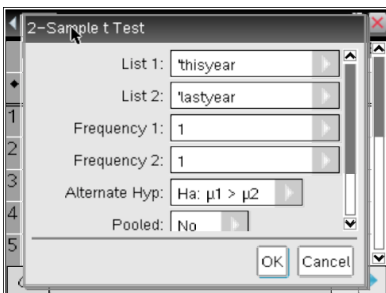
1. Home: Add Calculator: or use scratchpad 'A'



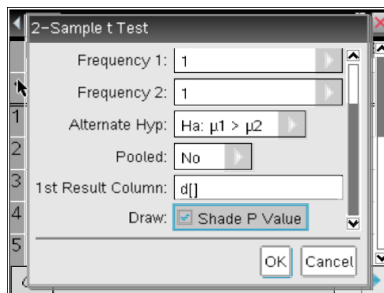
2. Menu: Statistics: Stat Tests: 2-Sample t Test



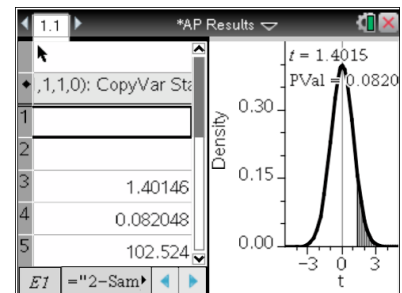
3. Choose 'Data' as Data Input Method



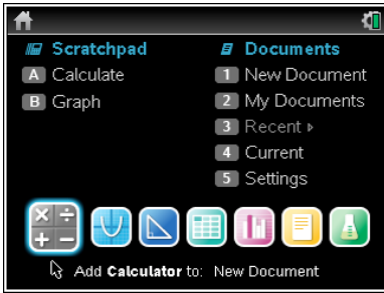
4. Enter the appropriate information for the problem



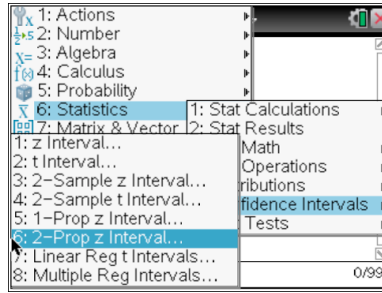
5. Click 'Shade P Value' to obtain a graph



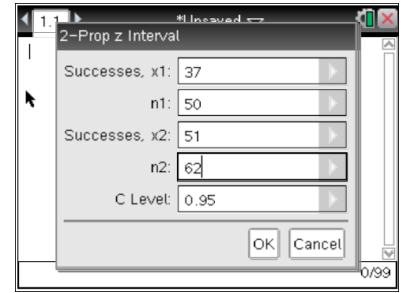
## Comparing Two Proportions: Confidence Interval



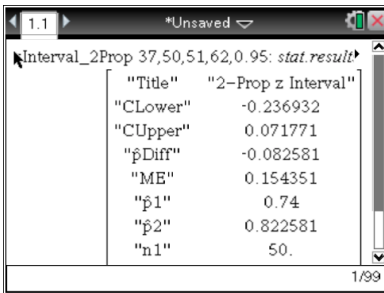
1. Home: Add Calculator: or use scratchpad 'A'



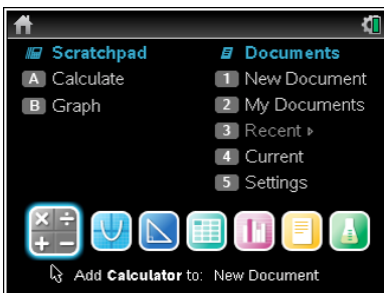
2. Menu: Statistics: Confidence Intervals: 2-Prop z Interval



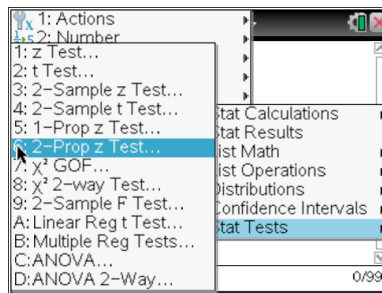
3. Enter the appropriate information for the problem



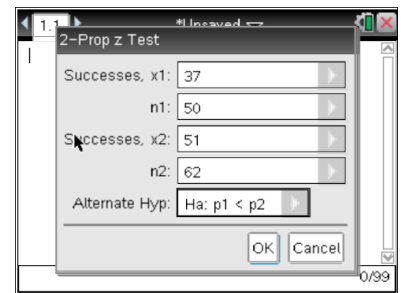
## Comparing Two Proportions: Significance Test



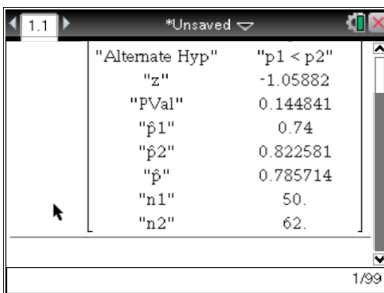
1. Home: Add Calculator: or use scratchpad 'A'



2. Menu: Statistics: Stat Tests: 2-Prop z Test



3. Enter the appropriate information for the problem



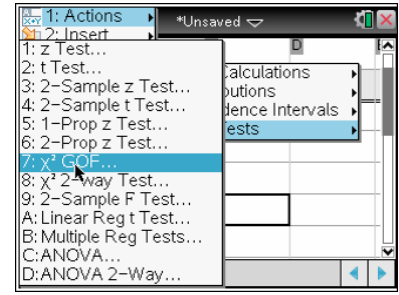
# The Chi-Squared Distribution: Goodness Of Fit Test

	observed		
1	9		
2	10		
3	15		
4	12		
5	8		

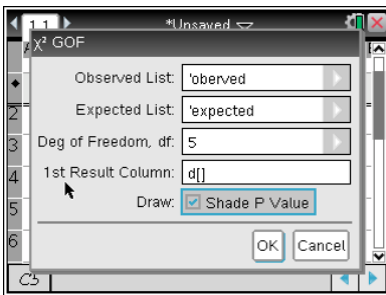
1. Begin with a list of observed counts

	observed	expected	
3	15	9.76	
4	12	8.54	
5	8	7.93	
6	7	7.93	

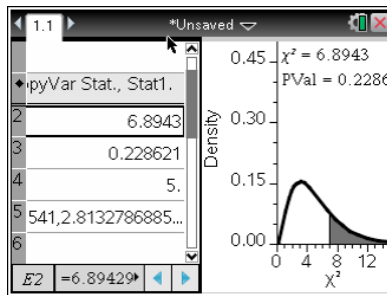
2. Calculate the expected counts and enter as a list



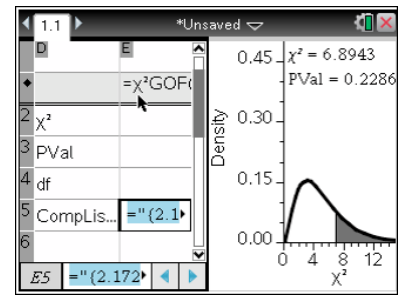
3. Menu: Statistics: Stat Tests:  $\chi^2$  GOF:



4. Enter list names, degrees of freedom. (Check 'Shade P Value' if you want obtain a graph)



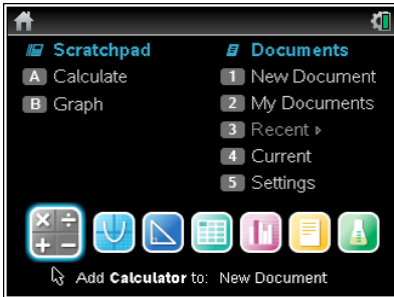
5. Scroll down results column to see  $\chi^2$  value and p-value



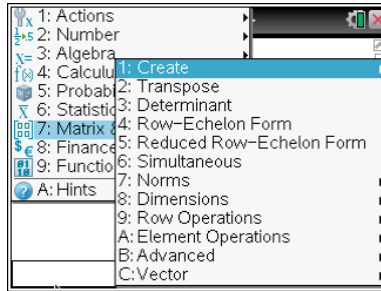
6. Scroll across the component list for 'follow-up analysis'



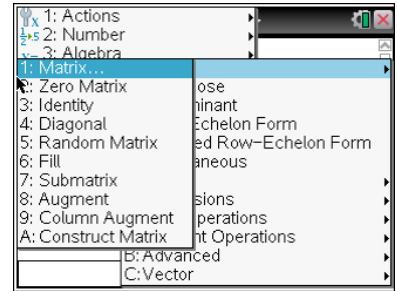
# The Chi-Squared Distribution: Two-Way Table



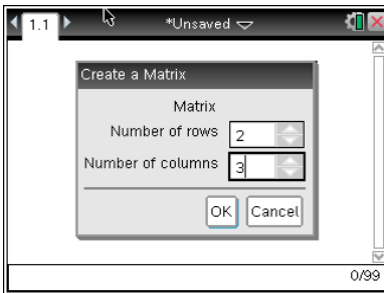
1. Home: Add Calculator: or use scratchpad 'A'



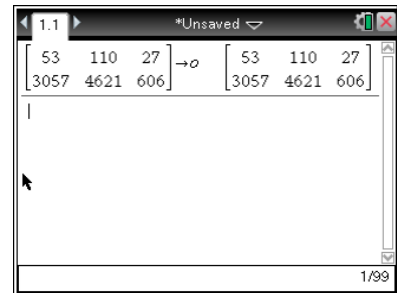
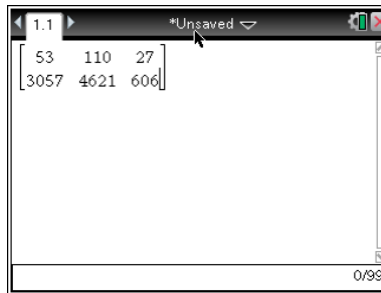
2. Menu: Matrix & Vector: Create



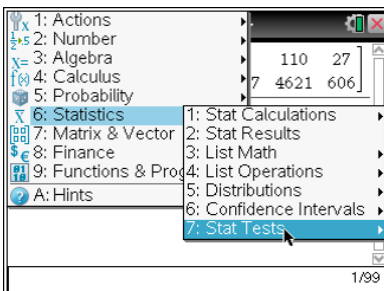
3. Matrix



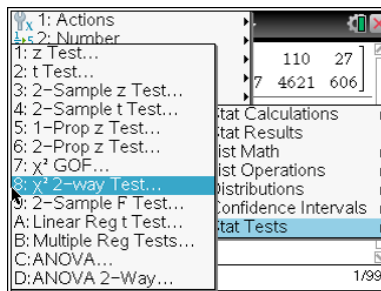
4. Enter the matrix size



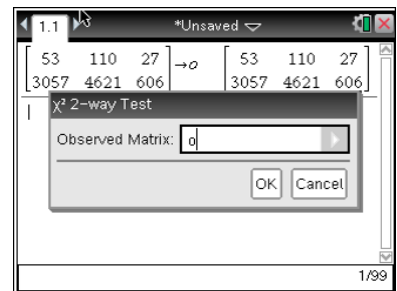
5. Sto → (Ctrl Var): 'matrix name'



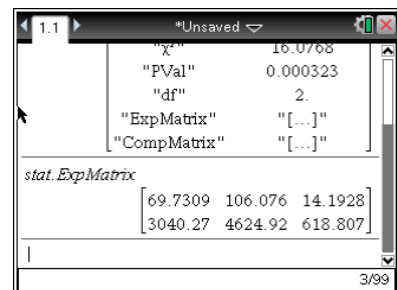
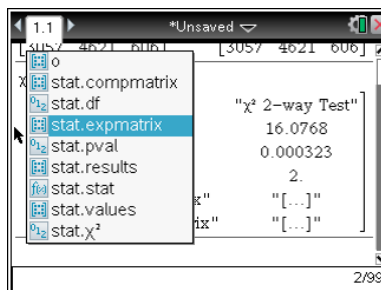
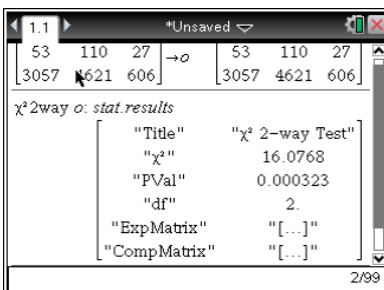
6. Menu: Statistics: Stat Tests



7.  $\chi^2$  2-way Test



8. Enter 'matrix name'



9. Var: stat.expmatrix: Enter: to obtain expected values  
(Var: stat.compmatrix: to obtain components of  $\chi^2$ -test statistic for follow-up analysis)

## Confidence Interval For Regression:

	temp	gas
1	49.4	520
2	38.2	610
3	27.2	870
4	28.6	850
5	29.5	880

1. Begin with named data lists

- 1: Actions
- 2: Insert
- 3: Data
- 4: Statistics
  - 1: Stat Calculations
  - 2: Distributions
  - 3: Confidence Intervals
  - 4: Linear Reg t Intervals
- 5: Table
- 6: Window
- 7: Help

2. Menu: Statistics: Confidence Intervals: Linear Reg t Intervals

Linear Reg t Intervals

Interval: Slope

OK Cancel

Linear Reg t Intervals

X List: temp

Y List: gas

Save RegEqn to: 2

Frequency List: 1

C Level: 0.95

1st Result Column: d1

OK Cancel

3. Enter the appropriate information for the problem

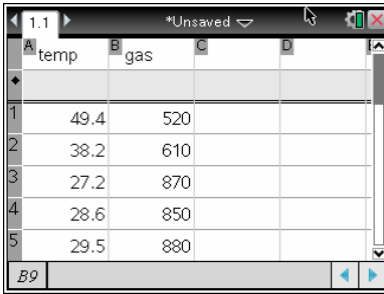
2	RegEqn	a+b*x
3	CLower	-23.6169
4	CUpper	-16.1269
5	b	-19.8719
6	ME	3.74498

4. Scroll down list for further results

7	df	6.
8	s	46.3832
9	SEslope	1.53049
10	a	1425.03
11	r <sup>2</sup>	0.965633

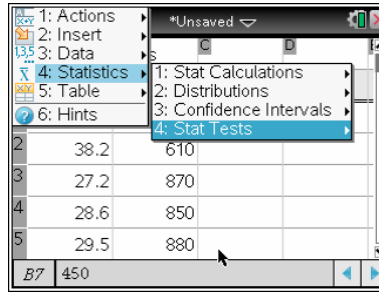
11	r <sup>2</sup>	0.965633
12	r	-0.982666
13	Resid	76.6433...

## Significance Test For Regression:

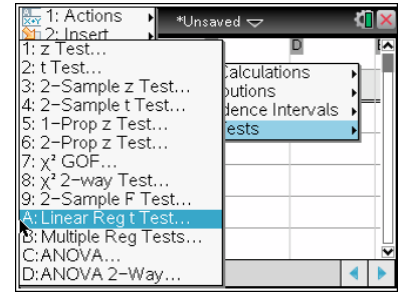


	temp	gas
1	49.4	520
2	38.2	610
3	27.2	870
4	28.6	850
5	29.5	880

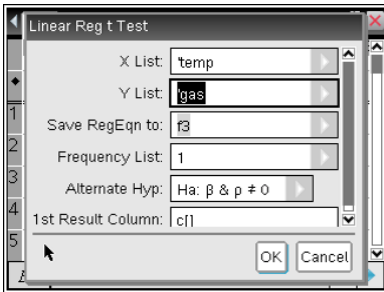
1. Begin with named data lists



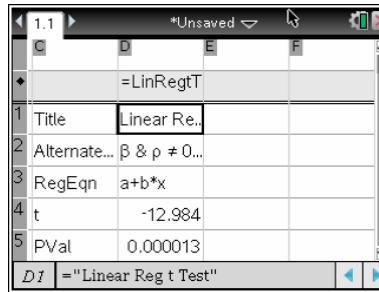
2. Menu: Statistics:  
Confidence Intervals:



3. Linear Reg t Test

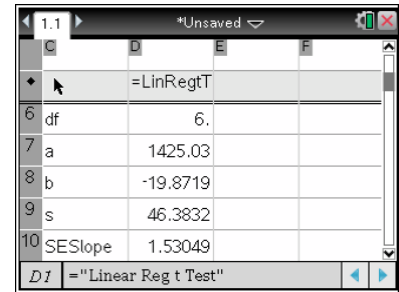


4. Enter the appropriate information  
for the problem

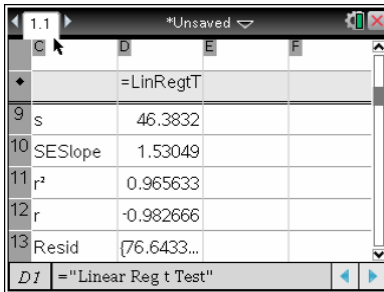


	=LinRegT
1	Title Linear Re..
2	Alternate... $\beta$ & $\rho \neq 0...$
3	RegEqn $a+b*x$
4	t -12.984
5	PVal 0.000013

5. Scroll down list for further results



	=LinRegT
6	df 6.
7	a 1425.03
8	b -19.8719
9	s 46.3832
10	SEslope 1.53049



	=LinRegT
9	s 46.3832
10	SEslope 1.53049
11	$r^2$ 0.965633
12	r -0.982666
13	Resid {76.6433...}

**Notes...**