

## Run Menu

With manual calculations, input formulas from left to right, just as they are written on paper. With formulas that include mixed arithmetic operators and parentheses, the calculator automatically applies true algebraic logic to calculate the result.

### Order of Operations

#### **Example:**

1.  $15 \times 3 + 61$

Enter the expression as it appears and press **[EXE]**

To edit an equation, there are two options.

- Using the [  $\blacktriangleleft$  ] will recall ONLY the last line entered, OR
- Pressing [AC/ON] followed by the [  $\blacktriangleup$  ] will recall lines previously entered. Note: this is not an infinite listing.
- Press [SHIFT] [DEL] to insert characters.

2.  $15 \times (3 + 61)$

### Fractions

#### **Example:**

3.  $1\frac{15}{16} + \frac{37}{9}$

Press 1 [a<sup>b/c</sup>]  
 15 [a<sup>b/c</sup>]  
 16 [ + ]  
 37 [a<sup>b/c</sup>]  
 9 [EXE]

Press [SHIFT] [a<sup>b/c</sup>]  
 to convert it to a  
 common fraction.

Press [F $\leftrightarrow$ D] to toggle  
 between fraction and its  
 decimal equivalent.

Note: All fraction answers will be given in simplest mixed number form.

### Notes:

## Storing Values

### **Example:**

4. Store the value 4 into the variable A.

4 [→]  
[ALPHA]  
[ x,θ,T ]  
[EXE]

5. Is  $c = 5$  a solution to  $4c = 16$ ?

4 [→]  
[ALPHA] [ln]  
[SHIFT] [VARS] [F6] [F5]  
4 [ALPHA] [ln]  
[SHIFT] [ . ] 16

## Summation

### **Example:**

6. Find the sum of the squares from 1 to 10.

Press [OPTN]	Enter [ x,θ,T ]	
[F4]	[ x <sup>2</sup> ] [ , ]	“x <sup>2</sup> ” is the expression
[F6]	[ x,θ,T ] [ , ]	“x” is the variable used by the expression
[F3]	1 [ , ]	“1” is the initial term of the sequence
	10 [ ) ] and [EXE]	“10” is the last term of the sequence

7. Find the sum of every other square from 1 to 10.

Press [ ◀ ] [ ◀ ] [ , ] 2 [ ) ] and [EXE].

This will compute the sum of the squares of 1, 3, 5, 7 and 9.

8. Find the sum of every other square from 1 to 10 beginning with 2.

Press [ ◀ ] until the “1” is selected and type 2 and [EXE].

This will compute the sum of the squares of 2, 4, 6, 8 and 10.

## Notes:

## Complex Numbers

### Example:

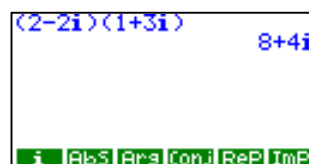
9. Find  $\sqrt{-25}$

Press [SHIFT] [x<sup>2</sup>] -25 and [EXE]. This shows the principle square root.



10. Find  $(2 - 2i)(1 + 3i)$ .

To get the “i”, press [OPTN] [F3] [F1]



## Numerical Calculations

### Example:

11. Solve  $2x^2 + 7x - 9 = 0$

One option for solving this equation is from the **RUN** menu.

Press [OPTN]

[F4]

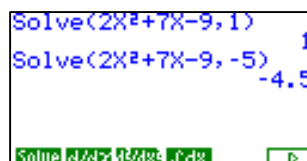
[F1]

Enter the quadratic expression [ , ]

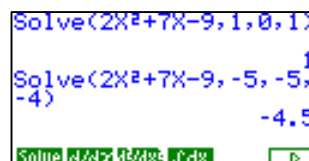
an estimated solution [ , ]

the upper and lower bounds (optional)

[EXE]



Without bounds



With bounds

## Differential Calculations

12. Find the derivative at the point  $x = 3$  for the function  $y = x^3 + 4x^2 + x - 6$ , when the increase/decrease of  $x$  is defined as  $\Delta x = 1E-5$ .

Press [OPTN]

[F4]

[F2]

Enter the equation [ , ]

the point for which the derivative is to be determined [ , ]

the increase/decrease of  $x$  [ ) ]

[EXE]



## Quadratic Differential Calculations

13. Find the quadratic differential coefficient at the point where  $x = 3$  for the function  $y = x^3 + 4x^2 + x - 6$  using a final boundary value of  $n = 6$ .

Press [OPTN]

[F4]

[F3]

Enter the equation [ , ]

the differential coefficient point [ , ]

the final boundary [ ) ]

[EXE]





## Integral Calculations

14. Find the integral calculation for the function  $\int (2x^2 + 3x + 4)dx$   
with a tolerance of “tol” =  $1E-4$ .

Press [OPTN]

[F4]

[F4]

Enter the expression [ , ]

the start and end points [ , ]

(9850 Plus only) the tolerance (Gauss-Kronrod Rule) or number of divisions (Simpson’s Rule) [ ] ]

(The Gauss-Kronrod Rule is used for this example)

[EXE]

```
J(2X^2+3X+4,1,5,1E-4)
134.6666667
Solve d/dx d/dx; f dx
```

NOTE:

press [SHIFT]

[MENU]

scroll down to **Integration**

press [F1] or [F2] to select the rule for integration.

```
Angle :Rad ↑
Coord :On
Grid :Off
Axes :On
Label :Off
Display :Norm1
Integration :Gauss
|Gaus|Simp
```

---

## Notes:

## Graph Menu

This calculator is capable of drawing the following types of graphs:

- Rectangular coordinate (Y =) graphs
- Parametric graphs
- Inequality graphs
- Polar coordinate (r =) graphs
- x = constant graphs
- Integration graphs (RUN mode only)

## The Soft Menu

**SEL** - [F1] draw or non-draw status

**COLR** - [F4] graph color

**DEL** - [F2] delete function

**GMEM** - [F5] graph memory save/recall

**TYPE** - [F3] graph type menu

**DRAW** - [F6] graph draw

## Inequalities

### **Example:**

15. Graph  $Y < \sin x$   
and  $Y > \cos x$

Press [F3] for "TYPE"

[F6]

[F2]

[sin]

[x,θ,T]

[EXE]

Press [F3]

[F6]

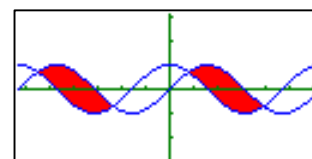
[F1]

[cos]

[x,θ,T]

[EXE]

To graph press [F6] OR [EXE]

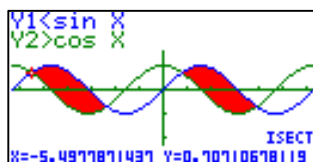


## Graph Solve

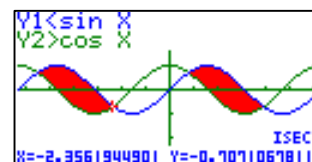
### **Example:**

16. Find the intersection points determined by the boundaries for the above inequalities.

Press [F5] for "G-Solv" {Graph-Solve} and [F5] again for "ISCT" {Intersection}.



Notice that this gives the intersection point to the far left. By pressing [▶] you can find the next intersection point.



## Graphing in a Specific Range

This will graph a function given a specific interval.

### Example:

17. Graph  $y = \frac{1}{2}x^2 + 2x$  within the range of  $-2 \leq x \leq 1$ .

Press [F2], [F1] to delete all previously entered functions.

Change "TYPE" to "Y="

Enter the equation [ , ]

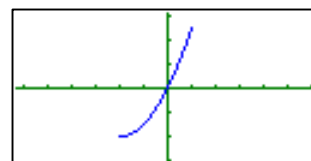
[SHIFT], [ + ] {for the left bracket}

-2

[ , ]

1

[SHIFT], [ - ] {for the right bracket}[F6]



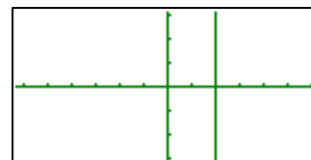
## Vertical Lines

{Delete all previously entered functions using [F2] and [F1]}

### Example:

18. Graph  $x = 2$

Press [F3] [F4], and 2.



## Greatest Integer Function

{Delete all previously entered functions using [F2] and [F1]}

### Example:

19. Graph  $Y = [x]$

Press [F3]

[F1]

[OPTN]

[F5]

[F5]

[ x ]

[EXE]

Press [SHIFT]

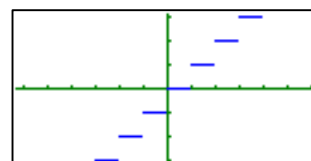
[MENU]

[F2]

[EXE]

This changes the graph to "plot" rather than "connect".

Press [F6]



## Table Menu

Press [MENU]

Go to TABLE menu

[F6]

X	Y2
1	-3
2	3
3	13
4	27

To change the range:

[EXIT]

[F5]

\*Enter new range [-5, 5]<sub>1</sub>

\*This notation indicates:

[ min, max ]<sub>scale</sub>

X	Y2
-5	45
-4	27
-3	13
-2	3

## Polar and Rectangular Equations

{Delete all previously entered functions using [F2] and [F1]}

### **Example:**

20. Graph  $r = 3\cos 4\theta$   
and  $Y1 = 2x^2 - 5$

Use the following View Window:

$$x [-5, 5]_1$$

$$y [-5, 5]_1$$

Press [SHIFT], [MENU] for setup

[F1]

[EXE] to change Draw Type to Connect.

Press [F3]

[F2]

Enter first equation

[EXE]

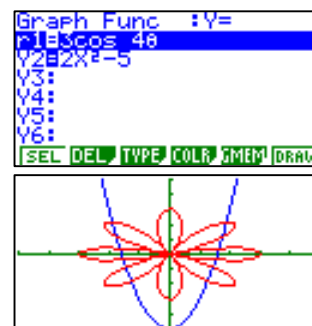
Press [F3]

[F1]

Enter second equation

[EXE]

[F6] or [EXE] to graph

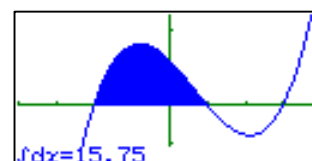
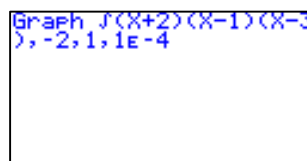


## Integration

### **Example:**

21. Graph the following with a “tol” =  $1E-4$

$$\int_{-2}^1 (x+2)(x-1)(x-3)dx$$



To clear the screen:  
from the RUN menu,  
press [SHIFT]

[F4]

[F1]

[EXE]

Change the V-WIN to:

$$x[-4, 4]_1$$

$$y[-8, 12]_5$$

To change function type to Y=:

press [SHIFT]

[MENU]

[▼]

[F1]

[EXE]

Press [SHIFT]

[F4]

[F5]

[F5]

enter in the expression

enter [ , ]

-2 [ , ]

1 [ , ]

1 [EXP] -4

[EXE]

## Notes:

## Overwrite

This will display multiple versions of the graph using the specified values. All versions will appear simultaneously.

### **Example:**

22. Graph  $y = Ax^2 - 1$ , where A is -1, 1 and 3.

Delete all previous entries.

Set V-WIN to "INIT" [F1]

Choose the [TYPE] of graph, in this case [Y=] which is [F1]

Enter in equation using [ALPHA], [x,θ,T] for "A".

Press [ , ]

[SHIFT], [ + ] {for left bracket}

[ALPHA], [x,θ,T]

[SHIFT], [ . ] {for equal sign}

-1, [ , ]

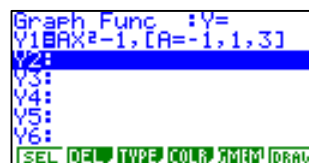
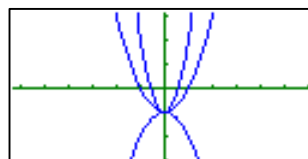
1, [ , ]

3

[SHIFT], [ - ] {for right bracket}

[EXE]

[EXE]

## Notes:

## Dynamic Graph Menu

This menu allows user to view changes in a graph as parameters change on its equation.

### Manually Entering Equations

#### Example:

23. Determine the effect  $a$  has on the equation  $y = a \sin x$ .

Press [ALPHA] [A]

[sin]

[x,θ,T]

[EXE]

```
Dynamic Func:Y=
Y1:Asin X
Y2:
Y3:
Y4:
Y5:
Y6:
[SEL] [DEL] [TYPE] [VAR] [B-TH] [RCL]
```

Press [F4]

[F2]

-2, [EXE]

2, [EXE]

1, [EXE] [EXE]

```
Y1=Asin X
Dynamic Range
A
Start:-2
End :2
Pitch:1
```

Press [F3]

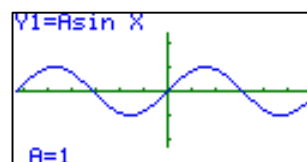
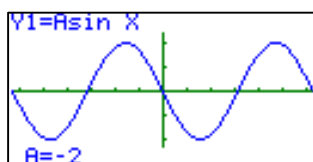
Highlight "Normal"

[F1]

[EXE]

```
Speed Control
Dynamic Speed : >
Stop&Go:ll>
Slow : >
Normal : >
Fast : >
[SEL]
```

[F6]



### Using Built-in Functions

24. Determine the effect that  $a$ ,  $b$  and  $c$  has on the function  $y = a(x + b)^2 + c$ .

Press [F5] [▼]

[F1]

```
Y=AX+B
Y=A(X+B)^2+C
Y=AX^2+BX+C
Y=AX^3+BX^2+CX+D
Y=Asin (BX+C)
Y=Acos (BX+C)
Y=Atan (BX+C)
[SEL]
```

Press [F4]

[F2]

-3, [EXE]

3, [EXE]

1, [EXE] [EXE]

```
Y1=A(X+B)^2+C
Dynamic Range
A
Start:-3
End :3
Pitch:1
```

Press [F3]

Highlight "Normal"

[F1]

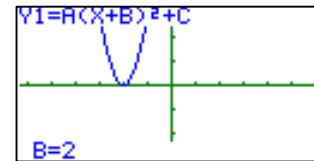
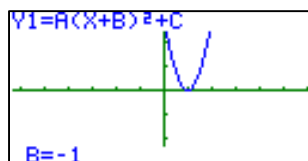
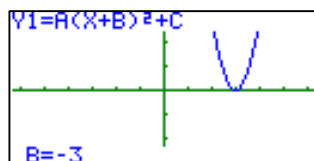
[EXE]

```
Speed Control
Dynamic Speed : >
Stop&Go:ll>
Slow : >
Normal : >
Fast : >
[SEL]
```

To select the variable to "move", use the up/down arrows to highlight the variable  $B$  and press [F1].

```
Y1=A(X+B)^2+C
Dynamic Var : B / >
A=3
B=3
C=0
[SEL] [RANG] [SPEED] [AUTO] [DYNA]
```

[F6]



## Conics Menu

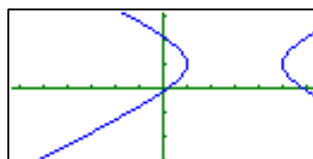
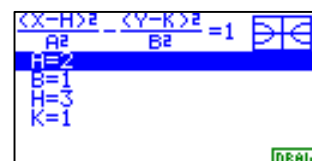
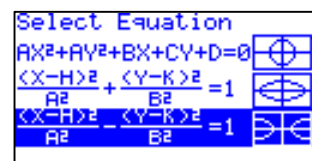
This mode graphs parabolas, circles, ellipses and hyperbolas.

**Example:** 
$$25. \text{ Graph } \frac{(x-3)^2}{4} - \frac{(y-1)^2}{1} = 1$$

Use the down arrow to select the correct form.

**[EXE]**

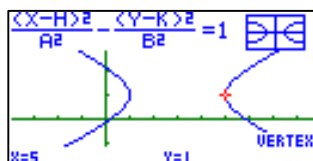
Enter the values for A, B, H and K and press **[F6]**



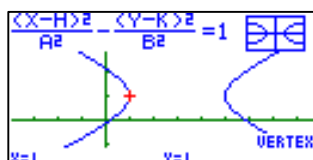
To change the view screen, use the up, down, left and right arrows.

Press **[F5]** for the Graph-Solve option

**[F4]**



Use the left or right arrow to find the remaining vertex.



**Notes:**

## Equation Menu

This menu is used to solve three types of equations.

- Linear equations with two to six unknowns
- Quadratic equations
- Cubic equations

### Quadratic and Cubic Equations

**Example:**

#### Real Solutions

26. Solve  $x^3 - 2x^2 - x + 2 = 0$

Press [F2]

```
Equation
Select Type
F1: Simultaneous
F2: Polynomial
F3: Solver
SIML POLY SOLV
```

[F2]

```
Polynomial
Data For 3 Degree
In Memory
Degree?
2 3
```

Enter the coefficient of each term followed by [EXE].

```
aX^3+bX^2+cX+d=0
[ ] [ ] [ ] [ ] [ ]
1 -2 -1 2
SOLV DEL CLR
```

Press [F1] or [EXE] to solve.

```
aX^3+bX^2+cX+d=0
[ ] [ ] [ ] [ ] [ ]
1 -2 -1 2
REPT
```

#### Complex Solutions

27. Solve  $x^3 + x^2 + x - 3 = 0$

Press [F1] (REPT)

[F3] (CLR)

Enter coefficients

[F1]

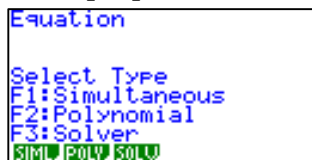
```
aX^3+bX^2+cX+d=0
[ ] [ ] [ ] [ ] [ ]
1 1 1 -3
REPT
-1+1.414213562i
```

## Simultaneous Equations

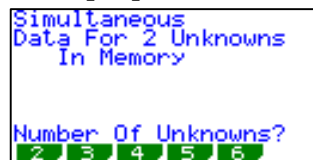
### Example:

28. Find the solution to the system:  $5x + 7y = -11$   
 $\frac{3}{4}x - \frac{1}{2}y = 3$

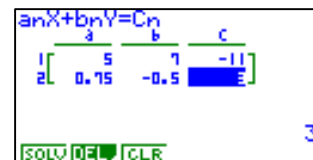
Press [F1]



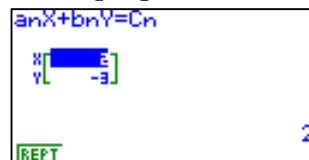
Press [F1]



Enter coefficients

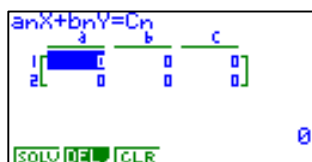


Press [F1]

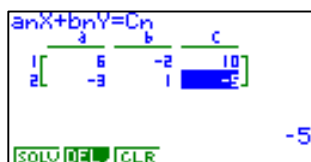


29. Find the solution to the system:  $6x - 2y = 10$   
 $-3x + y = -5$

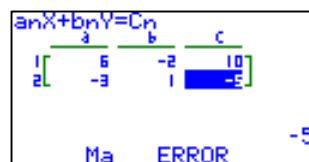
Press [F1] for REPT  
 [F3] to clear entries



Enter coefficients



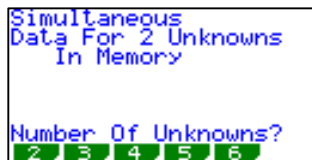
Press [F1]



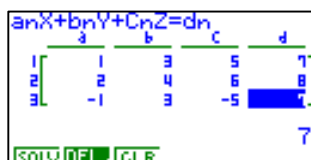
Press AC<sup>ON</sup> to continue.

30. Find the solution to the system:  $x + 3y + 5z = 7$   
 $2x + 4y + 6z = 8$   
 $-x + 3y - 5z = 7$

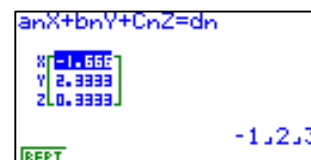
Press [EXIT]  
 [F2]



Enter coefficients



Press [F1]



Press [SHIFT][a<sup>b/c</sup>]

### Notes:

## Solve Calculations (9850 plus model only)

### Example:

31. Calculate initial velocity of an object thrown into the air and taking a time of 2 seconds to reach a height of 14 meters, when gravitational acceleration is  $9.8 \text{ m/s}^2$ .

The following formula expresses the relationship between height H, initial velocity V, and gravitational acceleration G of a free falling object.

$$H = VT - \frac{1}{2} GT^2$$

```
Equation
Select Type
F1: Simultaneous
F2: Polynomial
F3: Solver
SIML, POLY, SOLV
```

Press [F3]

Press [ALPHA] [H]

[SHIFT] [=] (above “. ”)

[ALPHA] [V]

[ALPHA] [T]

[ - ] [ 1/2 ] be certain not to enter (-)

[ALPHA] [G]

[ALPHA] [T] [x<sup>2</sup>]

[EXE]

Enter values for

H = 14 [EXE]

V = 0 [EXE]

T = 2 [EXE]

G = 9.8 [EXE]

up arrow to highlight

“V = 0”

[F6]

```
Eq: H=VT-1.2GT^2
H=0
U=0
T=0
G=0
RCL, DEL, SOLV
```

```
Eq: H=VT-1.2GT^2
U=16.8
Lft=14
Rst=14
REPT
```

## Statistics Menu

This menu will allow input of statistical data into lists, perform single-variable and paired-variable statistical calculations, perform tests, analyze data and draw statistical graphs.

### The Soft Menu

**GRPH** – Graph menu which allows graphing of data as a scatter diagram, xy line, normal probability plot, histogram, med-box, mean-box, and many more.

**CALC** – Statistical calculation menu which allows single-variable and paired-variable statistical calculations.

**TEST** – Test menu that performs z tests, t tests, etc.

**INTR** – Confidence interval menu

**DIST** – Distribution menu

**SRT-A** and **SRT-D** – Sorts data in ascending/descending order.

**DEL** and **DEL-A** – Deletes highlighted data or all data.

**INS** – Inserts new cell at highlighted cell.

### Single-variable Statistics

#### **Example:**

32. Enter the following into List 1.

```
63   68   76   78   80   91   94
63   76   76   80   82   91   100
```

List 1	List 2	List 3	List 4
63			
68			
76			
78			
80			
91			
94			
63			
76			
76			
80			
82			
91			
100			

Enter each data point followed by **[EXE]**.

Press **[F2]**

**[F1]**

Press the down arrow to view all information.

1-Variable
$\bar{x}$ = 79.8571428
$\Sigma x$ = 1118
$\Sigma x^2$ = 90896
$\bar{x}\sigma_n$ = 10.7428191
$\bar{x}\sigma_{n-1}$ = 11.1483502
$n$ = 14

1-Variable
Med = 79
$\sigma_3$ = 91
$\bar{x} - \bar{x}\sigma_n$ = 69.1143237
$\bar{x} + \bar{x}\sigma_n$ = 90.599962
maxX = 100
Mod = 76

Press **[EXIT]** twice

**[F1]**

**[F6]**

**[▼]**

**[F6]**

**[F1]**

Make sure that the Xlist is "List1" and Frequency is "1"

**[EXE]**

StatGraph1
Graph Type : Hist
XList : List1
Frequency : 1
Graph Color : Orange

Press **[SHIFT], [F3]**

Set your window to:

$x[60,105]_{10}$

$y[-1,6]_1$

**[EXE]**

View Window
Xmin : 60
max : 105
scale : 10
Ymin : -1
max : 6
scale : 1



Press [F1]

[F4]

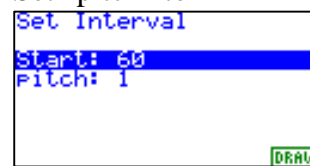
Make sure that "StatGraph1" is the only graph with "DrawOn".



[F6]

Set "Start" to 60

Set "pitch" to 1

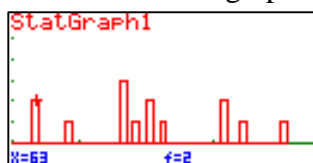


Press [F6] to graph.

Press [SHIFT] [F1]

Use left/right arrow keys to view frequencies.

Use [SHIFT] [F6] to toggle between list and graph.



Press [F6]

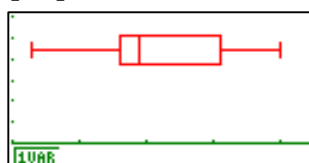
[ ]

[F6]

[F2]

[EXE]

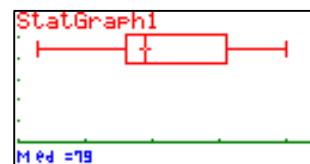
[F1]



Press [SHIFT]

[F1]

to view the stat information



## Paired-variable Statistics

### Example:

33. Enter the following into List 1.

0    500    1000    1500  
2000    2500    3000    3500

Enter the following into List 2.

32    27    23    18  
14.5    9    3.5    -3

Press [F6] [F4] [F1] to clear List 1.

Enter each data point followed by [EXE].

Press right arrow to go to List 2.

Press [F6]

[F1]

[F6]

[ ]

[F1]



Press [EXIT]

[F1]



Troubleshooting:

If the screen is not fitting to the data, press [SHIFT] [MENU] and check that the "Stat Wind" is set to "Auto".

Press [F1]

[F6]



## Tests

### **Example:**

34. Perform a 1-Sample Z Test where List1 = {11.2, 10.9, 12.5, 11.3, 11.7}, where  $\mu_0 = 11.5$  and  $\sigma = 3$  ( $\mu < \mu_0$ ).

Delete all Lists

Enter data above in List1

Press [F3] (Test)

[F1] (Z)

[F1] (1-S)

[F1] (List)

[▼] [F2] (<)

[▼] 11.5 [EXE]

3 [EXE]

[F1] (list1)

[▼] [F1] (1)

[▼] [F1] (CALC)

[EXIT]

Press down arrow to "Execute"

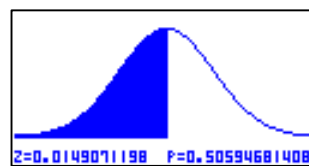
Press [F6] to draw.

```

1-Sample ZTest
Data      :List
μ         :<μ₀
μ₀        :11.5
σ         :3
List      :List1
Freq      :1
List Var
  
```

```

1-Sample ZTest
μ         <11.5
z         =0.014907
P         =0.50594
x̄         =11.52
x̄σn-1    =0.61806
n         =5
  
```



### **Notes:**

## Matrix Menu

This mode is used for storing and editing matrices. Matrix operations are performed in the RUN menu.

### Creating a matrix

$$A = \begin{bmatrix} 3 & 5 \end{bmatrix}$$

Highlight "Mat A"

1 [EXE]

2 [EXE]

to enter dimensions of matrix A.

3 [EXE]

5 [EXE]

[EXIT]

$$B = \begin{bmatrix} 1 & 7 \\ 8 & \end{bmatrix}$$

down arrow to highlight "Mat B"

2 [EXE]

2 [EXE]

to enter dimensions of matrix B.

1 [EXE]

7 [EXE]

3 [EXE]

8 [EXE]

[EXIT]

$$C = \begin{bmatrix} 2 & -2 \\ -1 & \end{bmatrix}$$

Repeat for matrix C

## Matrix Operations

### Example:

35.  $B + C$

From the RUN menu:

Press [OPTN]

[F2]

[F1]

[ALPHA] [B]

[+]

[F1]

[ALPHA] [C]

[EXE]

36.  $A \cdot B$

[F1]

[ALPHA] [A]

[X]

[F1]

[ALPHA] [B]

[EXE]

37. Det [C]

[F3]

[F1]

[ALPHA] [C]

[EXE]

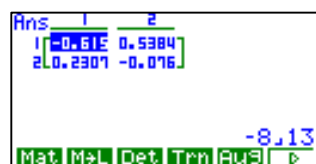
38.  $B^{-1}$

[F1]

[ALPHA] [B]

[SHIFT] [ $x^{-1}$ ] (above “ $\circ$ ”)

[EXE]

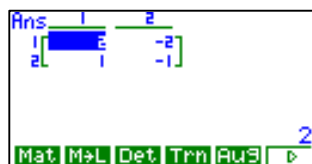


39.  $C^2$

[F1]

[ALPHA] [C]

[ $x^2$ ]



**Notes:**

## Time Value of Money Menu

\*9850 plus model only\*



This menu will perform financial calculations such as simple/compound interest, investment appraisal (cash flow), amortization, interest rate conversion, etc.

### Simple Interest

#### **Example:**

40. Find the interest on a \$350 loan for 6 months at 15%.

Press [F1]

[SHIFT] [MENU]

Change "Date Mode" to "360"

[EXE]

Enter:

n = 180 (number of days in 6 months)

I% = 15

PV = -350

[F1] to determine amount of interest

[EXIT]

[F2] to determine interest + loan

```
Simple Interest:360
n =180
I% =15
PV =-350
SI SFV
```

```
Simple Interest:360
SI =26.25
REPT GRPH
```

```
Simple Interest:360
SFV=376.25
REPT GRPH
```

### Compound Interest

#### **Example:**

41. Find the annual compounded rate of increase on money that increased from \$141.1 billion to \$170.3 billion over a six-year period.

Press [F2] from TVM menu

[SHIFT] [MENU]

Change "Payment" to "End"

[EXE]

Enter:

n = 6

I% = 0

PV = 141.1

PMT = 0

FV = -170.3

P/Y = 1

C/Y = 1

Press [F2] to determine rate of increase

```
Compound Interest:End
n =6
I% =3.184533654
PV =141.1
PMT=0
FV =-170.3
P/Y=1
n I% PV PMT FV ↓
```

```
Compound Interest:End
I% =3.184533654
REPT PMT GRPH
```

### Notes:

## Cash Flow / Investment Appraisal

### **Example:**

42. An investment of \$15,000 in machinery projects the annual revenues shown in the table below (all revenues realized at the end of the fiscal year). What is the net profit or loss of this investment if the useful service of life of the machine is 3 years, the resale value after three years is \$2,500, and the capital cost is 11%?

<u>Year</u>	<u>Revenues</u>
1	\$6000
2	\$5040
3	\$7080 + 2500

From the **LIST** menu:

[**▶**] [**▶**] to List 3  
 [(-)] 15000 [**EXE**]  
 6000 [**EXE**]  
 5040 [**EXE**]  
 7080 [+ ] 2500 [**EXE**]

	List 1	List 2	List 3	List 4
1			-15000	
2			6000	
3			5040	
4			7080	
5				

SRT# SRT# DEL CLR INS

From the **TVM** menu:

[**F3**]  
 Enter I% = 11 [**EXE**]  
 Press [**F6**]  
 [**F3**]  
 [**F1**]

Cash Flow
NPV=1500.795902
REPT
GRPH

---

### Notes: