

TI CALCULATOR SKILLS

Below is a list of skills/procedures/key pads sequences that are useful for everyday teaching.

In addition to this document, please review the help manual written for staff/students/parents that is in the Moreton Bay College webpage and it is also saved on the shared drive.

<http://www.mbc.qld.edu.au/maths>

To access the commands via the keypads, just press them. If you wish to access the other commands with the keypad, please press **2nd** then respective command. For example, **2nd** [LIST] (above the **STAT** command).

One feature of the calculator that is not used often is the movement around the screen when you have a rather large calculation formula/line. To go to the start or end of the input line just press **2nd** **◀** or **2nd** **▶**.

Another good feature is to standardise the viewing/graphing window. Press **ZOOM** **6** and the calculator will set the viewing window to the defaults (x and y values range from -10 to 10 with increments of 1). Check the troubleshooting checklist later in the document if no cartesian plane is drawn.

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SOLVING EQUATIONS SOLVER

There are many methods to solving equations. Solve and Solver commands and the use of the zero command in the CALC menu.

Press **MATH** \blacktriangle and place your cursor on Solver and press **ENTER**.

If there is a previous equation, use your \blacktriangle to enable you to input and equation.

To use this facility, the equation must be equal to zero.

For example, solve $x^2 - 6 = x$.

The equation must be rearranged to have all terms on one side and the other side being zero.

Hence $x^2 - x - 6 = 0$

Enter the equation and press **ENTER**.

As there is only one unknown and the calculator has an automatic domain -1×10^{99} to 1×10^{99} (negative infinity to positive infinity).

Place your cursor on 6 (or what number is present) and type a guess (generally type in -10)

With your cursor on the guess, press **ALPHA** **ENTER** (for [SOLVE]).

Is there another solution? Place your cursor on the value of x and type in another guess. Type in 10 and press **ALPHA** [SOLVE].

You must be careful in using the Solver facility as there may be more than two solutions and hence, you must be careful with your starting guess.

```

NUM CPX PRB
4: J(
5: *J
6: fMin(
7: fMax(
8: nDeriv(
9: fnInt(
2: Solver...
    
```

```

EQUATION SOLVER
eqn: 0=e^(3X)-5e^
(-X)
    
```

```

EQUATION SOLVER
eqn: 0=X^2-X-6
    
```

```

X^2-X-6=0
X=6
bound=(-1e99, 1...
    
```

```

X^2-X-6=0
X=-2
bound=(-1e99, 1...
left-rt=0
    
```

```

X^2-X-6=0
X=3
bound=(-1e99, 1...
left-rt=0
    
```

SOLVE

Another useful method of solving equations is the use of the solve command.

To find the command (and all other commands) press **2nd** [CATALOG] **4** **▲** until your cursor is on solve(and then press **ENTER** .

```
CATALOG
solve(
SortA(
SortD(
startTmr
stdDev(
Stop
StoreGDB
```

The syntax required is equation, variable, guess. You have to be careful with your starting guess.

Generally the first guess is -10 and if there is another solution, try 10. If there are more than two solutions, you need to input another guess.

```
solve(X^2-X-6,X,-
10)
-2
solve(X^2-X-6,X,1
0)
3
```

Solve $x^2 - x - 6 = 0$

Input as shown in the screen capture.

Press **2nd** **ENTER** to call up previous entry and place your cursor over the **(-)** and delete it. Press **ENTER** .

LISTS

Another way of entering data in a list is to type in a set of values and store them in an appropriate list.

```
(1,5,8)→L2
```

Instead of typing in numbers in a list, you can generate a sequence.

2nd [STAT] **5** for the sequence command and then type in your sequence requirements (formula, variable, start, finish)

```
seq(X,X,0,6)
{0 1 2 3 4 5 6}
seq(X,X,0,6)→L1
{0 1 2 3 4 5 6}
```

The screen capture shows a sequence generated on the home screen and the same sequence copied to L1.

In addition, you can do the same sequence in a list.

L1	L2	L3	1
-----	-4	-5	
	-4	3	-----
	NUM		
	-4		
	-4		
L1 = seq(X,X,0,6)			

Another feature in the list is the use of " " to save formulae. (You cannot see the last " in the next screen capture). As well, you can see the result of the sequence in L1.

L1	0	L3	2
0	0	-5	
1	1	3	
2	2	-----	
L2 = "seq(X,X,0,6)"			

Next to L2, you will see a black box which identifies which list has a formulae in " ".

L1	L2	0	3
0	0	-----	
1	1		
2	2		
L3 = "3L2-1"			

The screen capture to the right shows L3 having a saved formula.

DELETING AND INSERTING LISTS

At times, students delete lists by mistake.

Press **[STAT]** **[1]** to access lists.

If you wish to clear the data in list 1, place your cursor over L1 and press **[CLEAR]**

You will notice that the set of values is cleared, but it appears that the data is still there. Press **[v]** and the data is cleared.

L1	L2	L3	1
1	-2	-1	
2	2	7	
3	-----	-----	
L1 = {1, 3, 4, 2, 3, 6...			

L1	L2	L3	1
1	-2	-1	
2	2	7	
3	-----	-----	
L1 = █			

L1	L2	L3	1
█	-2	-1	
	2	7	
	-----	-----	
L1(1) =			

If the cursor is on L1 and **[DEL]** is pressed, list 1 is deleted. Do not panic.

L1	L2	L3	1
-----	-2	-1	
	2	7	
	-----	-----	
L1 = █			

L2	L3	L4	1
-2	-1	-----	
2	7		
-----	-----		
L2 = {-2, 2}			

Place your cursor where the list is to be inserted and press **[2nd]** **[INS]** .

Press **[2nd]** **[L1]** (as list 1 has been deleted) and press **[ENTER]** .

	L2	L3	1
	-2 2	-1 7	

Name=			

	L2	L3	1
	-2 2	-1 7	

Name=L1			

	L2	L3	1
	-2 2	-1 7	

L1 =			

NUMERICAL DERIVATIVE

The command `nDeriv(` will calculate a value (not always exact – read manual) of an expression with respect to a variable given a value of the variable.

For example what is the value of $\frac{dy}{dx}$ of $y=3x^2-5x+1$ when $x=2$?

Press `MATH` `▴` until your cursor is on the command `nDeriv(` and then press `ENTER`.

```

NUM CPX PRB
4: ∫(
5: √
6: fMin(
7: fMax(
8: nDeriv(
9: fnInt(
0: Solver...

```

The syntax requires the expression, variable and the value of x .

```

nDeriv(3X^2-5X+1,
X,2)
7

```

Another way of calculating the value of the derivative (or gradient of a tangent) is to input the equation into `Y=` and press `GRAPH`.

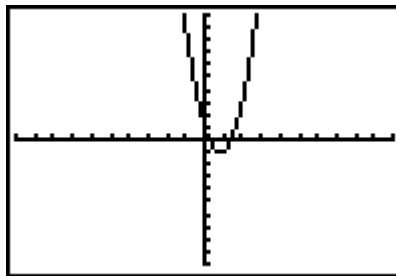
Press `2nd` `[CALC]` (a very good menu) and press `6`.

Press `1` `ENTER` ($x=1$)

```

Plot1 Plot2 Plot3
Y1: 3X^2-5X+1
Y2:
Y3:
Y4:
Y5:
Y6:
Y7:

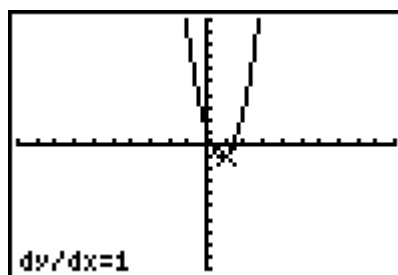
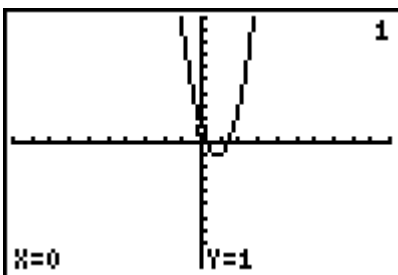
```



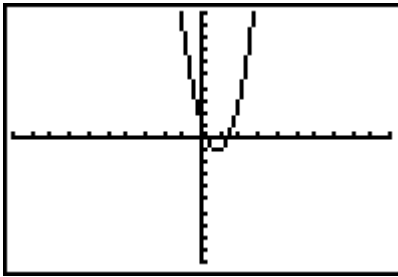
```

CALCULATE
1: value
2: zero
3: minimum
4: maximum
5: intersect
6: dy/dx
7: ∫f(x)dx

```

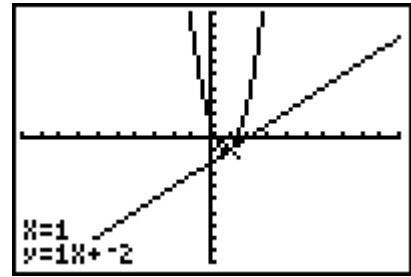


In addition to the above two methods is to draw a tangent. By doing this you determine the equation of the tangent and also have the gradient at the particular point. Enter the equation into $\boxed{Y=}$, $\boxed{\text{GRAPH}}$ (always check the values in the viewing window)
 To determine the equation of a tangent press $\boxed{2\text{nd}} \boxed{\text{DRAW}}$ then $\boxed{5}$ and type in the value of x.



```

  0:QUIT POINTS STO
  1:ClrDraw
  2:Line(
  3:Horizontal
  4:Vertical
  5:Tangent(
  6:DrawF
  7:Shade(
  
```



NUMERICAL INTEGRAL

The command $\text{fnInt}()$ will calculate a value (not always exact – read manual) of an expression with respect to a variable given a value of the variable.

Evaluate $\int_1^4 x^2 - 2x - 3 \, dx$

Press $\boxed{\text{MATRX}} \boxed{\uparrow}$ until your cursor is on the command $\text{fnInt}()$ and then press $\boxed{\text{ENTER}}$.

The syntax requires the expression, variable, lower bound and upper bound and the value of x.

```

  0:NUM CPX PRB
  4:∫(
  5:∫
  6:fMin(
  7:fMax(
  8:nDeriv(
  9:fnInt(
  0:Solver...
  
```

The screen capture to the right shows the evaluated integrand and it also shows the calculation involving the y-variable. You can only use this facility if an expression has been entered into a position in the $\boxed{Y=}$.

```

  fnInt(X^2-2X-3,X,
  1,4)
  -3
  fnInt(Y1,X,1,4)
  -3
  
```

Press $\boxed{\text{MATH}} \boxed{\uparrow}$ until your cursor is on the command $\text{fnInt}()$ and then press $\boxed{\text{ENTER}}$.

Press $\boxed{\text{VARS}} \boxed{\rightarrow} \boxed{1}$ (or $\boxed{\text{ENTER}}$)

```

  VARS VARS
  0:Function...
  2:Parametric...
  3:Polar...
  4:On/Off...
  
```

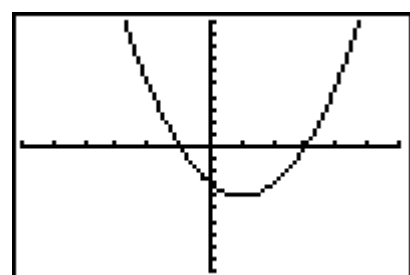
```

  Y1
  2:Y2
  3:Y3
  4:Y4
  5:Y5
  6:Y6
  7:Y7
  
```

Another method of calculating the integrand is to graph the expression and to use the $\boxed{\text{CALC}}$ menu.

Press $\boxed{7}$

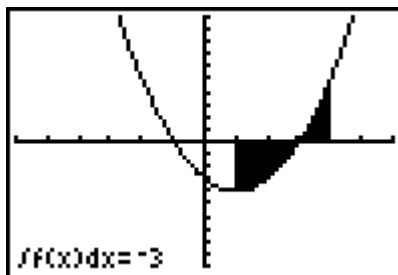
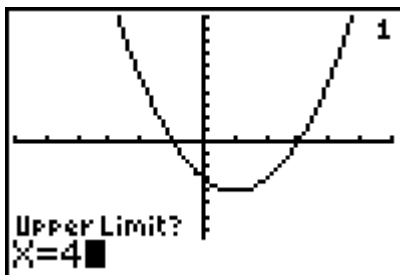
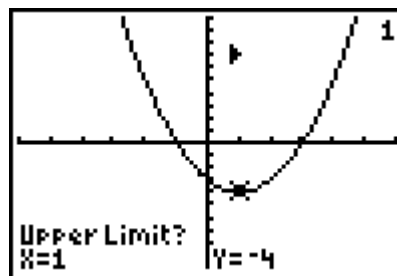
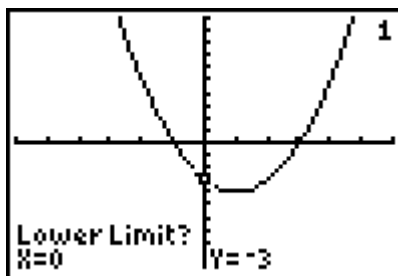
Enter the lower and upper bounds and press $\boxed{\text{ENTER}}$ after each entry.



```

1: value
2: zero
3: minimum
4: maximum
5: intersect
6: dy/dx
7: ∫f(x)dx

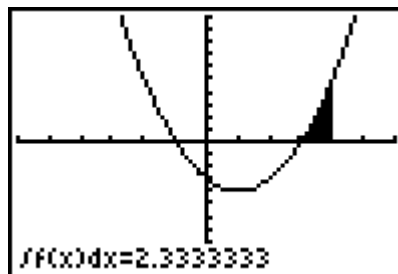
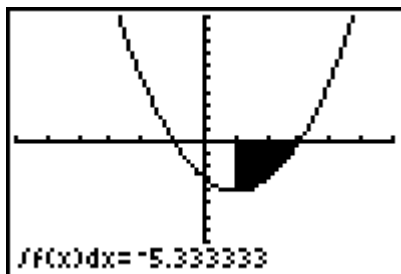
```



CAUTION: Ensure that students understand the concept of physical area and the definite integrand.

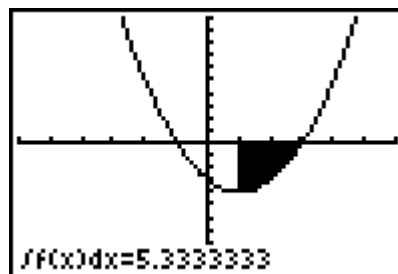
If you wish to calculate the physical area under the curve from $x = 1$ to $x = 4$, you need to calculate two separate integrands.

$$\int_1^3 x^2 - 2x - 3 \, dx + \int_3^4 x^2 - 2x - 3 \, dx$$



Reminder: Add the positive areas or you could enter the bounds in reverse to calculate a positive area.

$$\int_3^1 x^2 - 2x - 3 \, dx \text{ which calculates a positive area.}$$



The screen capture to the right shows the calculation of the total area knowing that one calculated area will be negative.

```

fnInt(X^2-2X-3,X,
3,1)+fnInt(X^2-2X
-3,X,3,4)
7.666666667

```

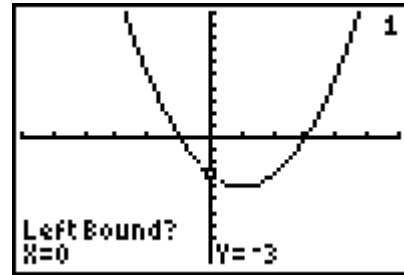
SOLUTIONS/ROOTS/ZEROES

The [CALC] menu zero, minimum and maximum commands have the same keypad presses.

For example, to find one of the zeroes of $x^2 - 2x - 3$.

Input the equation into $Y=$

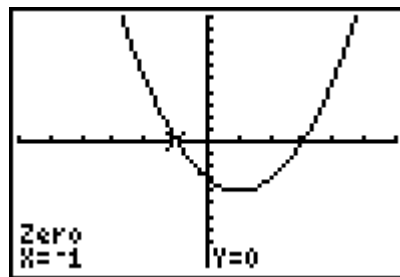
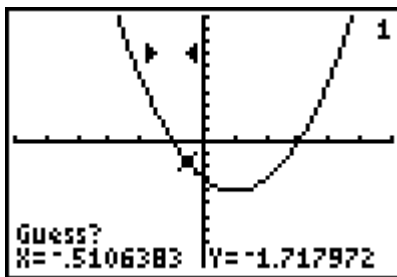
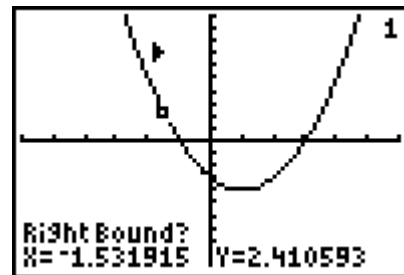
Graph the expression and press 2^{nd} [CALC] 2 .



Either input a value to the left of the first solution/root/zero or use your arrow keys to place the cursor to the left of the solution/root/zero and then press ENTER

In the example the arrow keys have been used to place the cursor after the solution/root/zero.

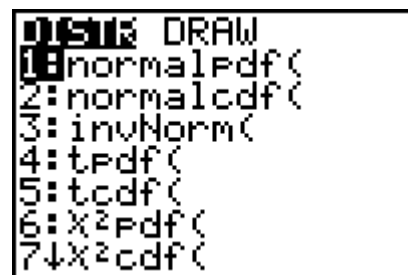
Instead of a guess (which you could do), just press ENTER .



PROBABILITY

Pressing 2^{nd} [STAT] will show the screen for the probability commands.

The normal distribution and binomial distributions (down the screen) are the commands we use most often.



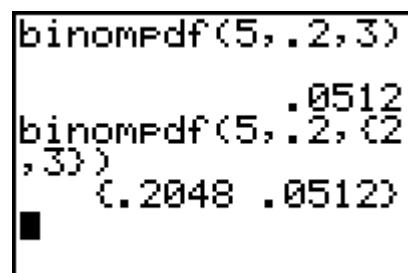
BINOMIAL DISTRIBUTION

2^{nd} [STAT] \uparrow and place your cursor on binompdf(and press ENTER .

If $X \sim B(5, 0.2)$. What is the $P(X = 3)$?

The commands are binompdf(n, p, r).

You can also list more than one probability.



If you do not state a value of r, the set of probabilities will be all values from r = 0 to r = 5.

```
binompdf(5,.2)
(.32768 .4096 ...
```

Use your \blacktriangleright to view all the probabilities.

In addition, you could set the calculator to 4 decimal places when calculating probabilities.

```
NORMAL SCI ENG
FLOAT 0 1 2 3 5 6 7 8 9
RADIAN DEGREE
FUNC PAR POL SEQ
CONNECTED DOT
SEQUENTIAL SIMUL
REAL a+bi re^θi
FULL HORIZ G-T
SET CLOCK 10/06/05 4:38PM
```

Whilst the screen capture shows the **MODE** menu, do not forget about the other facilities the TI calculator has.

You can also input the binomial commands into a list and view the probabilities (you will need to state values from 0 to n (e.g. L1 and then use a list formula L2 that refers to L1)).

#	L2	L3	1
0	-----	-----	
1			
2			
3			
4			
5			

L1 = "e4(X,X,0,5..."			

In list 1, a sequence has been generated from 0 to 5.

In list 2, the binomial probabilities for n = 5 and p = 0.6 have been generated (rounded to 4 decimal places).

L1	#	#	L3	2
0		.01024	-----	
1		.0768		
2		.2304		
3		.3456		
4		.2592		
5		.07776		
-----		-----		
L2 = "...df(5,.6,L1"				

Place your cursor on L2 and press **CLEAR** (do not press the delete pad **DEL**). See page 4 for inserting and deleting lists.

2nd **STAT** \blacktriangle and place your cursor on binompdf(and press **ENTER**.

In the example to the right, the binompdf(has been saved in L2.

Another way of calculating the probabilities is to input the binomial distribution into Y1 and set up the tableset menu and then view the probabilities in the table menu (either all or input the "r" value).

```
Plot1 Plot2 Plot3
\Y1=binompdf(5,.
6,X)
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
```

```
TABLE SETUP
TblStart=0
ΔTbl=1
Indent: Auto
Depend: TABLE Ask
```

X	Y1	
0	.01024	
1	.3456	
X=3		

OR

TABLE SETUP	
TblStart=0	
ΔTbl=1	
Indent:	Ask
Depend:	Auto Ask

X	Y1	
0	.01024	
1	.0768	
2	.2304	
3	.3456	
4	.2592	
5	.07776	
6	0	

X=0

(Please note the value of 0 for $n = 6$ (not possible for $n = 5$))

To add many binomial probabilities you can either use the sum facility or use the cumulative binomial facility.

CUMULATIVE BINOMIAL DISTRIBUTION

2nd **STAT** **▴** and place your cursor on binomcdf(and press enter.

The cumulative binomial command sums the binomial probabilities from zero to the value stated.

$P(X \leq 4)$ given $X \sim B(8, 0.6)$

If you wish to calculate $P(X > 6)$, you may wish to use

$P(E) = 1 - P(E')$ or sum the individual probabilities.

binomcdf(8,.6,4)	
	.4059
1-binomcdf(8,.6,	
6)	
	.1064

If you wish to know all the cumulative sums of the probabilities, you may wish to enter the command shown in the screen capture (the **▸** key has been used to go to the end of the set of cumulative probabilities).

You must be careful when using this command and the use of $<$, $>$, \leq , and \geq .

binomcdf(8,.6)	
...6	.9832 1.0000)

For example, $P(3 < X \leq 7)$ given $X \sim B(8, 0.6)$. The calculator cannot calculate this in one step.

The complete set of the cumulative probabilities (as seen in the previous screen capture) could have been used.

$$0.9832 - 0.1737 = 0.8095$$

binomcdf(8,.6,7)	
-binomcdf(8,.6,3	
)	
	.8095

For example, $P(2 \leq X \leq 6)$ given $X \sim B(8, 0.6)$.

Sum the probabilities to $X = 6$ and take away the sum of probabilities to $X = 1$.

```
binomcdf(8,.6,6)
-binomcdf(8,.6,1)
)
.8851
```

RANDOM INTEGER GENERATOR

Like the binomial commands the random integer generator is quite useful (a different approach to the Application, Prob Sim).

MATH \leftarrow **5**

The screen capture to the right shows the random simulation of

- (a) $1 \leq \text{number} \leq 6$
- (b) $1 \leq \text{number} \leq 6$, four times
- (c) sum of four numbers, $1 \leq \text{number} \leq 6$

```
randInt(1,6) 2
randInt(1,6,4)
(4 2 6 2)
sum(randInt(1,6,
4))
14
```

The common joke is that the students can use their calculator for board games that have misplaced dice.

In addition to random integer generator, you can send a randomly generated numbers to a list.

MATH \leftarrow **5** **1** **,** **6** **,** **8** **)** **STO** \rightarrow **2nd** **[L1]** generates the list of eight random numbers, $1 \leq \text{number} \leq 6$ and sends the numbers to L1.

```
randInt(1,6,8) $\rightarrow$ L
1
(1 3 4 2 3 6 4 ...
```

L1	L2	L3	1
1	---	---	
2			
3			
4			
L1(1) = 1			

NORMAL DISTRIBUTION

Probability of a normally distributed variable

Enter the following **2nd** **VAR** **2**

normalcdf(should appear on the screen

Enter the following information

Lower boundary upper boundary μ σ

To finish the calculation, enter the following **)** **ENTER**

NOTE: Negative infinity is represented by $(-)$ 1 2^{nd} $,$ 9 9
 Positive infinity is represented by 1 2^{nd} $,$ 9 9

(You can also enter 1×10^9 to represent infinity)

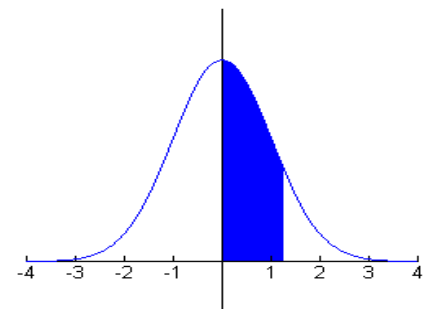
Example

Find $P(0 < z < 1.24)$

Enter the following:

2^{nd} $VAR\Sigma$ 2 0 $,$ 1 $.$ 2 4 $,$ 0 $,$ 1 $)$ $ENTER$

The answer of 0.3925122375 should appear.
 $P(0 < z < 1.24) \approx 0.3925$



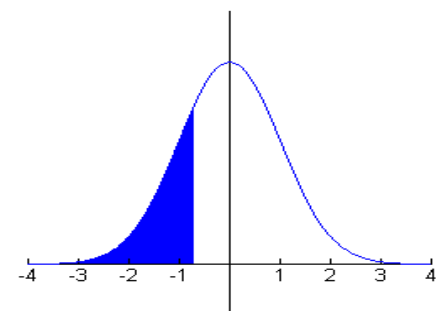
Example

Find $P(z < -0.72)$

Enter the following:

2^{nd} $VAR\Sigma$ 2 $(-)$ 1 2^{nd} $,$ 9 9 $,$ $(-)$ $.$ 7 2 $,$ 0 $,$ 1 $)$ $ENTER$

The answer of 0.2357624233 should appear.
 $P(z < -0.72) \approx 0.2358$



Example

A normal variable has a mean of 53 and a standard deviation of 12. Find the proportion of scores more than 65.

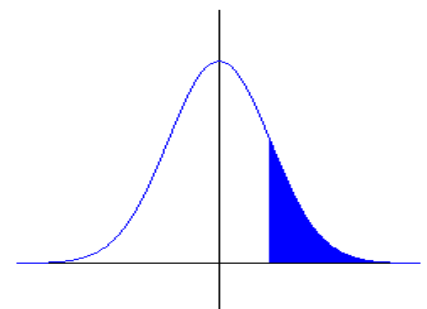
Need to find $P(X > 65)$

Enter the following:

2^{nd} $VAR\Sigma$ 2 6 5 $,$ 1 2^{nd} $,$ 9 9 $,$ 5 3 $,$ 1 2 $)$ $ENTER$

The answer of 0.1586552596 should appear.

The proportion of scores more than 65 is approximately 0.1587



**FINDING A NORMALLY DISTRIBUTED VARIABLE
 (given the probability)**

Enter the following: 2^{nd} $VAR\Sigma$ 3

invNorm(should appear on the screen

Enter the following information

Percentile $,$ μ $,$ σ

To finish the calculation, enter the following $\boxed{)} \boxed{\text{ENTER}}$

The percentage of a Z-score or X-score is the percentage (as a decimal) of the scores that lied to the left of the Z-score or X-score.

Example 50% of scores lie to the left of the mean, therefore the mean has a percentile of 0.5.

Example 95% of scores lie to the left of the Z-score 1.64, therefore this Z-score has a percentile of 0.95.

Example

A set of standard normal scores, z , has a normal distribution. Find the value of z in each of the following.

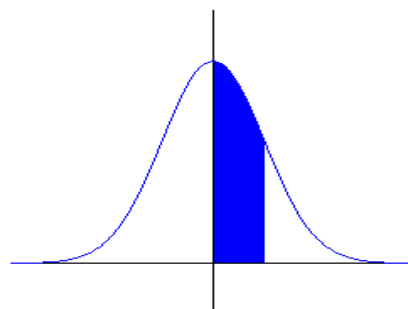
(a) $P(0 < Z < z) = 0.2967$

As the value z is to the right of the mean, to calculate its percentile you must add 0.5. The percentile needed is 0.7967

Enter the following:

$\boxed{2\text{nd}} \boxed{\text{VAR}} \boxed{3} \boxed{\cdot} \boxed{7} \boxed{9} \boxed{6} \boxed{7} \boxed{,} \boxed{0} \boxed{,} \boxed{1} \boxed{)} \boxed{\text{ENTER}}$

The answer of 0.8298917332 should appear.
The z-score is approximately 0.83.



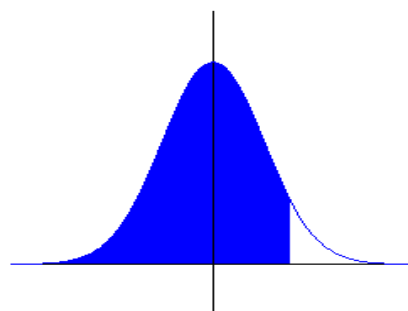
(b) $P(Z < z) = 0.9162$

91.62% of the scores sit to the left of the z-score, therefore its percentile is 0.9162.

Enter the following:

$\boxed{2\text{nd}} \boxed{\text{VAR}} \boxed{3} \boxed{\cdot} \boxed{9} \boxed{1} \boxed{6} \boxed{2} \boxed{,} \boxed{0} \boxed{,} \boxed{1} \boxed{)} \boxed{\text{ENTER}}$

The answer of 1.379956627 should appear.
The z-score is approximately 1.38



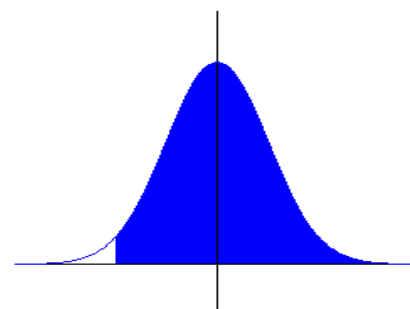
(c) $P(Z > z) = 0.9986$

99.86% of the scores sit to the right of the z-score, therefore its percentile is 0.0014 ($1 - 0.9986$)

Enter the following:

$\boxed{2\text{nd}} \boxed{\text{VAR}} \boxed{3} \boxed{\cdot} \boxed{0} \boxed{0} \boxed{1} \boxed{4} \boxed{,} \boxed{1} \boxed{)} \boxed{\text{ENTER}}$

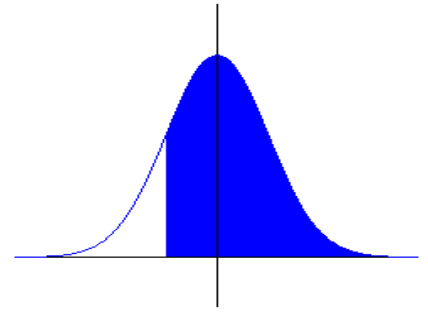
The answer of -2.988882269 should appear.
The z-score is approximately -2.99.



Example

A normal variable has a mean of 53 and a standard deviation of 12. If 70% of the scores are at least x , what is the value of x ?

70% of the scores sit to the right of the x -score, therefore its percentile is 0.3 ($1 - 0.7$).



Enter the following:

`2nd` `VARS` `3` `.` `3` `,` `5` `3` `,` `1` `2` `)` `ENTER`

The answer of 46.70719388 should appear.
The x -score is approximately 46.71.

TABLE FUNCTION

Press `Y=` and enter `2` `X,T,θ,n` `+` `5`

```
Plot1 Plot2 Plot3
Y1=2X+5
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
```

Press `2nd` `[TBLSET]` and input the data as shown.

```
TABLE SETUP
TblStart=-3
ΔTbl=1
Indent: Auto Ask
Depend: Auto Ask
```

Press `2nd` `[TABLE]`

This shows the values of $y = 2x + 5$ for values of x starting at $x = -3$ and increasing by 1 each time.

X	Y1
-3	-1
-2	1
-1	3
0	5
1	7
2	9
3	11

X = -3

What if you wanted to start at 2.3 and increase in increments of 0.2?

Press `2nd` `[TBLSET]` and input the data as shown.

```
TABLE SETUP
TblStart=2.3
ΔTbl=.2
Indent: Auto Ask
Depend: Auto Ask
```

Press $\boxed{2\text{nd}} \boxed{[\text{TABLE}]}$

This shows the values of $y = 2x + 5$ for values of x starting at $x = 2.3$ and increasing by 0.2 each time.

X	Y ₁	
2.3	9.6	
2.5	10	
2.7	10.4	
2.9	10.8	
3.1	11.2	
3.3	11.6	
3.5	12	

X=2.3

If you wish to enter the x -values yourself, press $\boxed{2\text{nd}} \boxed{[\text{TBLSET}]}$. Change the independent to ask by using $\boxed{\downarrow} \boxed{\downarrow} \boxed{\rightarrow}$ $\boxed{[\text{ENTER}]}$. This gets the TI 83 to prompt you for the x -values.

```
TABLE SETUP
TblStart=-3
ΔTbl=1
Indent: Auto
Depend: Ask
```

X	Y ₁	

X=

Press $\boxed{2\text{nd}} \boxed{[\text{TABLE}]}$ to input values.

Press $\boxed{4} \boxed{[\text{ENTER}]}$ and the value of 13 is shown in the Y_1 column.

$Y_1 = 2 \cdot 4 + 5$. You can have more equations (i.e. Y_2)

X	Y ₁	
4	13	

X=4

Press $\boxed{[\text{Y=}]}$ enter $3x - 1$ into Y_2

X	Y ₁	Y ₂
4	13	11
3	11	8

X=

$\boxed{2\text{nd}} \boxed{[\text{TABLE}]} \boxed{3}$. For $x = 3$, the values of Y_1 and Y_2 are calculated ($Y_1 = 2 \cdot 3 + 5$ and $Y_2 = 3 \cdot 3 - 1$).

Y VARIABLES

Calculate the value of $y = 3x + 1$ when $x = 2$.

Into $\boxed{[\text{Y=}]}$ type $\boxed{3} \boxed{[\text{X,T,θ,n}]} \boxed{+} \boxed{1}$
 $\boxed{2\text{nd}} \boxed{[\text{QUIT}]} \boxed{[\text{VARS}]} \boxed{\rightarrow} \boxed{1} \boxed{1}$
 $\boxed{1} \boxed{2} \boxed{)} \boxed{[\text{ENTER}]}$

You may wish to evaluate the expression with other values for the variable.

$\boxed{[\text{VARS}]} \boxed{\rightarrow} \boxed{1} \boxed{2\text{nd}} \boxed{\{ } \boxed{2} \boxed{,} \boxed{5} \boxed{2\text{nd}} \boxed{\} } \boxed{[\text{ENTER}]}$. i.e. $x = 2, y = 7$ and $x = 5, y = 16$.

```
Y1(2)
Y1(2,5)
(7 16)
```

Sometimes you may delete a list instead of clearing it. Do not panic. If you have used your cursor to highlight L2 (for example) and pressed **DEL** (delete), you will find that the entire column will disappear. To insert a list, place your cursor where you want to insert a list and press **2nd** **[INS]** and then name the list by pressing **2nd** **[2]** **ENTER**.

L1	DEL	L3	2
3 6 7 12 19 -----	6 3 7 8 2 -----	-----	
L2 = {6, 3, 7, 8, 2}			

L1	DEL	L4	2
3 6 7 12 19 -----	-----	-----	
L3 =			

L1	DEL	L3	2
3 6 7 12 19 -----	-----	-----	
Name=			

L1	DEL	L3	2
3 6 7 12 19 -----	-----	-----	
Name=L2			

L1	DEL	L3	2
3 6 7 12 19 -----	6 3 7 8 2 -----	-----	
L2 = {6, 3, 7, 8, 2}			

ERROR MESSAGES GRAPHS (HISTOGRAMS, SCATTERGRAM, BOX-AND-WHISKER)

One of the many questions asked is why the graphs are not being drawn correctly. As well, many ask why there are other graphs drawn.

Suggestion: use some of the following procedures before you enter data into lists, enter equations into **Y=** or press **GRAPH** .

Procedures to follow before graphing

1 Check window values (i.e. portion of the cartesian plane is what you want to see). Press **WINDOW** . For example, you may want to see the graph for the values of x between 5 and 9 and this window will not allow you to do this.

WINDOW
Xmin=200
Xmax=250
Xscl=10
Ymin=0
Ymax=15
Yscl=3
Xres=1

2 Check that the data entered in lists match up (i.e. for example, 6 values in L1 and 5 values in L2).

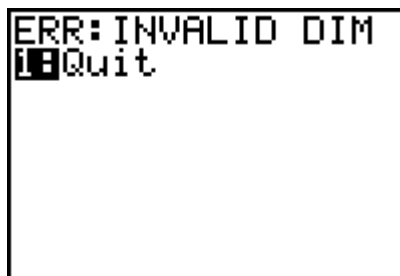
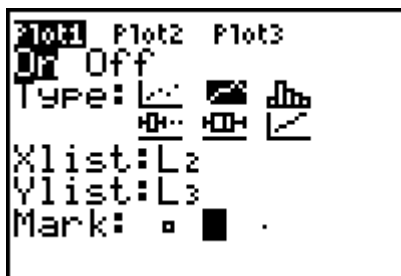
L1	L2	L3	2
2 3 4 5 6 7 -----	2 5 12 4 -----	-----	
L2(6) =			

If you press **[GRAPH]** , the TI83 will give you an error message. For example, if you enter the data shown, have a STATPLOT on and press **[GRAPH]**, the TI83 will give you an error message.

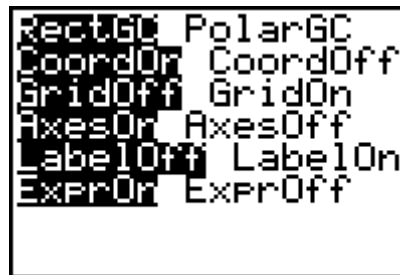


3 Another problem could be that you have graphs turned on, but there is no data for the TI83 to graph. The TI83 has been told to graph a connected line graph for data in L2 and L3, but there is no data to graph.

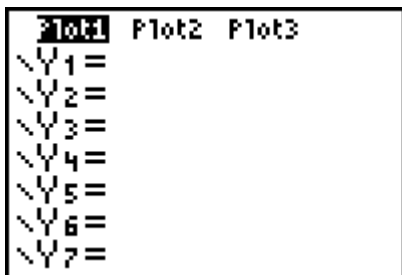
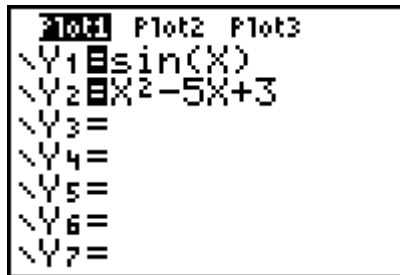
L1	L2	L3	2
-----	-----	-----	
-----	-----	-----	
L2(1)=			



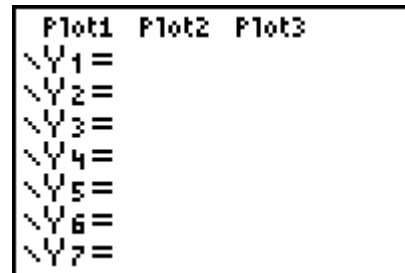
4 Due to games and programming, the **[FORMAT]** menu will be changed. Press **[2nd]** **[FORMAT]** and have the menu as shown. Highlight the options on the left-hand side of the menu. Use **[↑]**, **[↓]**, **[←]**, **[→]** keys to put cursor over the commands then press **[ENTER]** .



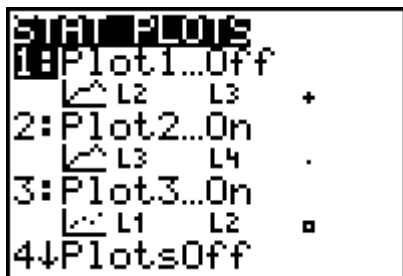
5 Delete equations in the **[Y=]** menu. Use your arrow keys and the **[CLEAR]** button to delete the equations.



Looking at this screen, you can see that Plot 1 is ON. Whilst in this menu, you can use the arrow keys to put the cursor on Plot 1 and press **[ENTER]**. Plot 1 is turned OFF. (You can also turn plots on.)

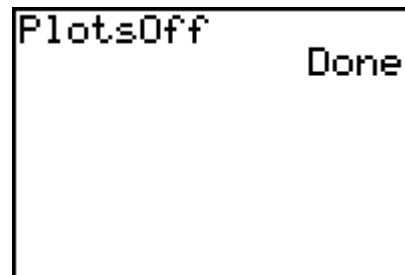


6 Turn off all Stat Plots. Press $\boxed{2\text{nd}}$ [STAT PLOT]. For example, 2 plots have been turned on.



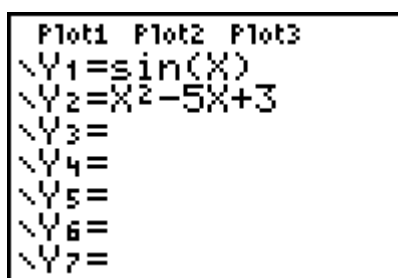
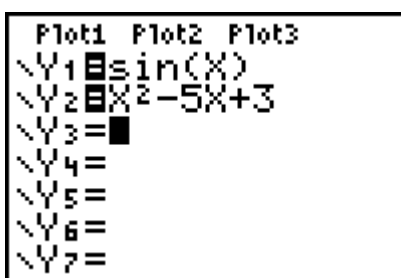
Press $\boxed{4}$ and $\boxed{\text{ENTER}}$.

All plots have been turned off.

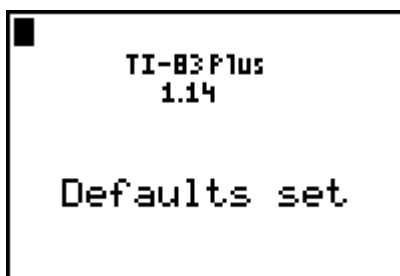
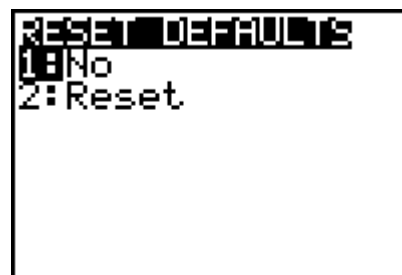


You could individually turn off some plots, but it is just as easy to turn all plots off.

7 To turn off the equations (and leave them in the lines), place the cursor on the = and press $\boxed{\text{ENTER}}$.



8 Another procedure is to reset the defaults. Press $\boxed{2\text{nd}}$ [MEM] $\boxed{7}$ $\boxed{2}$ $\boxed{2}$. Only use this method as a last resort.



You are now ready to draw graphs.

TRANSMITTING APPLICATIONS

Many applications can be transmitted from calculator to calculator. They can also be downloaded from www.education.ti.com.

Connect both TI83 calculators via the link cable. Ensure the cable is firmly pushed in on both calculators.

Press **2nd**[LINK] on both calculators

Receiving TI83

```

SEND RECEIVE
1:All+...
2:All-...
3:Prgm...
4>List...
5:Lists to TI82...
6:GDB...
7↓Pic...
    
```

Press **▶**

```

SEND RECEIVE
1:Receive
    
```

Transmitting TI83

```

SEND RECEIVE
1:All+...
2:All-...
3:Prgm...
4>List...
5:Lists to TI82...
6:GDB...
7↓Pic...
    
```

Press **◀** then press **ENTER** when cursor is on C (corresponds to Apps).

```

SEND RECEIVE
B:String...
C:APPS...
D:APPVars...
E:GROUP...
F:SendId
G:SendOS
H:Back Up...
    
```

Press **ENTER** and use your **▲** and **▼** and **ENTER** keypads to highlight which Applications to transmit.

```

SEND RECEIVE TRANSMIT
▶*AreaForm APP
*CBL/CBR APP
*CellSheet APP
*Conics APP
*CtlgHelp APP
*DecDefnd APP
*DemoTrns APP
    
```

Press **▶** to highlight TRANSMIT on the sending calculator.

```

SELECT TRANSMIT
1:Transmit
    
```

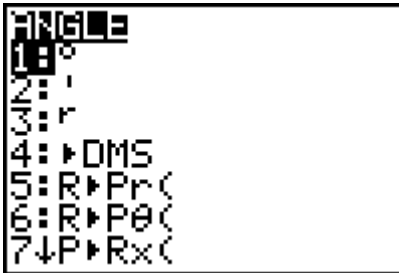
You must press **ENTER** on your TI83 first (i.e. the receiving TI83). Now press **ENTER** on the calculator you are transferring data from.

You may find that you will need to press **2** to overwrite the Applications on your TI83.

Use the above procedure to transfer data, lists, programmes, etc.

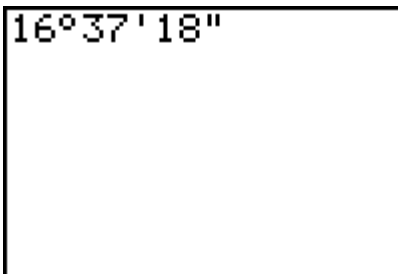
ANGLES (DEGREES, MINUTES, SECONDS) AND TIME

To enter angles, you must know where the symbols are. Press $\boxed{2nd}$ [ANGLE]. Degrees and Minutes are here and to access seconds, you must use \boxed{ALPHA} $\boxed{+}$.

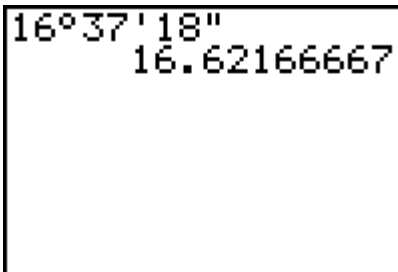


To enter $16^\circ 37' 18''$ (16 degrees, 37 minutes and 18 seconds);

Press $\boxed{1}$ $\boxed{6}$ $\boxed{2nd}$ [ANGLE] $\boxed{1}$ $\boxed{3}$ $\boxed{7}$ $\boxed{2nd}$ [ANGLE] $\boxed{2}$ 18 \boxed{ALPHA} $\boxed{+}$

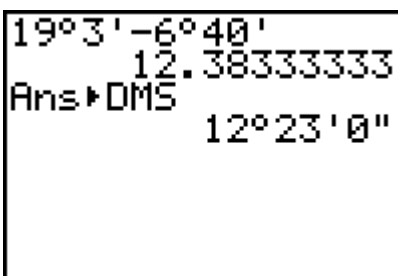
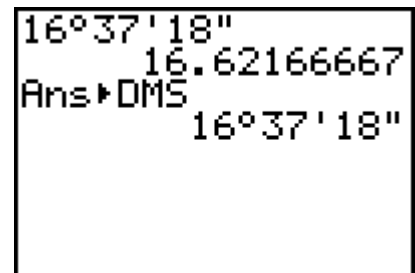


If you press enter, you will see that the answer on the screen has been changed to degrees.



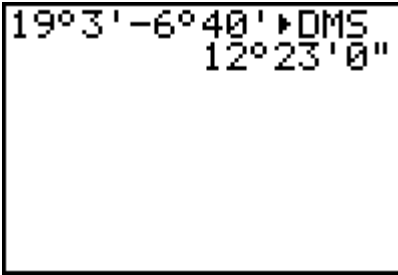
If you wish to convert the answer back to degrees, minutes and seconds, access the ANGLE menu.

Press $\boxed{4}$. Press \boxed{ENTER}



As well, the degrees/minutes/seconds corresponds to hours, minutes and seconds. You may wish to find the difference in time. For example, what is the time difference between 6:40am and 7:03pm? You must work in 24 hour time and hence, 7:03pm is 1903 hours. Use the angle facility to find the difference in time and convert back to hours and minutes.

You must be careful when checking time differences over 2 or more days.

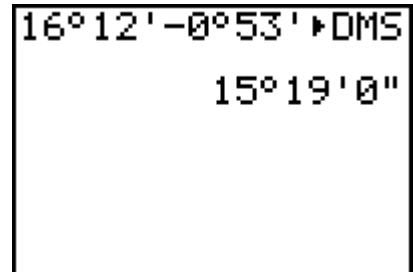


As shown on the left, you can do all the calculations in one step.

The answer is 12 hours and 23 minutes.

To enter any time between 12am and 1am, you must enter 0° first.

For example, what is the time difference between 12:53am and 4:12 pm?



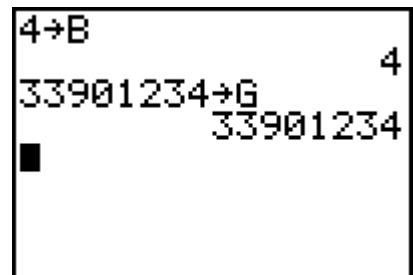
The answer is 15 hours and 19 minutes.

STORING VALUES

Storing values on the TI83 is very easy. Yes, you can use the calculator as a telephone directory. For example, 4 is stored in B and 3390 1234 is my friend Graphica's home number.

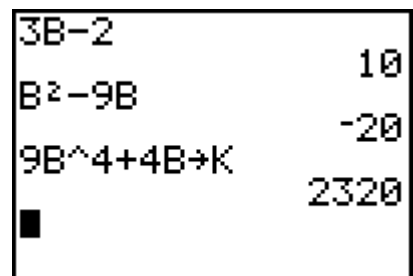
Press 4 [STO] [ALPHA] [B] and [ENTER] .

Press 3 3 9 0 1 2 3 4 [STO] [ALPHA] [G] and [ENTER] .



To access these numbers, you simply use the [ALPHA] and the corresponding letter.

You can also store another answer.



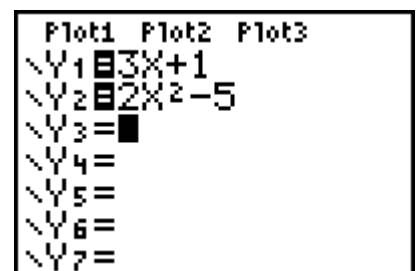
COMPOSITE FUNCTIONS

The effect of applying one function, Y_1 , then another function, Y_2 , can be achieved via the composite function $Y_2(Y_1)$.

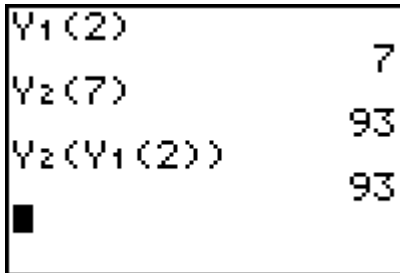
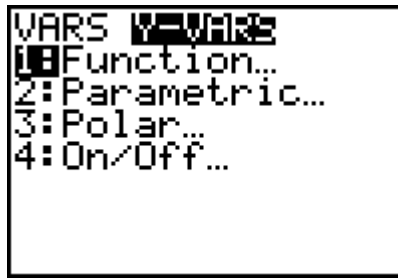
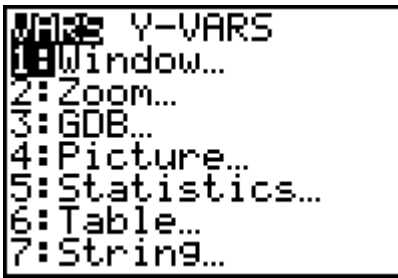
If $f(x) = 3x + 1$ and $g(x) = 2x^2 - 5$

Enter the equations into Y_1 and Y_2 by pressing the [Y=] .

Press [2nd] [QUIT] to display the home screen.



Press $\boxed{\text{VARS}}$ $\boxed{\rightarrow}$ (Y-Vars) $\boxed{1}$ (Function) $\boxed{1}$ (for Y_1) and type in $\boxed{2}$. This will calculate $f(2)$.



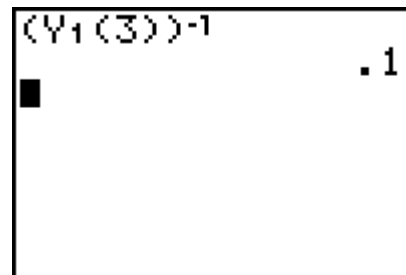
This screen capture shows the calculations $f(2)$ and $g(7)$ which is the same as $g(f(2))$.

X	Y3	Y4
2	93	14286
Y4 =		

As well, you can find the inverse of functions. For example, $(f(3))^{-1}$.

For the inverse, use the $\boxed{x^{-1}}$.

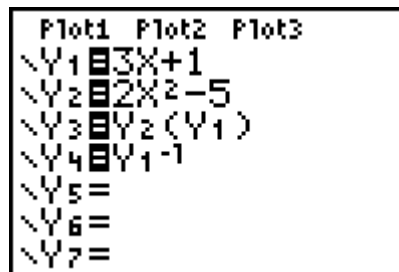
Another way in which to find values of composite functions and inverses is to use the $\boxed{Y=}$.



In Y_3 enter $Y_2(Y_1)$ which represents $g(f(x))$ and if you wish to enter Y_1^{-1} which represents $f^{-1}(x)$.

See Table Function, Page 14, (set the TBLSET Independent to ASK).

Press $\boxed{2nd}$ [TABLE] to access table and enter 2. To access Y_3 and Y_4 use your $\boxed{\rightarrow}$ and $\boxed{\leftarrow}$ keys.



X	Y1	Y2
2	7	3
X =		

OPERATING SYSTEM

One of the benefits of having a TI83 plus calculator is that you can update your operating system. You can log onto www.education.ti.com and download the operating system or download it from another TI83 plus calculator.

Warning: Updating operating system will delete RAM memory (i.e. programmes, lists, games etc). Backup your data on another calculator or on your computer (TI Connect software).

Connect both TI83 calculators via the link cable. Ensure the cable is firmly pushed in on both calculators.

Press **[2nd]** **[LINK]** on both calculators

Receiving TI83

```
SEND RECEIVE
1: All+...
2: All-...
3: Prgm...
4: List...
5: Lists to TI82...
6: GDB...
7↓Pic...
```

Transmitting TI83

```
SEND RECEIVE
1: All+...
2: All-...
3: Prgm...
4: List...
5: Lists to TI82...
6: GDB...
7↓Pic...
```

Press **[▶]**

```
SEND RECEIVE
1: Receive
```

Press **[▲]** and place cursor over G.

```
SEND RECEIVE
BTstring...
C: APPS...
D: APPVars...
E: Group...
F: SendId
G: SendOS
H: Back Up...
```

You must press **[ENTER]** on your TI83 first (i.e. the receiving TI83). Now press **[ENTER]** on the calculator you are transferring the Operating System from.

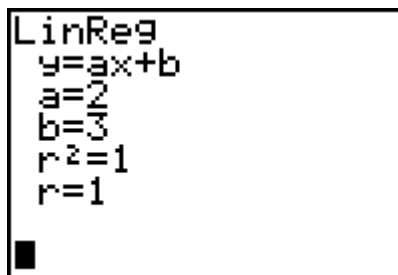
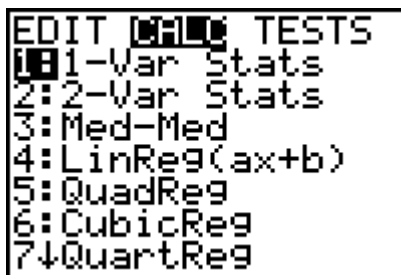
EQUATION OF A LINE (given two points)

Determine the equation of the line that passes through (-2, -1) and (2, 7).

Press **[STAT]** **[1]** and input the x co-ordinates into L2 and the y co-ordinates into L3.

L1	L2	L3	3
1 2 3 4 5 6 7	-2 2 -----	-1 7 -----	
L3(3) =			

To determine the equation of the line press **[STAT]** **[>]** **[4]** **[2nd]** **[L2]** , **[2nd]** **[L3]** **[ENTER]**



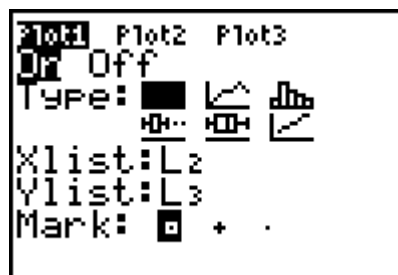
Do not worry if you do not have r^2 and r at the bottom of your calculations (this calculator has the diagnostic turned on).

How do you know if $y = 2x + 3$ is correct?

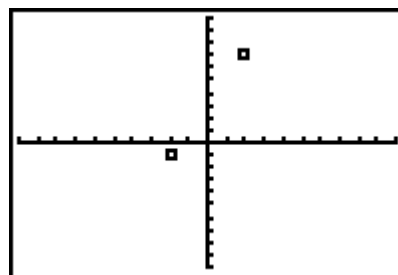
Press **[2nd]** **[STAT PLOT]** and turn on a graph (ensure that other graphs are off and there are no other graphs in **[Y=]**).



Press **[1]** and place your cursor over On and press **[ENTER]** . Highlight **[On]** by placing your cursor it and press **[ENTER]** . Place your cursor on the lines of Xlist and Ylist and enter the respective lists (**[2nd]** **[L2]** and **[2nd]** **[L3]**). The box or the plus operation are usually the best to display graphs of data.



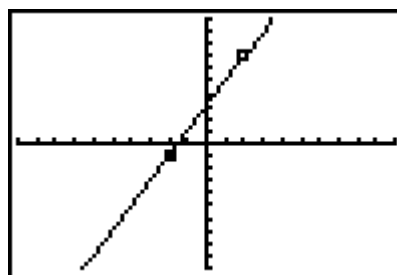
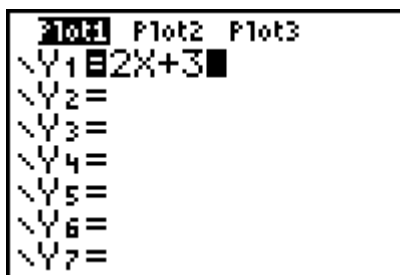
Press **[GRAPH]** (or press **[ZOOM]** **[6]** for the default window)



Press **[Y=]** and enter $2x + 3$ into Y1.

Notice that Plot1 is turned on.

Press **[GRAPH]**



If you wish to trace values using **TRACE**, please be careful as you have drawn two graphs.

Use or to alternate between graphs and input a value that you wish to find information about.

