

# TI-84 Skills for the IB Maths SL

Dr. William Larson, International School of Geneva

If you have not already done so, upgrade to OS 2.55MP and PlySmlt2.

## Sending and receiving an APP or program

To receive

LINK (2nd X,T,θ,n)  
RECEIVE 1:  
Receive ENTER

To send

LINK (2nd X,T,θ,n)  
SEND C:Apps  
CtlgHelp  
ENTER (this selects the APP)  
TRANSMIT  
1: Transmit ENTER

To reuse a previous entry scroll up, press ENTER

To get to the start or end of a long expression or list, for example in  $Y=$ , key 2nd ◀ or ▶ as needed.

## F1 the fraction template



Select . Type your formula into it.

The template eliminates the need for puzzling out brackets in complicated fractions.

Examples

$$\frac{x-1}{x+1} \quad \cos^{-1}\left(\frac{4^2+5^2-2^2}{2*4*5}\right)$$

## To convert a decimal to a fraction

0.375 MATH 1: Frac gives 3/8.

## To simplify fractions

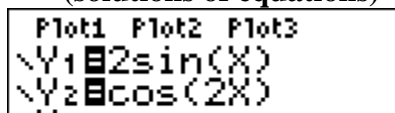
1371/3656 MATH 1: Frac gives 3/8.

The TI does not always give the exact value, for example  $X = 5.673546567E-12$  as an output is an attempt by the TI to report “ $X = 0$ ”; note the E-12 at the end.

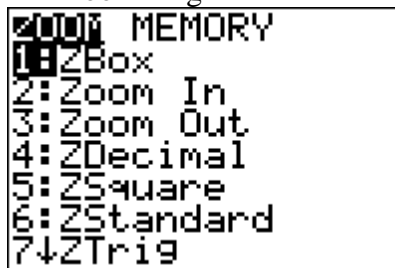
**Dimension error** usually comes from having a STATPLOT on. Go to  $Y=$ . If a Plot is highlighted, un-highlight it with ENTER. If all else fails, MEM (2nd ENTER) 5 : Reset 2 : Defaults 2 : Reset always works.

**Err: WINDOW RANGE** means you set X (or Y) min bigger than max

## Intersections of 2 curves (solutions of equations)



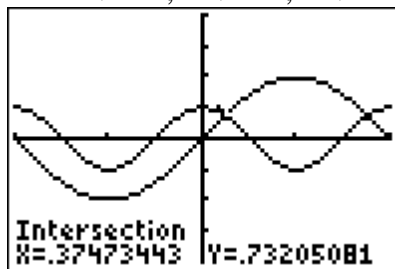
Zoom Trig



2nd CALC

5: intersect

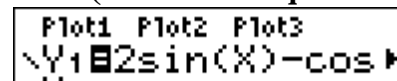
ENTER, ENTER, ENTER,



To store results from intersection or maximum, etc.

Keying [ENTER] will store the X and Y values of that point stored in variables X and Y respectively. Recall the x value with the X,T,θ,n button or with ALPHA X, Recall the y value with ALPHA Y.

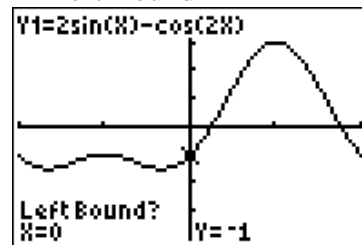
## Zeros (solutions of equations)



2nd CALC

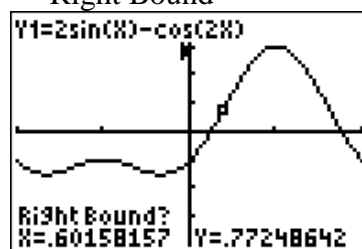
2: zero

Left Bound

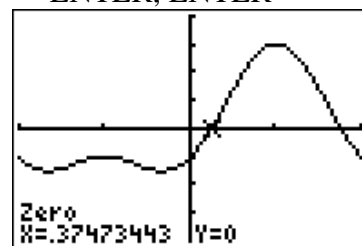


ENTER

Right Bound



ENTER, ENTER



## Maxima & Minima

2nd CALC

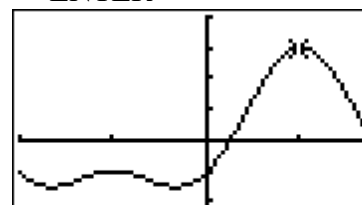
2: zero

Left Bound

ENTER

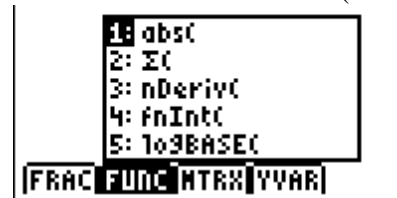
Right Bound

ENTER



## Numerical derivative

ALPHA F2 3:nDeriv(



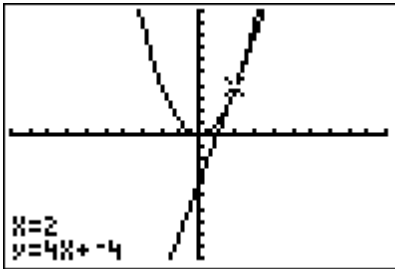
$$\left. \frac{d}{dx}(x^2) \right|_{x=2}$$

4

An analytical derivative (e.g.  $f(x) = 2x$  in this example), cannot be found with the TI-84.

### Find the tangent line

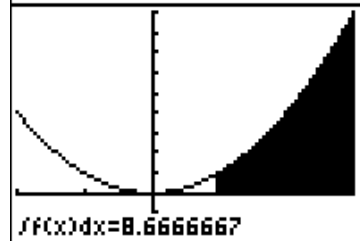
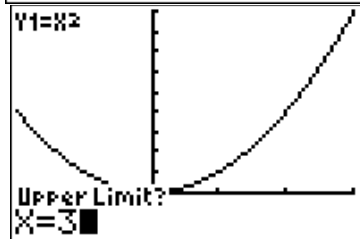
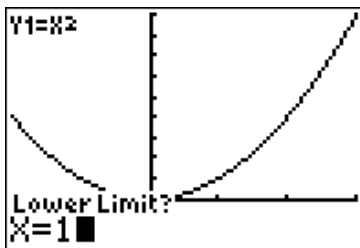
Put  $x^2$  in  $Y=$   
 In GRAPH  
 2nd Draw5:Tangent  
 X=2



The tangent line is  $y = 4x - 4$

### Definite integral

$\int_1^3 x^2 dx$   
 2nd CALC  
 7:  $\int f(x) dx$   
 Lower Bound



The integral is 8.67  
 Or

1: abs(
2: $\Sigma$ (
3: nDeriv(
4: fnInt(
5: logBASE(
FRAC F10: MTRX YVAR

$$\int_1^3 (x^2) dx$$

8.666666667

The integral is 8.67

### Use TABLE to solve

\$5000 is invested at 6.3%. The value of the investment will exceed \$10 000 after n full years. Calculate the minimum value of n.  
 Put the equation in  $Y=$

$$Y_3 = 5000(1.063)^x$$

scroll to  $Y > 10000$

X	Y3
8	8151.5
9	8665
10	9210.9
11	9791.2
12	10408
13	11064
14	11761

X=12

So  $n = 12$

### Matrix

Create a matrix  
 2<sup>nd</sup> MATRIX  
 Edit

NAMES MATH  $\left[ \begin{matrix} 0 \\ 0 \\ 0 \end{matrix} \right]$   
 1: [A] 3x3  
 2: [B]  
 3: [C]  
 4: [D]

Type it in

MATRIX[A] 3 x 3  
 $\left[ \begin{matrix} 1 & -3 & 0 \\ 2 & 0 & 1 \\ 4 & 1 & 3 \end{matrix} \right]$

Find determinant with detA  
 2<sup>nd</sup> MATRIX

NAMES MATH EDIT  
 1: det(  
 2: T  
 3: dim(  
 4: Fill(  
 5: identity(  
 6: randM(  
 7: augment(  
 ENTER

2<sup>nd</sup> MATRIX

NAMES MATH EDIT  
 1: [A] 3x3  
 2: [B]  
 3: [C]  
 4: [D]  
 5: [E]  
 det([A])

Det A = 5

### Inverse matrix with $A^{-1}$

$$A = \begin{pmatrix} 1 & -3 & 0 \\ 2 & 0 & 1 \\ 4 & 1 & 3 \end{pmatrix}$$

$$\begin{bmatrix} 1 & -3 & 0 \\ 2 & 0 & 1 \\ 4 & 1 & 3 \end{bmatrix}^{-1}$$

The inverse is

$$\begin{bmatrix} -.2 & 1.8 & -.6 \\ -.4 & .6 & -.2 \\ .4 & -2.6 & 1.2 \end{bmatrix}$$

### Solve a matrix equation using $X = A^{-1}B$

solve

$$x - 3y = 1$$

$$2x + z = 2$$

$$4x + y + 3z = -1$$

MATRIX[B] 3 x 1  
 $\left[ \begin{matrix} 1 \\ 2 \\ -1 \end{matrix} \right]$   
 [A]<sup>-1</sup>[B]  $\left[ \begin{matrix} 4 \\ 1 \\ -6 \end{matrix} \right]$

So  $x = 4, y = 1, z = -6$

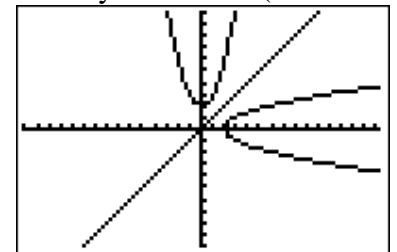
### Graphing the Inverse with DrawInv

Put a graph in  $Y1$   
 Zoom 5: ZSquare

Plot1 Plot2 Plot3  
 $Y_1 = X^2 + 2$   
 $Y_2 = X$

Key 2<sup>nd</sup> DRAW

Key 8: DrawInv(  $Y1$



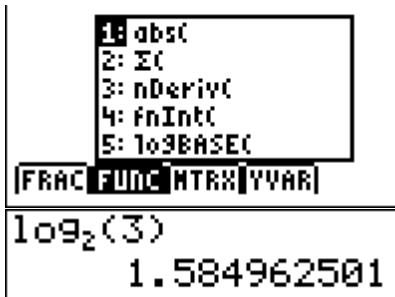
The TI-84 does not care if  $f(x)$  passes the HLT

### Evaluate logs

$$3 = 2^x$$

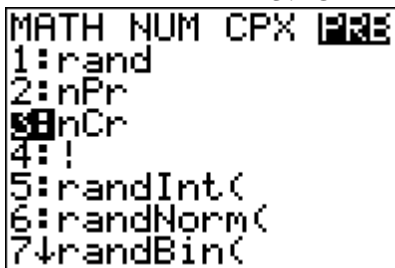
$$x = \log_2 3$$

ALPHA F2: 5: logBASE



## Binomial coefficients

MATH PRB 3:nCr

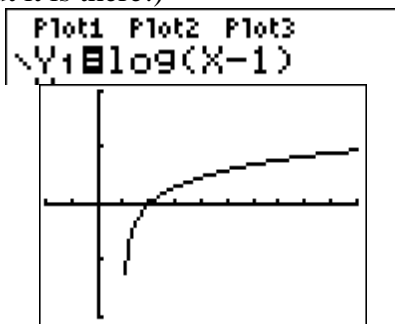


$$\binom{5}{3} = 10$$

So  $\binom{5}{3} = 10$

## The V.A. of logs is not visible

(but it is there!)



F4 accesses the Y1, etc. variables



## Applications

They are accessed by pressing the APPS button.

The TI-84/TI-83 applications (APPS) allowed by the IB are:

- PlySmlt2 – The Polynomial Root Finder and Simultaneous Equation Solver
- Finance

Useless, but allowed

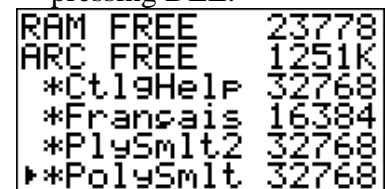
- CtlgHelp – Catalogue Help
- Various language APPS
- CBL/CBR

All other APPS should be deleted using

- MEM (2<sup>ND</sup>+) 2:Mem
- Mgmt/Del A:APPS



Put the cursor in front of the APP to be deleted and pressing DEL.

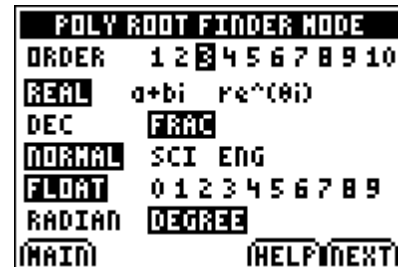


**PlySmlt2 (Polynomial Root Finder and Simultaneous Equation Solver Version 2.0)** has two programs

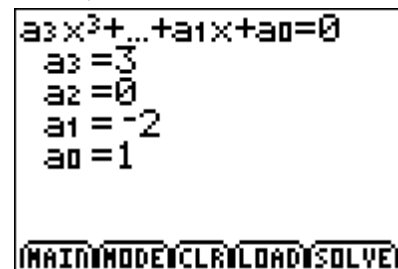
- 1: Polynomial Root Finder
- 2: Simultaneous Equation Solver

## Polynomial Root Finder

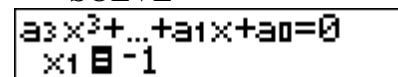
The Polynomial Root Finder can find the roots (i.e. zeros, solutions) for any polynomial with real coefficients up to degree 10. Solve  $3x^3 - 2x + 1 = 0$



NEXT



SOLVE

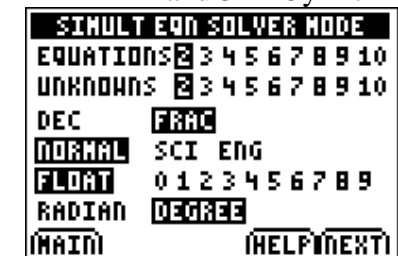


The only real solution is  $x = -1$

## Simultaneous Equation Solver

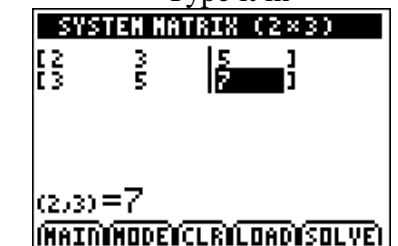
The Simultaneous Equation Solver can solve up to 10 unknowns and 10 equations simultaneously.

Solve  $2x + 3y = 5$   
and  $3x + 5y = 7$

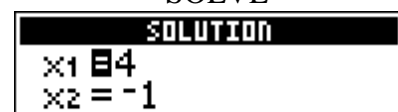


NEXT

Type it in



SOLVE



$x = 4$  and  $y = -1$

## Do not use TRACE & ZOOM

Do not use TRACE &/or ZOOM to find the intersections and

**intercepts.** TRACE skips from one pixel element to the next. If the x-value of a pixel element happens to be exactly the x-value of an intercept or intersection, you will get the right answer. Otherwise the closest pixel element will almost certainly not be correct to 3 significant figures. ZOOM will allow you to zoom in on an intercept or intersection. Eventually you will zoom in enough that TRACE will give enough significant figures, but this is very clumsy and time consuming compared to using CALC

## Putting a list in the STAT list editor

Type a list into L1 using STAT EDIT 1:Edit.

### Clearing the contents of a list

Move the cursor up to the name of the list, e.g. L1, and key CLEAR. (Do not key DEL. DEL deletes the list entirely, including the name, i.e. "L1" itself disappears.)

### Recreating a list

If you have accidentally deleted a list (not just the contents, but the name itself), for example L1, and want it back key STAT 5:SetUpEditor ENTER.

## Mean and Standard Deviation

The number of bottles of water sold at a railway station on each day is given in the following table.

Day	0	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (T°)	21	20.7	20	19	18	17.3	17	17.3	18	19	20	20.7	21
Number of bottles sold (n)	150	141	126	125	98	101	93	99	116	121	119	134	141

- (a) Write down  
 (i) the mean temperature;  
 (ii) the standard deviation of the temperatures.

Go to STAT EDIT

```

3001 CALC TESTS
1:Edit...
2:SortA(
3:SortD(
4:ClrList
5:SetUpEditor
  
```

Type your values into L1. If you have frequencies, type them into L2. (The example below does not use the above numbers.)

L1	L2	L3	2
1	2	1	
4	4	1	
6	6	1	
10	10	1	
14	14	1	
16	16	4	
20	20	3	
L2(1)=2			

Go to STAT CALC 1-Var Stats ENTER

If you just have values in L1 type 1-Var Stats L1

If you have values in L1 and frequencies in L2

Type 1-Var Stats L1, L2

```

1-Var Stats
x̄=5.194444444
Σx=374
Σx²=2138
Sx=1.658430353
σx=1.646873206
↓n=72
  
```

The mean is  $\bar{x}$

The standard deviation is  $\sigma x$ .

### normalcdf(

Given  $\mu = 20$ ,  $\sigma = 3$  find Prob( $19 \leq x \leq 23$ )

2<sup>nd</sup> DISTR 2: normalcdf( [normalPdf( is not needed ever]

```

normalcdf
lower:19
upper:23
μ:20
σ:3
Paste
ENTER, ENTER, ENTER,
normalcdf(19,23)
.4719033368
  
```

### invNorm

Given  $\mu = 20$ ,  $\sigma = 3$  find  $d$  such that 5% less than  $d$ , find  $d$

2<sup>nd</sup> DISTR 3:invNorm

```

invNorm
area:0.05
μ:20
σ:3
Paste
  
```

ENTER, ENTER, ENTER,

```

invNorm(0.05,20)
15.06543912
  
```

$d = 15.1$

### invNorm

Given  $\mu = \mu$ ,  $\sigma = 3$  find  $d$  such that 20% less than 10, find  $\mu$

2<sup>nd</sup> DISTR 3:invNorm

```

invNorm
area:.2
μ:0
σ:1
Paste
  
```

ENTER

```

invNorm(.2,0,1)
-.8416212335
  
```

$$-0.84162 = \frac{10 - \mu}{3}$$

$$\text{Solve } -0.84162 = \frac{10 - \mu}{3} \rightarrow$$

$$\mu = 7.48$$

$$[z = \frac{x - \mu}{\sigma} \text{ is in Info booklet}]$$

Use 1-Var Stats for mean & SD, but NOT for Median, Q1 & Q3.

### binomPDF, binomCDF

If  $n = 6$ ,  $p = .75$ , find  $P(x = 6)$ .

Key 2<sup>nd</sup> DISTR DISTR

A:binompdf

```

DISTR DRAW
7:1/x²pdf(
8:x²cdf(
9:Fpdf(
0:Fcdf(
1:binompdf(
B:binomcdf(
C:poissonpdf(
  
```

ENTER key the values into the template

```

binompdf
trials:6
P:.75
x value:6
Paste
  
```

ENTER, ENTER, ENTER gives

```

binompdf(6,.75,6)
.1779785156
  
```

B: binomcdf works the same way