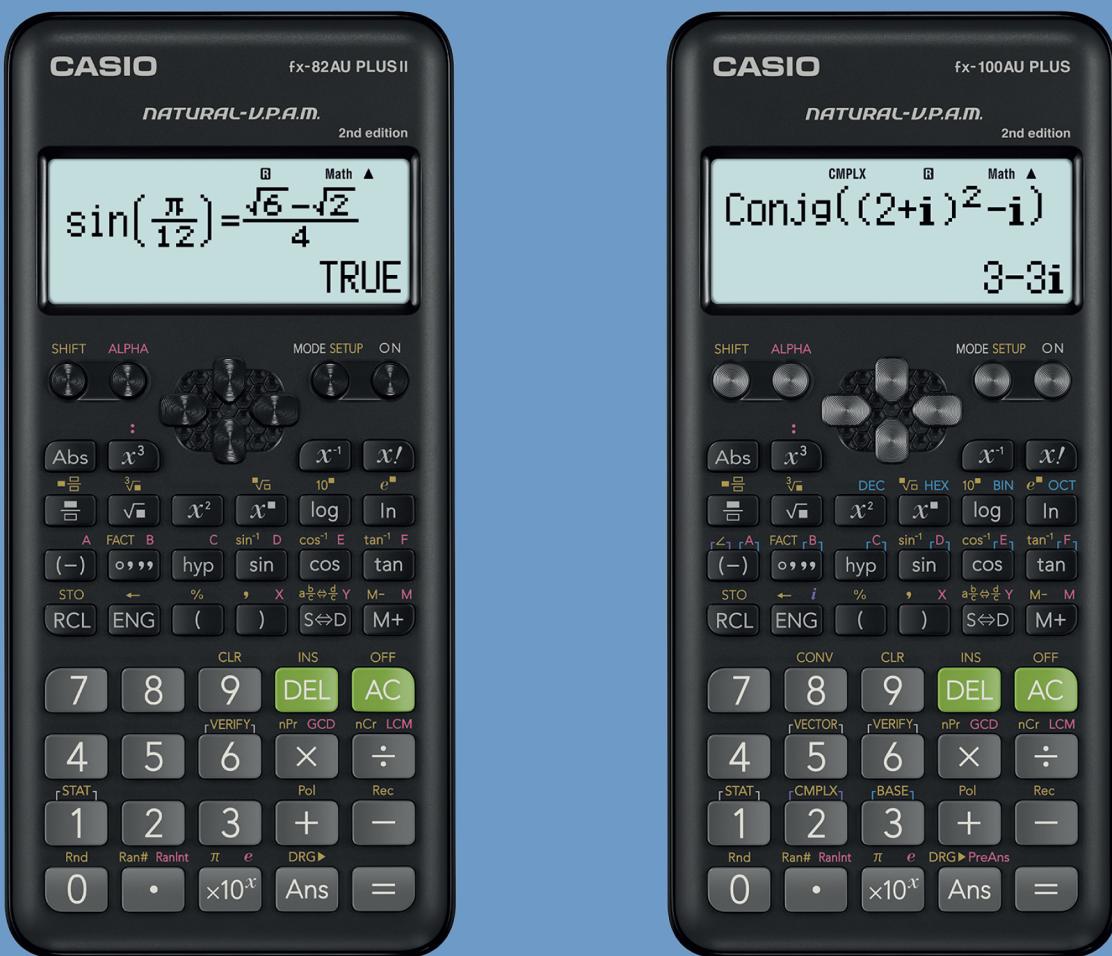


How Do I on a **CASIO fx-82AU PLUS II** and **fx-100AU PLUS**

The useable manual



Team Steps

Made in Australia

How Do I

on a CASIO fx-82AU PLUS II and fx-100AU PLUS

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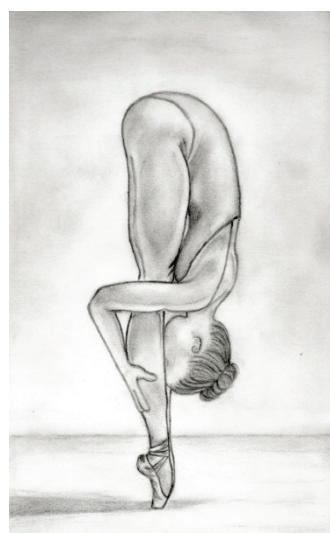
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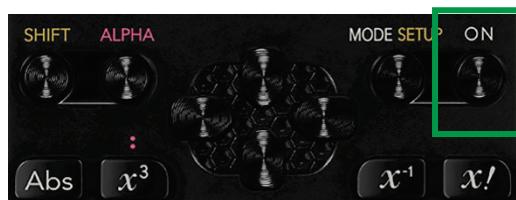


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1.1 Getting ready to begin

Turn your calculator ON.



In the picture above you can see a **SHIFT** key. Pressing it allows you to use the **yellow** functions *above* certain keys.

Note that this key does *not* work like a computer's Shift key. A calculator's Shift key is *pressed and released* and then the next button pressed.

In Section 1 we assume you have just taken the fx-82AU PLUS II or fx-100AU PLUS out of the box and have not changed any of the out-of-the-box (aka factory/default) settings.

If your calculator is *not* out-of-the-box, then we suggest you *initialise* it, which returns all the settings back to the factory settings.

To initialise, press:



All - use **[3]**

Reset All?

[=] :Yes
[AC] :Cancel

Yes - use **[=]**

Reset All

Press [AC] key

Finally press **[AC]**



The **D** indicates the calculator is set to calculate in *degrees* and Math indicates the calculator is in *MathIO* mode (you will learn more about this later).

You are ready to start!

1.2 Some first steps

An almost empty screen awaits you.

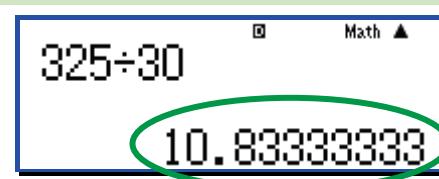


Notice the **flashing cursor** to the left of screen. This signifies the calculator is ready for you to enter a calculation.

Let's calculate $325 \div 30$.

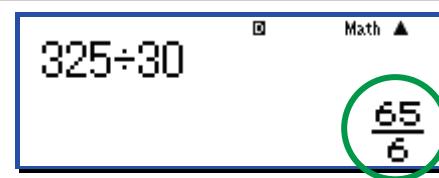
Enter:

3 2 5
÷
3 0
=



The **decimal approximation**, 10.83333333 is shown on the **right side** (the output side) of the screen.

To see the **fraction** representation press **S+D**. (S = standard form, D = decimal form).



Note the fraction is in simplified form.

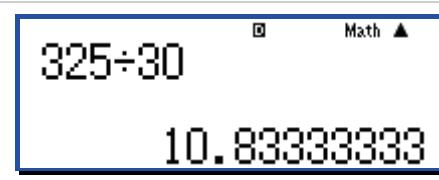
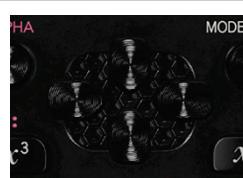
Press **AC**. This clears the screen.



Notice the **small arrow pointing upwards**.

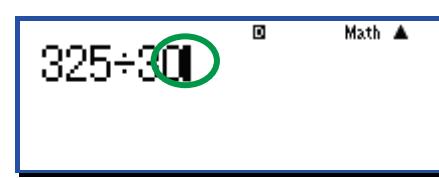
This indicates that the calculator has stored the previous calculation.

Press **▲** on the four-arrow pad. The previous calculation is recalled.

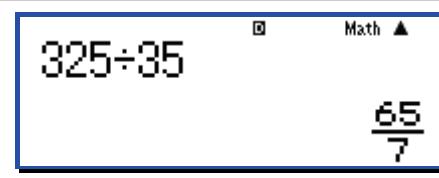


Suppose we wanted to calculate $325 \div 35$.

Press **▶▶▶▶▶▶** to get the cursor to the **right** of the 0. (Or press **◀**.)



Press **DEL**ete to remove the 0 and then press **5** then **=** then **S+D**.



What do you think $325 \div 40$ will be?

John owns a one-man gardening business. Every time he does a job, he calculates the amount he is owed by multiplying the number of hours worked by \$55 and then adds 15% to this figure to cover his health cover and other similar things.

If he completed a job that took 7 hours, how much would he be owed?

First calculate 55×7 .

385 will now be stored in the *answer memory*.

A calculator screen showing the calculation 55×7 and the result 385. The screen has a blue border and the word "Math" at the top right.

Now let's find the 'extra' that John adds to this.

Enter:



A calculator screen showing the calculation $15\% \times \text{Ans}$ and the result 57.75. The screen has a blue border and the word "Math" at the top right.

Note that the **Shift** key does not work like a computer's Shift key. A calculator's Shift key is pressed and released and then the next button is pressed.

Now we need to add \$57.75 to \$385.

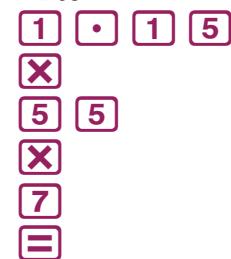
We can use the answer memory again. Enter:



A calculator screen showing the calculation $\text{Ans} + 385$ and the result 442.75. The screen has a blue border and the word "Math" at the top right.

Alternatively we could have calculated 115% of 55×7 .

Enter:



A calculator screen showing the calculation $1.15 \times 55 \times 7$ and the result 442.75. The screen has a blue border and the word "Math" at the top right.

Ah, the same result!

2.1 MthIO and LineO

The fx-82AU PLUS II has three operation modes, COMP(uting), STAT(istics), and VERIF(y). The fx-100AU PLUS has three extra operation modes, CMPLX, BASE-N, and VECTOR.

When in COMP(uting) mode, MthIO (mathematical-input-output) is the default setting. When set this way the calculator allows you to input fractions that look like fractions as well as other mathematical forms that look similar to what we would write on paper. The output is also in *natural* form. Two examples are shown below.

Two screenshots of the calculator screen. The left screenshot shows the input $3 \times \frac{7}{2}$ and the output $\frac{21}{2}$. The right screenshot shows the input $\frac{56}{16}$ and the output $\frac{7}{2}$.

To get set up for this type of display press:

MODE



① - for COMP

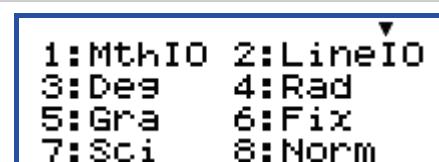
which brings us back to the calculation screen.



Then press:

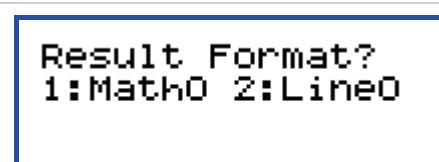
SHIFT

SET UP



① - for MthIO

You are now asked to choose MathO or LineO, press **②** – for LineO.



What is the difference between MathO or LineO?

One critical difference is LineO outputs decimal approximation answers if we use the **÷** key and fraction answers if we use the **≡** key. See below.

A screenshot of the calculator screen showing the input $102 \div 68$ and the output 1.5 . The "Math" button is circled in green at the top right.

A screenshot of the calculator screen showing the input $\frac{102}{68}$ and the output $\frac{3}{2}$.

When set to MathO, the machine tries to always display non-integer answers in fractional form.

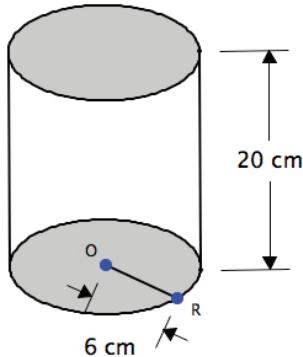
Note that the word **Math** can be seen top right of screen when MathIO is selected. LineO is more useful for everyday calculations. LineO is the *default* setting.



Unless otherwise stated, all calculations performed beyond this point will be done with the calculator set to MathIO and LineO.

2.2 Displaying decimals – Fix and Norm

Many calculations you do will result in decimal approximations for a quantity. For example suppose a cylindrical oil tank is to be made for a racing car. The tank has base radius of 6 cm, height of 20 cm and is made of aluminium.



Calculate the area of the circular base of the tank, and its volume, correct to 2 decimal places.

We know that $A_c = \pi r^2$

So in this case $A_c = \pi \times 6^2$

$$= 36\pi$$

$$\approx 108\text{cm}^2 \text{ (estimated mentally)}$$

Let's use the calculator to gain a little more accuracy.

A screenshot of a TI-Nspire CX CAS calculator. The screen shows the expression 36π and its numerical approximation 113.0973355 .

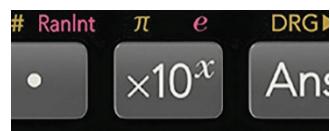
Enter:

3 [] 6 []

SHIFT

(π) – use $\times 10^x$

[]



Note that 10 digits are displayed. We require 2 decimal place accuracy.

The area is 113.10 cm^2 .

We could have the calculator display the answer to this level of accuracy.

1:MthIO 2:LineIO
3:Deg 4:Rad
5:Gra 6:Fix
7:Sci 8:Norm

Enter the settings menu, press:

SHIFT

SET UP

Fix – use 6

Fix 0~9?

36 π
113.10

Press 2 to choose two-decimal-place accuracy.

Note that in this setting the result is rounded correct to 2 decimal places, not truncated.

Most importantly though, Fix is a display feature, the calculator has still stored the 10 digit value.

To calculate the volume, we do *not* want to use the rounded figure. We want to use the most accurate value we have – the one with all the decimal places.

We can use the *answer* memory to our advantage:

e DRG►
10^x Ans =

Ans×20
2261.95

which gives us the volume of the tank,
2261.95 cm³ rounded to two decimal places.

Note that 113.10 was *not* used in the calculation,
113.0973355 was, since $113.10 \times 20 = 2262$.

We can display more digits using the Fix option again.

Ans×20
2261.94671

There are a series of different settings you can choose with respect to the display of numbers.

Enter the settings menu.

SHIFT

SET UP

1:MthIO 2:LineIO
3:Deg 4:Rad
5:Gra 6:Fix
7:Sci 8:Norm

Options 6, 7 and 8 are associated with the display of numbers.

Press
8 (for Norm)

Norm 1~2?

Then press **2** for Norm2.

Ans×20
2261.946711

For general calculations there are two **Norm** settings, **Norm1** and **Norm2**.

One difference between them is that **Norm1** displays positive numbers smaller than 0.01 in scientific notation, whereas **Norm2** displays positive numbers smaller than 0.000000001 in scientific notation.

For most purposes Norm2 is the most useful display and is the factory setting (restored upon initialisation).

Unless otherwise stated, Norm2 is the setting used in calculations from this point onwards.

2.3 Entering and simplifying fractions

The fraction $\frac{51}{68}$ can be thought of as 51 parts of 68 equal parts of some whole. Is there a simpler way to think about this fraction?



Enter **5** **1** then **=**.



Note that a fraction *template* appears and the cursor is flashing in the denominator waiting for you to enter the **6** **8**.



Press **=**.

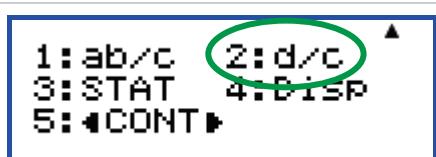
The calculator simplifies the fraction, dividing numerator and denominator by 17. Do you know your 17 times table?

The default setting displays an output as a fraction (proper or improper) as opposed to a mixed number. To set your calculator to display a fraction, do the following.



To enter the settings menu press:

SHIFT
SET UP



Press:

▼ (to see the rest of the options)
2 (to choose **fraction output**)

Simplify $\frac{867}{68}$.



Press **S^hD** to see this as a decimal and **SHIFT** **(a b/c ⇔ d/c)** to see this as a mixed number.



2.4 Fractions and decimals

When working with fractions we want the calculator to be in **COMP**(uting) and to be set up to use **MthIO** and **LineO**. See Section 2.1 for details.

Fractions show the exact value of a quantity. For example, we know that $\frac{6}{33} + \frac{5}{33}$ is exactly equal to $\frac{11}{33} = \frac{1}{3}$ and that the decimal 0.333 (correct to 3 decimal places) is an approximation for $\frac{1}{3}$. Let's see how the fx-82AU PLUS II and the fx-100AU PLUS deal with fraction calculations.

Calculate $\frac{6}{33} + \frac{5}{33}$ on the calculator. The fraction key will be used for entry.



Enter **6** then **□**.



Note that the fraction appears and the cursor is flashing in the denominator waiting for you to enter the 33.

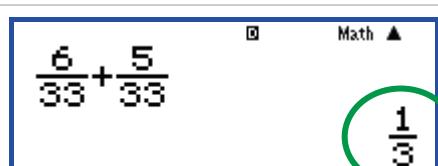


Enter **3** **3**.

Note that the **cursor is still in the denominator** and we need it to be *outside and to the right* of the fraction to continue.

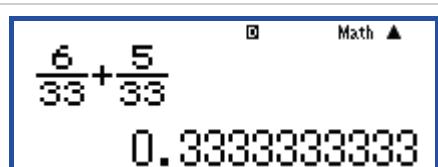


Press **▶** to position the cursor as required.



Enter **+** **5** **□** **3** **3** **=**.

$\frac{11}{33}$ is displayed in simplified form as $\frac{1}{3}$.



Press **S+D** to see the decimal approximation.

Press **S+D** again to return to the fraction.

Calculate $\frac{12}{2584} + \frac{11}{574}$.

The calculator screen shows the fraction $\frac{12}{2584} + \frac{11}{574}$. The result is displayed as $\frac{2207}{92701}$, where the fraction part is highlighted with a green oval.

Even in this case, a **fractional output** is given! This one would be a challenge using mind alone.

Calculate $\frac{12}{2584} + \frac{11}{5748}$.

To do this we can edit the previous calculation, changing 574 to 5748.

The calculator screen shows the fraction $\frac{12}{2584} + \frac{11}{5748}$. The cursor is positioned at the end of the denominator '5748'.

Press \blacktriangleleft and note that the cursor is at the end of the input line.

The calculator screen shows the fraction $\frac{12}{2584} + \frac{11}{5748}$. The result is a decimal number: 0.00655767196.

Press \blacktriangleleft again and then press **8** **=**.

No fraction this time, a decimal approximation. Interesting! Why does this happen? It happens because the calculator has a limit to what it can display as a fraction. The limit is 10 characters made up from the numerator, denominator and the vinculum.

Note that **S+D** will not convert this to a fraction.

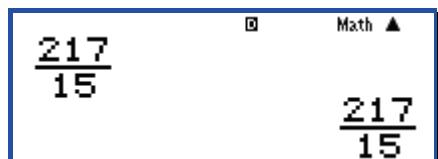
2.5 Fractions and mixed numbers

You have now seen a little of how the calculator works with fractions.

Let's explore some more.



Convert $\frac{217}{15}$ to a mixed number.



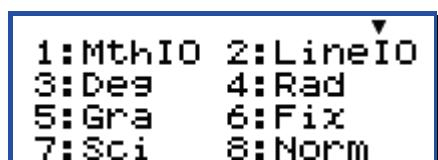
Enter $\frac{217}{15}$ and press $\boxed{=}$.

This process simply stores the fraction in the answer memory.



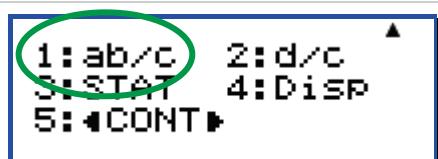
Press **SHIFT** then $(a \frac{b}{c} \leftrightarrow d)$ – use **S+D**, to convert.

The default setting is to display an output as a fraction (proper or improper) as opposed to a mixed number. This setting can be changed so the default display is a mixed number.



Enter the settings menu by pressing:

SHIFT
SET UP



Press:
▼ (to see the rest of the options)
1 (to choose **mixed number output**)



Now enter $\frac{254}{18}$ and press $\boxed{=}$. Check you get the output shown opposite – a mixed number.



Press **SHIFT** $(a \frac{b}{c} \leftrightarrow d)$ – use **S+D**, to see this as an improper fraction.

SHIFT $(a \frac{b}{c} \leftrightarrow d)$ works in connection with the fraction output setting.

2.6 Entering mixed numbers

Calculate $1\frac{3}{5} \times 100$ on the calculator.

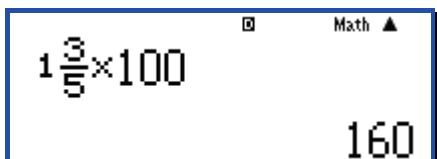


SHIFT (■)- use

This enters a mixed number template.
The cursor is flashing in the non-fraction part.



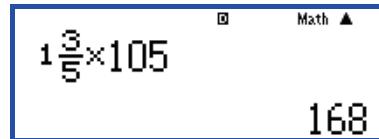
Enter **1** **3** **5**.



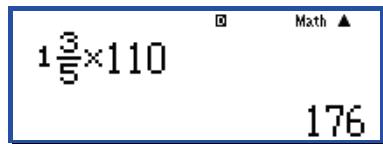
Now enter **1** **0** **0** .

Now calculate $1\frac{3}{5} \times 105$ and $1\frac{3}{5} \times 110$.

Press to position the cursor to the right of 100 and press **DEL** **5** .



Then, **DEL** **DEL** **1** **0** .



Can you predict what $1\frac{3}{5} \times 115$ will be? What about $1\frac{3}{5} \times 120$?

Can you explain why this works?

If $2\frac{3}{5} \times 100 = 260$, what do you think $2\frac{3}{5} \times 105$ equals? Check it out.

2.7 Letter memories

In previous sections we have seen how to use the *answer memory*. Consult the index to locate where.

Look on your calculator and you will see nine red capital letters, A, B, C, D, E, F, X, Y and M.

Each of these are letter memories, and is able to store a value.

Store 7 as the value of A and then calculate A+5.

The calculator screen shows two rows of operations:

Row 1: $7 \rightarrow A$ followed by the number 7. To its right, the sequence **7 SHIFT STO** is shown, with a note that **RCL** can also be used for recall.

Row 2: $A+5$ followed by the number 12. To its right, the sequence **ALPHA A + 5 =** is shown.

To the right of the screen is a portion of the calculator's function keys, including **SHIFT ALPHA**, **Abs**, **x^3** , **$\sqrt[n]{\square}$** , **$\sqrt{\square}$** , **FACT**, **(-)**, and **OFF**.

Store 50 as the value of M and then add 5 to M.

M has a couple of special functions (keys) that add and subtract values to/from it; you can see them opposite.

The calculator screen shows two rows of operations:

Row 1: $50 \rightarrow M$ followed by the number 50. To its right, the sequence **5 SHIFT STO M** is shown.

Row 2: $5M+$ followed by the number 5. To its right, the sequence **M+ 5** is shown.

To the right of the screen is a portion of the calculator's function keys, including **M-**, **M+**, and **OFF**.

Note the **M** now visible top left of screen. It indicates M has a value other than 0.

The calculator screen shows two rows of operations:

Row 1: $5M+$ followed by the number 5. To its right, the sequence **M+ 5** is shown.

Row 2: M followed by the number 55. To its right, the sequence **ALPHA M =** is shown.

To the right of the screen is a portion of the calculator's function keys, including **M-**, **M+**, and **OFF**.

To see the new value of M, hopefully 55, press:

The calculator screen shows the final result of the operation, which is the value 55.

Store 5 as the value of A,
8 as the value of B and
-6 as the value of C.

Then calculate the value of $A \times (B+C)$ and $A \times B + A \times C$.



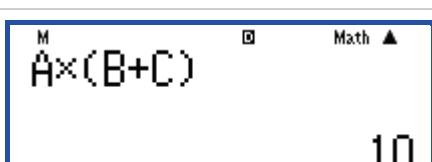
5
SHIFT
STO
A



8
SHIFT
STO
B

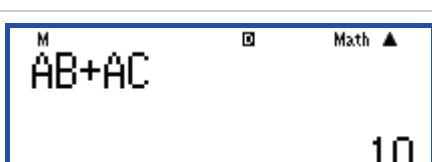


(-) 6
SHIFT
STO
C



ALPHA A \times () ALPHA B $+$ ALPHA C ()

10



ALPHA A ALPHA B $+$ ALPHA A ALPHA C
=

10

So for the values we chose $A \times (B+C) = A \times B + A \times C$.

Is this true for all values we could choose for A, B and C? Test out some more.

To remove the M from the top left of screen, set M to have value 0.

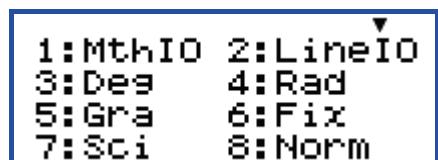
Press:

0
SHIFT
STO
M

You can *zero* the other memories in a similar way if required.

2.8 LineIO

LineIO stands for line-input-output. This is the *old* way of operating on these calculators. You can choose MathIO (the *new* way, with lovely input of fractions and other things) or LineIO. You can make this choice in the settings menu.

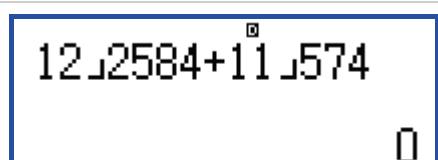


To enter the settings menu press:
SHIFT
SET UP.



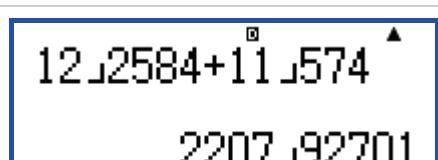
Press:
2 – to choose LineIO.

Note you do not see the word Math top right of the screen any longer.



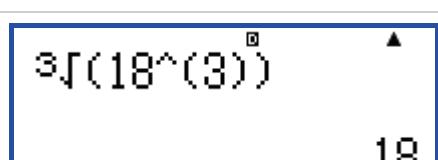
Enter the calculation seen left.
 \lfloor is the ‘old’ fraction symbol.
It is entered with the key.

You will not need to use the cursor keys to navigate since everything goes in a straight line.

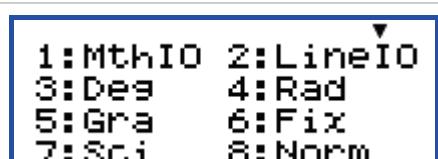


Press .

LineIO has a very different look to MathIO.



Try the example shown left.

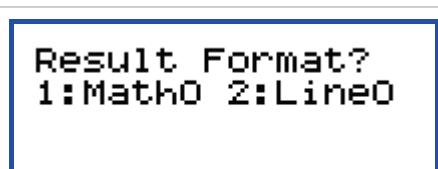


Return the settings to MathIO and LineO.

Press:

SHIFT

SET UP.



1 – to choose MathIO.

Then 2 – to choose LineIO.

3.1 Powers

What is a power of 5?

125 is a power of 5. It is actually the 3rd power of 5 because $5 \times 5 \times 5 = 125$ or 5^3 (pronounced '5 to the 3') = 125.

When we write $5^3 = 125$, the number 5 is called the *base* and 3 is called the *exponent* (also known as a logarithm).

$2^6 = 64$. So we say 64 is the 6th power of 2.



Calculate the following:

a) the 8th power of 3

c) 4^6

e) 7^7

b) the 4th power of 9

d) 16^3

f) 7×49^3

3 ⁸	Math ▲
6561	3 x^{\square} 8 =

9 ⁴	Math ▲
6561	9 x^{\square} 4 =

What? $3^8 = 9^4$, how can that be?

4 ⁶	Math ▲
4096	4 x^{\square} 6 =

16 ³	Math ▲
4096	1 6 x^{\square} 3 =

What? $4^6 = 16^3$, how can that be?

7 ⁷	Math ▲
823543	7 x^{\square} 7 =

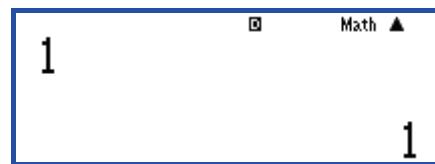
7 \times 49 ³	Math ▲
823543	7 \times 4 9 x^{\square} 3 =

What? $7^7 = 7 \times 49^3$, how can that be?

Is $2^{20} = 4 \times 8^6$? Try to work out why.

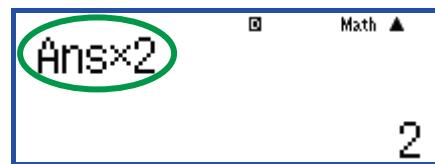
A famous tale tells that the inventor of Chess made his King so happy he was offered a prize of his naming for the work he had done. He asked for 1 grain of wheat for the first square of the board and then double that for the second and double that for the third and
Let's calculate the amount for each square.

Start by entering **1** and pressing **=**.
This stores 1 in the *answer memory*.



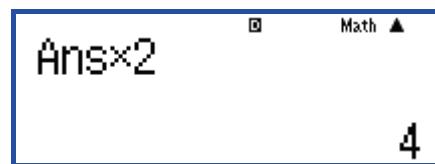
Now press **x 2 =**.

Note the input reads:
answer multiplied by 2.



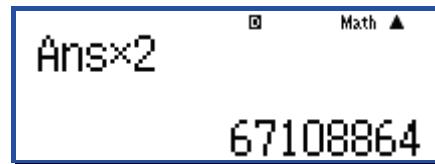
Now press **=**.

You can see we now have a recursive process going.



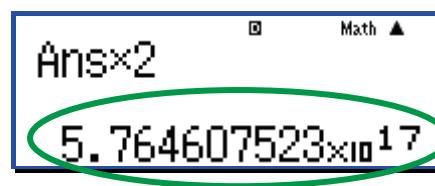
Press **=** **=** **=** I have pressed it quite a few times in the screen opposite.

If you forget how many presses you have made, you can press the **◀** arrow and go backwards and then use the **▶** to go forwards. But it will only hold 14 previous calculations in the memory! So you might have to start again.



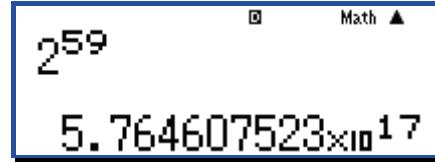
The screen opposite shows **how many grains** I think he got for the 60th square; do you agree?

Note that $5.764607523 \times 10^{17}$ means
5764607523????????? (the ?s are unknown digits).
The decimal is moved 17 places to the right. This calculator can display no more than 10 digits.



Another way to calculate this would be to find 2^{59} .
Enter **2 x⁹ 5 9 =**.

How many wheat grains in total would he have had? See if you can find out how to work that out.
[There are 64 squares on a chess board.]



3.2 Square roots and other roots

I bet you have heard of a square root, e.g. $\sqrt{16} = 4$.
 The square root of a number, k , is that number j which, when multiplied by itself, gives the number k . If j is an integer, then k is called a *perfect square*, e.g. If $k = 16$, $j = 4$.



As well as square roots there are cubed roots, 4th roots, 5th roots,, n^{th} roots.

Calculate the value of each of the following:

a) $\sqrt{64}$
 b) $\sqrt{649536196}$

c) $\sqrt{27435328}$
 d) $\sqrt[3]{64}$

e) $\sqrt[4]{64}$
 f) $\sqrt[100]{2^{100}}$

$\sqrt{64}$

$\begin{matrix} \sqrt{ } \\ 6 \\ 4 \\ = \end{matrix}$

8

64 is a perfect square! I bet you already knew that.

$\sqrt{649536196}$

$\begin{matrix} \sqrt{ } \\ 6 \\ 4 \\ 9 \\ 5 \\ 3 \\ 6 \\ 1 \\ 9 \\ 6 \\ = \end{matrix}$

25486

Ah, so 649536196 is also a perfect square. I bet you did not know that.

$\sqrt{27435328}$

$\begin{matrix} \sqrt{ } \\ 2 \\ 7 \\ 4 \\ 3 \\ 5 \\ 3 \\ 2 \\ 8 \\ = \end{matrix}$

5237.874378

No perfect square here.

Such things as $\sqrt{27435328}$ are called *surds*.

$\sqrt[3]{64}$

$\begin{matrix} \text{SHIFT} \\ 6 \\ 4 \\ = \end{matrix}$

4

So 64 is a perfect *cube* as $4 \times 4 \times 4 = 64$

$\sqrt[6]{64}$

$\begin{matrix} \text{SHIFT} \\ 6 \\ 4 \\ = \end{matrix}$

2

So 64 is a perfect square, cube and *hex*!

$\sqrt[100]{2^{100}}$

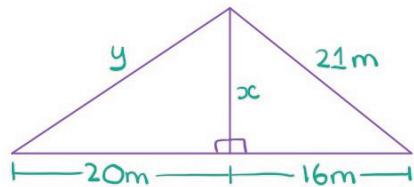
$\begin{matrix} 1 \\ 0 \\ 0 \\ \text{SHIFT} \\ 2 \\ x^{\square} \\ 1 \\ 0 \\ 0 \\ = \end{matrix}$

2

2? Can you explain what is happening here?

3.3 Square roots - Pythagoras

Suppose we need to determine the lengths of the currently unknown sides in the construction shown below. We could begin as follows:



$$\begin{aligned}c^2 &= a^2 + b^2 \\ \Rightarrow 21^2 &= 16^2 + x^2 \\ \Rightarrow x &= \sqrt{21^2 - 16^2} \\ y^2 &= 20^2 + x^2 \\ \Rightarrow y &= \sqrt{20^2 + x^2}\end{aligned}$$

We can calculate a decimal approximation for each of these quantities.

Enter the calculation as follows:

$\sqrt{21^2 - 16^2}$
13.60147051

\sqrt{x}
2 1 x^2
-
1 6 x^2
=

The output is stored in the answer memory and so we can use it to calculate the decimal approximation of y .

Enter as follows:

$\sqrt{20^2 + \text{Ans}^2}$
24.18677324

\sqrt{x}
2 0 x^2
+
Ans x^2
=

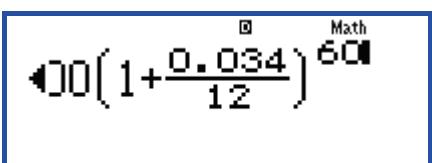
So we find $x = \sqrt{185} \text{ m} \approx 13.6 \text{ m}$ (correct to 1 d.p.)
and that $y = \sqrt{65} \text{ m} \approx 24.2 \text{ m}$ (correct to 1 d.p.).

3.4 A financial calculation

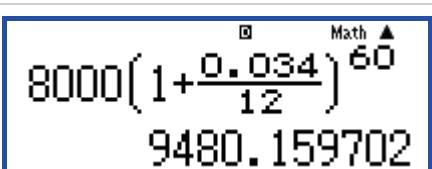
Suppose we wish to calculate the value of an investment of \$8000, five years after investing it in an account that pays interest of 3.4% p.a. compounded monthly. We can use the formula:

$$A = P \left(1 + \frac{r}{100}\right)^n$$

Calculate $8000 \left(1 + \frac{0.034}{12}\right)^{60}$ on your calculator.

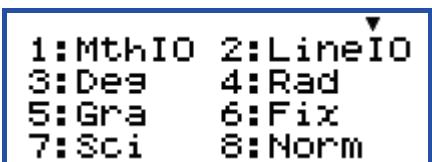


8 0 0 0
C 1 +
0 . 0 3 4 ÷ 1 2 ►)
x^ 6 0



=

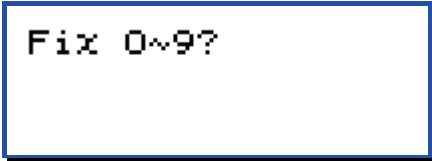
It is possible to set up the calculator to display the result correct to two decimal places; a good idea for many financial calculations.



Enter the settings menu, press:

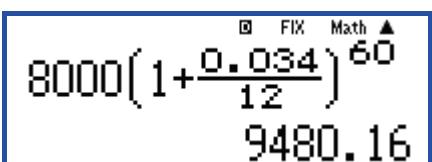
SHIFT

SET UP



Choose:

Fix – press 6



Press 2 to choose two-decimal-place accuracy.

Note that in this setting the result is *rounded* correct to 2 dp, not truncated.

Now set your calculator to Norm 2 - SHIFT SET UP 8 2

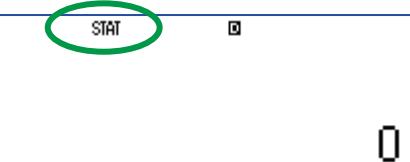
You can learn more about the Norm display setting in Section 2.2.

4.1 STAT mode and SETUP

When working with data, you need to set your calculator to **STAT**(istics) mode. It is also suggested that you set it to display the **Frequency** of each score.

If the screen shows the word **STAT** top left then you know the calculator is set to the correct mode. To set it to **STAT** mode do the following:

Press **MODE**



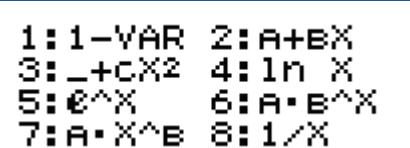
fx-82AU PLUS II screen shown.

Press **2** - for **STAT**

fx-82AU PLUS II

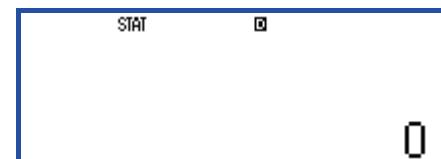
Press **3** - for **STAT**

fx-100AU PLUS



You will be shown all the different statistical forms with which the calculator can help.

Press **AC**.



Now we want to set the calculator to show the frequency of each data point you enter. Press:

SHIFT

SET UP

▼

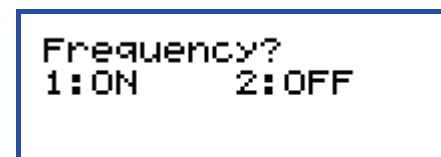


Press **3** - for **STAT**

fx-82AU PLUS II

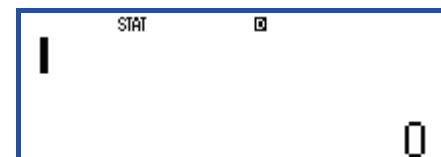
Press **4** - for **STAT**

fx-100AU PLUS



Press **1** to turn the frequency option on.

You are now ready to work with data.



4.2 Entering, editing and deleting data

Before doing this section, be sure you have carried out the directions from the previous section.

Below are the weights (in grams) of the last 10 tomatoes I picked.

54, 68, 45, 55, 64, 80, 52, 63, 72, 71.

Enter these data into the STAT section of your calculator.

The most used menu when working with statistics is the STAT menu.



To open the STAT menu press:

SHIFT

STAT – use **1**

1:Type 2:Data
3:Sum 4:Var
5:MinMax

fx-82AU PLUS II

1:Type 2:Data
3:Sum 4:Var
5:Distr 6:MinMax

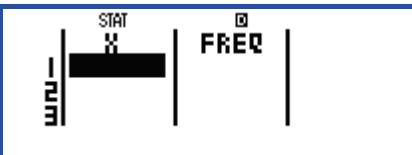
fx-100AU PLUS

First we need to choose the type of data we have:

1 – for **Type**

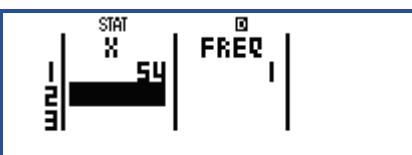
1:1-VAR 2:A+BX
3:_+CX² 4:ln X
5:e^X 6:A·B^X
7:A·X^B 8:1/X

In this activity we have a *single* variable, weight, so press **1** – for **1-VAR**



You are now ready to enter the data.

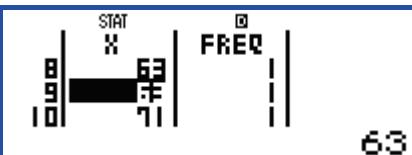
5 **4**
=



Pressing **=** ‘enters’ 54 with a frequency of 1 (in this case meaning it appears just once in our data).

Enter the rest of the data.

If you make an error, as I have with data point 9, simply *arrow* to it, type it again and press **=**.



To clear the data previously entered, with the table visible, enter the *data menu*. Press:

SHIFT STAT – use **1**

1:TYPE 2:Data
3>Edit

3 for Edit

1:Ins 2:Del-A

2 for Del-A

All the data has been cleared.

STAT X | FREQ |
2 |

Press **AC** to return to the screen in which calculations can be performed.

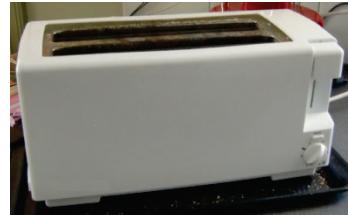
STAT

0

4.3 Five number summary

Before doing this section, be sure you have carried out contents of the two previous sections.

I set my toaster to the ‘number 1’ setting and then measured how long it took to *pop*. I did this 16 times, letting it cool down in between measurements. The measurements (in seconds) are given below.



94, 96, 96, 96, 98, 98, 99, 99, 96, 97, 127, 96, 99, 96, 99, 96.

Find the five number summary for these data (minimum value, 1st quartile, median, 3rd quartile and maximum value).

Open the STAT menu. Press:

SHIFT

STAT – use **1**

1:Type 2:Data
3:Sum 4:Var
5:MinMax

fx-82AU PLUS II

1:Type 2:Data
3:Sum 4:Var
5:Distr 6:MinMax

fx-100AU PLUS

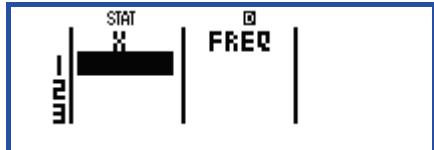
First we need to choose the type of data we are working with so press:

1 – for **Type**

1:1-VAR 2:A+BX
3:_+CX² 4:1n X
5:e^{^X} 6:A·B^{^X}
7:A·X^{^B} 8:1/X

In this activity we have a single variable, time, so press:

1 – for **1-VAR**



You are now ready to enter the data.

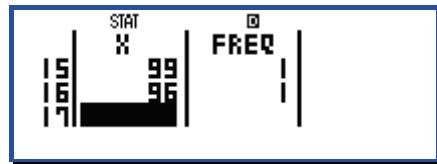
9 **4**

= etc.



Enter all 16 data points.

Note that I am choosing to enter every data point as an individual and so the frequency of each will be one, even though some values (like 96) occur seven times.



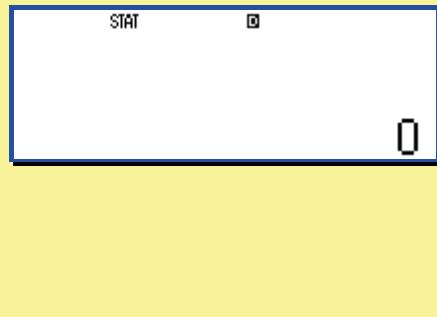
Check all the data is correct by scrolling up and down (\blacktriangle , \blacktriangledown). Edit as required.

Once your data is entered you MUST press **AC**.

This is a most important step.

Pressing **AC** returns you to the calculation screen from which the STAT menu can be accessed.

If you miss this step, you will open the *data menu* instead.



To calculate the 1st quartile open the STAT menu,

SHIFT

STAT

1:Type 2:Data
3:Sum 4:Var
5:MinMax

fx-82AU PLUS II

1:Type 2:Data
3:Sum 4:Var
5:Distr 6:MinMax

fx-100AU PLUS

5 – for **MinMax**

fx-82AU PLUS II

1:minX 2:maxX
3:Q1 4:med
5:Q3

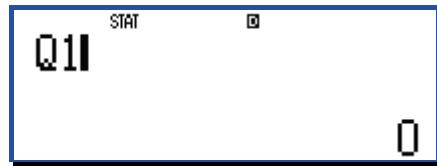
6 – for **MinMax**

fx-100AU PLUS

You can now choose which statistics you want:

3 – for **Q1**.

But the 1st quartile is not zero. Note the cursor is still flashing.



Pressing **=** calculates Q1 (this is a critical step).



To calculate the median, open the STAT menu.

Press:

SHIFT

STAT

1:Type 2:Data
3:Sum 4:Var
5:MinMax

fx-82AU PLUS II

1:Type 2:Data
3:Sum 4:Var
5:Distr 6:MinMax

fx-100AU PLUS

5 – for **MinMax**

fx-82AU PLUS II

1:minX 2:maxX
3:Q1 4:med
5:Q3

6 – for **MinMax**

fx-100AU PLUS

You can now choose which statistics you want:

4 – for **med**.

But the median is not 96 (this is displaying the value previously calculated). Note the cursor is still flashing.

STAT med 96

Pressing **=** calculates the median, 96.5 in this case.

STAT med 96.5

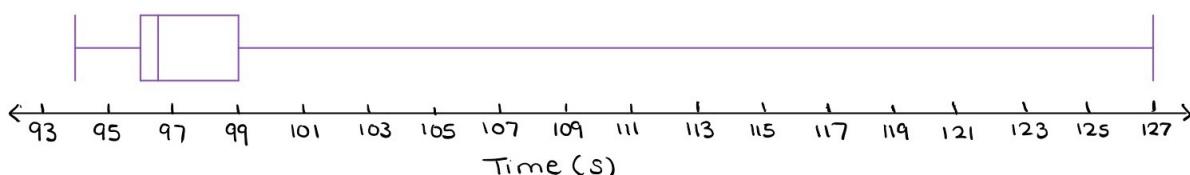
Each of the other statistics can be calculated in a similar manner, although in this case, the minimum and maximum values are easily observed from the data.

STAT minX 94

STAT Q3 99

STAT maxx 127

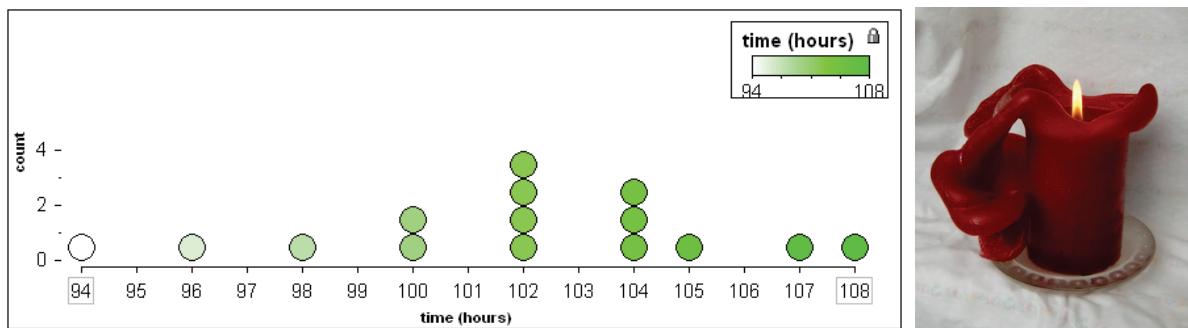
From these statistics a boxplot can be drawn, by hand.



4.4 Mean and standard deviation

Before doing this section, be sure you have carried out contents of the two previous sections.

A candle shop makes a certain type of candle called *large-scented*. Each candle is to have a label displaying how long the candle is expected to last. To determine the expected time, a sample of 15 candles are burned and the number of hours they each burned for (rounded to the nearest hour) is recorded. The data is given below in the form of a dot plot.



Calculate the sample mean (\bar{x}) and the sample standard deviation (s).

SHIFT
STAT – use **1**

1:TYPE 2:Data
3:Sum 4:Var
5:MinMax

fx-82AU PLUS II

1:TYPE 2:Data
3:Sum 4:Var
5:Distr 6:MinMax

fx-100AU PLUS

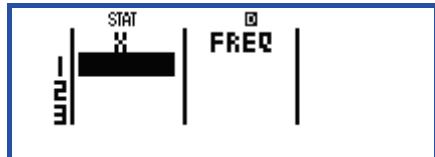
First we need to choose the type of data we are working with so press:

1 – for **Type**

1:1-VAR 2:A+BX
3:_+CX² 4:1n X
5:E^{^X} 6:A·B^{^X}
7:A·X^B 8:1/X

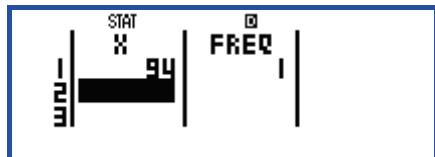
In this activity we have a single variable, time, so press:

1 – for **1-VAR**



You are now ready to enter the data.

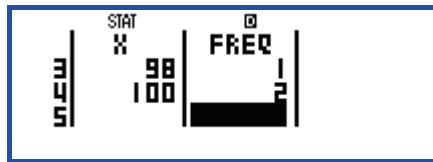
9 **4**
EXE



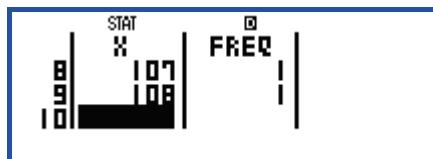
Enter all nine scores from the dotplot and change the frequency value when needed.

For example, we have two scores of 100 and so after entering 100 press:

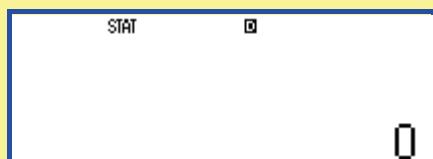
▶ ▲ [2] =



Check all the data is correct by scrolling up and down (▲, ▼). Edit as required.



Once your data is entered you **MUST** press **AC**.



To calculate the mean open the STAT menu, press:

SHIFT

STAT

1:Type 2:Data
3:Sum 4:Var
5:MinMax

fx-82AU PLUS II

1:Type 2:Data
3:Sum 4:Var
5:Distr 6:MinMax

fx-100AU PLUS

[4] – for Var

1:n 2: \bar{x}
3: σ_x 4: s_x

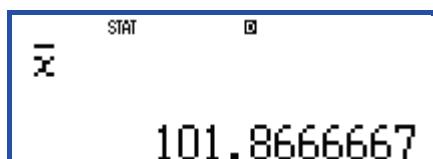
You can now choose which statistics you want:

[2] – for \bar{x} .

But the mean is not zero. See the cursor is still flashing.



Pressing [=] calculates \bar{x} (this is a critical step).



To calculate the sample standard deviation, open the STAT menu. Press:

SHIFT
STAT

1:Type 2:Data
3:Sum 4:Var
5:MinMax

fx-82AU PLUS II

1:Type 2:Data
3:Sum 4:Var
5:Distr 6:MinMax

fx-100AU PLUS

4 – for **Var**

1:n 2: \bar{x}
3: s_x 4: s_x

You can now choose which statistics you want:

4 – for the sample standard deviation.

STAT

SX

101.8666667

But the sample standard deviation is not 101.8777777
(this is the value from the previous calculation)

Pressing **=** calculates the sample standard deviation.

STAT

SX

3.833436852



4.5 Linear Regression

1948 was the first year that General Motors Holden (GMH) made the first Holden (aka the Humpy or 48-215 or FX). Prior to that GMH assembled other makes of car. From 1948 onwards, the number of non-Holden cars assembled declined as the number of Holden cars made increased.



The table below shows the number of non-Holden cars (N thousands) assembled in each year from 1948 to 1959. In the table, year 1 represents 1948.

year	1	2	3	4	5	6	7	8	9	10	11	12
N	25.2	22.2	23.9	20.3	15.4	14.4	19.3	20.6	15.1	10.9	13.8	13.2

- Find the slope of the least squares regression line.
- Use the equation to predict how many non-Holden cars would have been made, if the trend seen above continued, in 1974.

If data already exists in the lists, delete it – see Section 4.2 or press:

MODE **2**.

fx-82AU PLUS II

1:1-VAR 2:A+BX
3:_+CX² 4:ln X
5:e^{^X} 6:A·B^{^X}
7:A·X^{^B} 8:1/X

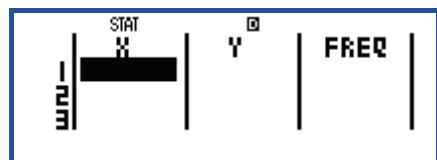
MODE **3**.

fx-100AU PLUS

This is a quick way to delete all previous data and also opens the data-type selection menu. Values associated with the least squares line can be calculated using option 2: **A+BX**

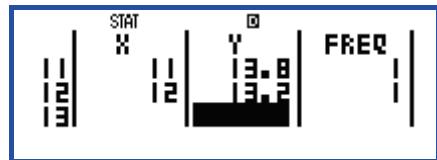
Press **2**

See Section 4.1 if you do not have a Frequency column.



Enter the data.

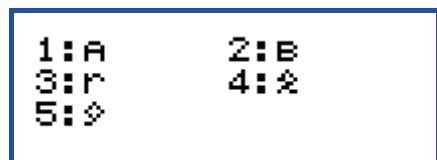
Once entered and checked, press **AC**.



To calculate the values we require press:

SHIFT STAT – use **1** and then **5** for **Reg**

This reveals the values that can be calculated.



The values are:

- A – the y -intercept of the least squares line
- B – the slope of the least squares line
- r – correlation coefficient

- \hat{x} – the predicted value of x given a value of y .
- \hat{y} – the predicted value of y given a value of x .

To find the slope, B, press:

2
=

STAT
B
-1.063286713

To find the y -intercept, A, press:

SHIFT
STAT
5 for Reg
1 for A
=

STAT
A
24.76969697

So the equation of the least squares line is $N \approx -1.06 \times \text{year} + 24.77$

Return to the calculation menu, press:

SHIFT
STAT
5 for Reg

1:A 2:B
3:r 4: \hat{x}
5: \hat{y}

To calculate the predicted number of non-holdens made in 1974, we note x will be 27. So press:

2 for B
X **2** **7** **+**
SHIFT
STAT
5 for Reg
1 for A
=

STAT
B \times 27+A
-3.939044289

Alternatively:

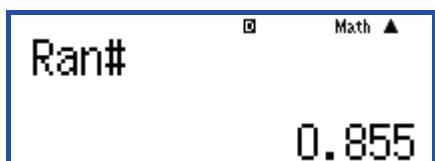
AC
2 **7**
SHIFT
STAT
5 for Reg
5 for \hat{y}
=

STAT
27
-3.939044289

Oh, a negative number of cars. I guess the trend did not continue!

4.6 Random numbers

Check that your calculator is in **COMP**(uting) mode and is set up to use **MthIO** and **LineO**. See Section 2.1.



Press:

SHIFT

Ran# - use **.**

=

This function produces pseudo-random numbers between 0 and 1 (with three decimal places).

Press **=** a few more times to see more of them.



1 **0** **0** **0** **X**

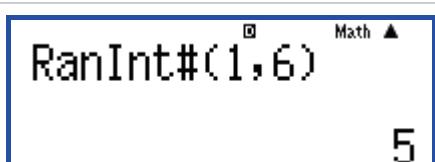
SHIFT

Ran# - use **.**

=

Pseudo-random number between 0 and 1000 are produced.

Press **=** a few more times to see more of them.



ALPHA

RanInt# - use **.**

1

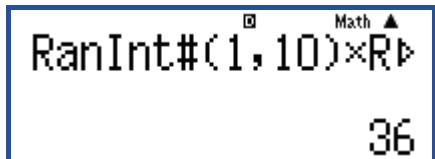
SHIFT

(,) - use **,**

6

=

will produce pseudo-random numbers between 1 and 6 inclusive.



On the screen left, I am calculating the *product* of two pseudo-random numbers between 1 and 10 inclusive.

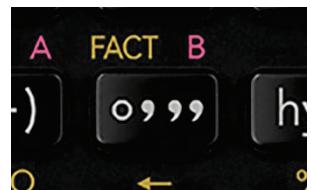
If we keep pressing **=** continually, will square numbers be common or uncommon? Why?

5.1 Degrees, minutes and seconds

One revolution can be broken up into 360 equal turns, each called 1 degree (1°). What does a 90° angle look like?

What does a 1° angle look like?

What if it is less than 1° ?



One degree can be broken up into 60 equal turns (small ones!), each called 1 minute ($1'$).

One minute can be broken up into 60 equal turns (very small ones!), each called 1 second ($1''$).

So, 42.5° would be the same as $42^\circ 30' 0''$ and 42.125° ($42\frac{1}{8}^\circ$) would be the same as $42^\circ 7' 30''$ (as $60 \div 8 = 7.5$) – phew!

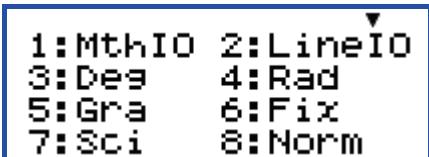
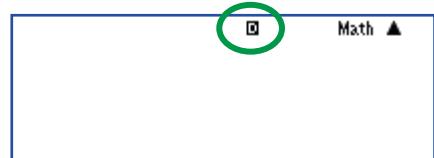
Convert each of the following decimal degrees into degrees, minutes and seconds.

a) 36.5°

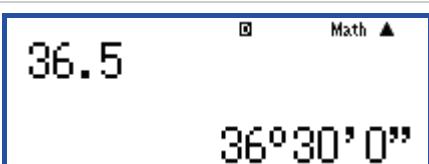
b) 36.6°

c) 36.25°

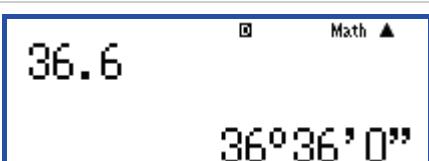
Before starting we need to be sure that the calculator is set to work in degrees. If you can see a small **D** at top of screen, then it is! If not, do the following.



SHIFT
SET UP
3 - for **Deg**

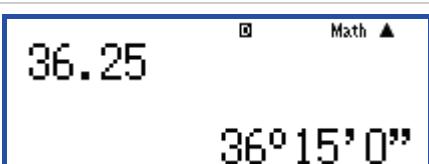


3 **6** **.** **5**
=
°,°,°



3 **6** **.** **6**
=
°,°,°

Can you see a pattern, what would 36.7° return?



3 **6** **.** **2** **5**
=
°,°,°

Consider the reverse process, converting an angle represented in degrees, minutes and seconds to decimal degrees (or even fractional).

What would $100^\circ 6' 30''$ be represented in decimal form?

Convert each of the following to decimal degrees.

a) $100^\circ 6' 30''$

b) $34^\circ 20' 20''$

c) $51^\circ 28' 38''$



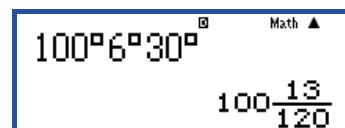
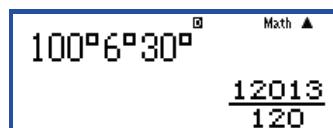
First enter the angle using the $\text{°}'''$ button:
1 0 0
 $\text{°}'''$
6
 $\text{°}'''$
3 0
 $\text{°}'''$
=



Now convert by pressing:

$\text{°}'''$

Now press S+D to see the fractional form and $\text{SHIFT } \left(\frac{a}{c} \leftrightarrow \frac{d}{c}\right)$ to see the mixed number.



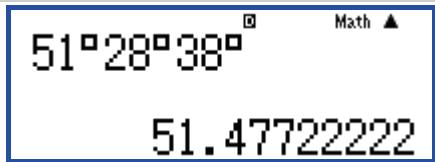
If you get the above screens in the reverse order, your calculator is set to display mixed numbers first rather than improper fractions.

Press $\text{SHIFT } \text{SET UP } \text{DOWN } 2$ and try this again.



3 4 $\text{°}'''$ 2 0 $\text{°}'''$ 2 0 $\text{°}'''$
=
 $\text{°}'''$

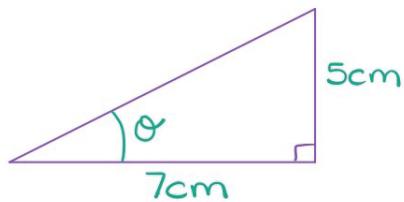
Did you predict that? It is $34 + \frac{20}{60} + \frac{20}{3600}$. Check it.



The angle given in part c) is the longitude measure of Greenwich. Why is Greenwich important?

5.2 Trigonometric calculations

Suppose you are required to find the size of the angles (represented in degrees minutes and seconds) in a right triangle with perpendicular legs of length 5 cm and 7 cm. We could begin as follows:



$$\tan(\theta) = \frac{5}{7}$$
$$\theta = \tan^{-1}\left(\frac{5}{7}\right)$$
$$\theta = \dots$$

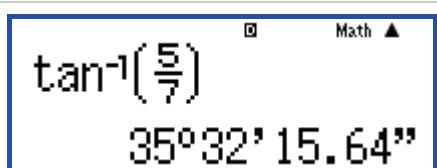
To calculate the value of θ :



First ensure the calculator is set in Degrees
If not, **SHIFT SETUP 3**.

Then,

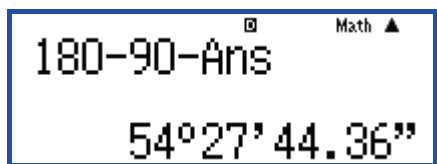
SHIFT
(tan⁻¹) – use **tan**
5 **÷** **7** **▶** **)**
=



Now convert by pressing:
„„



Calculate the other unknown angle as seen opposite.



Now convert by pressing:
„„

5.3 Scientific notation and ENG

Numbers can be expressed in scientific notation, correct to 3 significant figures, as follows.

1:MthIO 2:LineIO
3:Deg 4:Rad
5:Gra 6:Fix
7:Sci 8:Norm

Press **AC**.
Enter the SETUP menu:
SHIFT SETUP
7 – for Sci

Sci 0~9?

3 to choose 3 significant figures.

12458
SCI Math ▲
1.25 $\times 10^4$

247 $\times 0.000125$
SCI Math ▲
3.09 $\times 10^{-2}$

2.356 $\times 10^8 \times 7.2145$
SCI Math ▲
1.70 $\times 10^9$
And now enter:
2 **.** **3** **5** **6**
 $\times 10^x$
8
X
7 **.** **2** **1** **4** **5**
=

With the previous calculation active, repeatedly press **ENG**.

2.356 $\times 10^8 \times 7.2145$
SCI Math ▲
1.7 $\times 10^9$
2.356 $\times 10^8 \times 7.2145$
SCI Math ▲
1700 $\times 10^6$
2.356 $\times 10^8 \times 7.2145$
SCI Math ▲
1700000 $\times 10^3$

What does it do?

Press **SHIFT (←)** – use **ENG**, to go backwards.

Now set your calculator back to Norm 2 - **SHIFT SETUP** **8** **2**

5.4 Radians to degrees

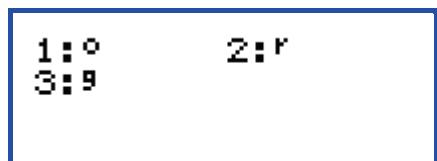
To convert an angle in radians to degrees, set the calculator to compute in degrees.

SHIFT
SETUP
3 - for Deg

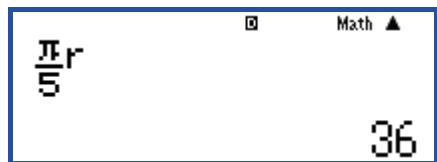
Convert $\frac{\pi}{5}$ to degrees.



SHIFT (π)
[**5**] **▶**

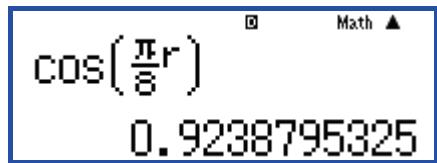


SHIFT
(DRG▶) – use **Ans**



2 – for **r**
[**=**]

The **(DRG▶)** menu options can be useful when used in an input, as they over-ride the angle unit setting of the calculator. For example, suppose we want to calculate $\cos(\frac{\pi}{8})$. We can do this without having to change the calculator's angle setting to radians by ensuring the 'r' is added to the end of the input as shown below.



6.1 Lowest common multiple (LCM)

Both the hot water tap and cold water tap in my sink are leaking; drip, drip, drip, drip, drip, drip, and so on.

Every now and again I hear what sounds like a single big DRIP.

I figured out that the hot water tap releases every 8 seconds and then cold water 14 seconds. How often do I hear the single big drip (when are they in sync)?

We could make two lists:

hot: 8, 16, 24, 32, 40, 48, **56**,

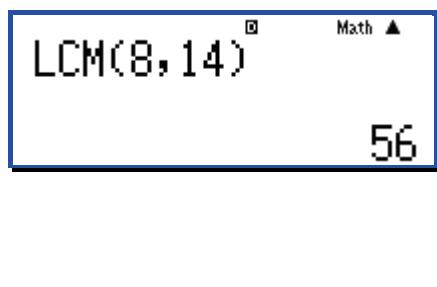
cold: 14, 28, 42, **56**, 70,

So if the taps started dripping in unison, I would hear the single big drip after 56 seconds and every 56 seconds after that, with 9 drips in between DRIPS.

56 is called the lowest common multiple (LCM) of 8 and 14.

The calculator is able to calculate the LCM of two integers.

Find the LCM of 8 and 14.

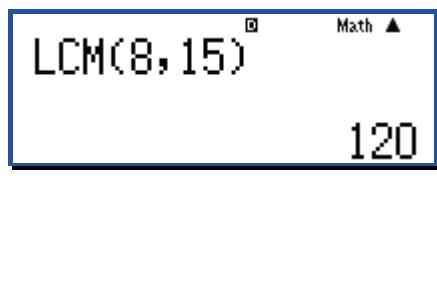


ALPHA
LCM – use \div
8
SHIFT (,) – use $)$
1 4
 $)$
=



The calculator agrees with my table!

Find the LCM of 8 and 15.



ALPHA
LCM – use \div
8
SHIFT (,) – use $)$
1 5
 $)$
=

Note that $8 \times 15 = 120$. However $8 \times 14 \neq 56$. Try to explain this observation.

What must be true for the LCM of two integers, a and b , to be equal to the product ab ?

6.2 Greatest common divisor (GCD)

Consider the number 20 and 36.

20 can be found in the 1-times tables, 2-times tables, the 4-times tables, 5-times tables, 10-times tables and of course the 20-times tables. Another way of saying this is that 20 is divisible by 1, 20 is divisible by 2,

Divisible means divides with no remainder.

36 is divisible by 1, 2, 3,

What is the largest number that will divide, with no remainder into 20 and 36? This number is called the *greatest common divisor* or GCD.

We can make a list and compare:

20 is divisible by 1, 2, 4, 5, 10 and 20

36 is divisible by 1, 2, 3, 4, 6, 9, 12, 18 and 36.

So it appears that 4 is the GCD of 20 and 36. Does the calculator agree?

Find the GCD of 20 and 36.

$$\text{GCD}(20, 36)$$

4

ALPHA
GCD – use \times
2 0
SHIFT (,) – use)
3 6
)
=

INS
DEL
nPr GCD
 \times

We have agreement!

Suppose we have a single rectangular block of land 120 m wide and 1000 m long and we want to divide it into square blocks. If the square must have integer dimensions, what is the size of the largest square blocks possible?

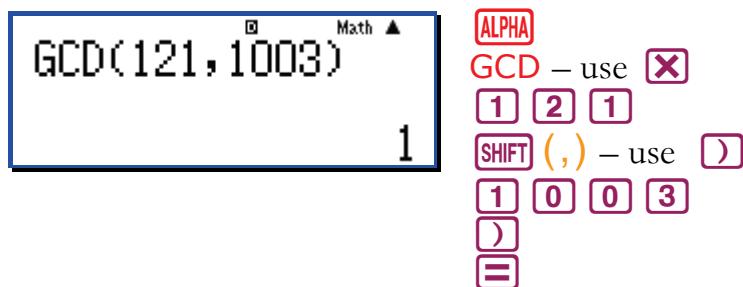
$$\text{GCD}(120, 1000)$$

40

ALPHA
GCD – use \times
1 2 0
SHIFT (,) – use)
1 0 0 0
)
=

So a square 40 m by 40 m is the largest possible.

What is the GCD of 121 and 1003?



1! So there is no integer apart from 1 that will divide, with no remainder, 121 and 1003.

Such pairs of numbers are called co-prime or relatively prime.

Does that mean 1003 is prime? 121 is clearly not as $11 \times 11 = 121$.

Find the product of the GCD and LCM of 6 and 15?

Two calculator screens are shown side-by-side. The left screen shows $\text{GCD}(6, 15)$ and the result 3 . The right screen shows $\text{LCM}(6, 15)$ and the result 30 .

So $\text{GCD}(6, 15) \times \text{LCM}(6, 15) = 90$.

Note also that $6 \times 15 = 90$.

Coincidence? Try some more cases to see if this is always true.

If you cannot find a counter example, see if you can reason why:

$$\text{GCD}(a, b) \times \text{LCM}(a, b) = ab, \text{ where } a, b \in \mathbb{Z}.$$

6.3 Prime factorisation

Is 1003 prime?

To find out we could start checking to see if the integers between 1 and the $\sqrt{1003}$ divide 1003 with no remainder.

Clearly we can ignore all the even numbers, since the digit sum is 4 (not divisible by three) then 3 will not work, nor 5, how about 7

The calculator is able to very efficiently perform a process similar to that started above and return to us the number written as a product of its prime factors.

Find the prime factors of 1003.

1 0 0 3
=
SHIFT FACT – use $\circ\bullet\bullet$

FACT B
 $\circ\bullet\bullet$

1003
17×59

So 1003 is not prime, it is divisible by 17 and 59 (as well as 1 and 1003).

Try and find the biggest prime you can in 60 seconds.

See if you can find one bigger than me:

124587539
 (124587539)

36 has 9 divisors (or factors): 1, 2, 3, 4, 6, 9, 12, 18 and 36.

How can you determine this from its prime factorisation?

Below you can see the prime factorisation of 36 – I will leave it to you to think about. Try some other examples.

36
 $2^2 \times 3^2$

6.4 Verifying equality

Verify mode allows you to check whether or not two numerical expressions are equal without comparing decimal approximations.

Is $\sqrt{20} = 4\sqrt{5}$?

To enter Verify mode, press:

MODE

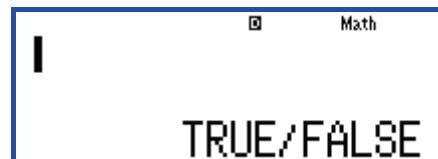
then

Press **3** - for **VERIF**

fx-82AU PLUS II

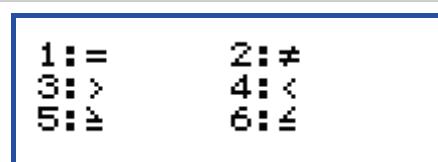
Press **5** - for **VERIF**

fx-100AU PLUS



2 0
►
SHIFT VERIFY – use **6**

VERIFY₁
6

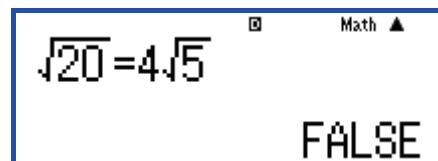


Press **1** - for **=**



Press:

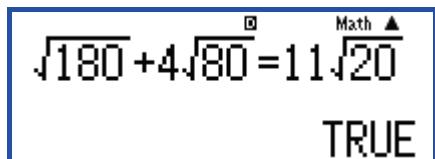
4
✓
5
=



False! See if you can figure out my error and get it to return TRUE.

Consider the equality $\sqrt{180} + 4\sqrt{80} = k\sqrt{m}$. What values for k and m make this true?

I think $k=11$ and $m=20$ will work.



Ding, ding! But there are more, can you figure them out?

7.1 Recurrence relationships - PreAns

Suppose we start with the numbers 0 and 1, *double 1 and add 0* to get a new number. We would then have 0, 1, 2.

Then do the same process, but with the last pair of numbers (1, 2), so we get 5. We would then have 0, 1, 2, 5.

Now keep repeating, so we would get 0, 1, 2, 5, 12, 29, 70,

This is a sequence of numbers called the Pell numbers. It is formally defined as follows:

$$P_n = \begin{cases} 0 & \text{if } n = 0 \\ 1 & \text{if } n = 1 \\ 2P_{n-1} + P_{n-2} & \text{otherwise} \end{cases}$$

Calculate the Pell numbers using the **Ans** and **PreAns** functions on the fx-100AU PLUS.

Set the calculator to **Comp** mode. Press:

MODE

then

1 - for **COMP**



Press:

0
=

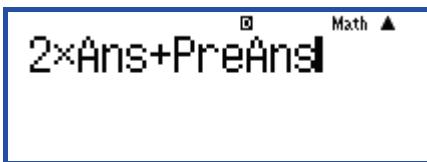


Press:

1
=

These two steps store 0 and 1 in the two special memories, the **Ans** memory (the immediately previous answer) and the **PreAns** memory (previous to the immediately previous) memory respectively.

We can now use these memories to construct a calculation – the Pell calculation.



Press:

2
X
Ans
+
ALPHA

PreAns – use **Ans**



Repeatedly pressing $\boxed{=}$ will calculate the Pell numbers.

$2 \times \text{Ans} + \text{PreAns}$

2

$2 \times \text{Ans} + \text{PreAns}$

5

$2 \times \text{Ans} + \text{PreAns}$

12

Calculate $\frac{P_{28}}{P_{27}}$

First calculate P_{27} and P_{28} .

To save re-entering the calculation, reset the Ans and PreAns to 0 and 1 and use the *replay function* to retrieve the calculation you previously entered.

Press:

0
1
 \blacktriangleleft
 \triangleright

$2 \times \text{Ans} + \text{PreAns}$

12

Press $\boxed{=}$ to start calculating.

$2 \times \text{Ans} + \text{PreAns}$

2

Counting carefully will return:

$2 \times \text{Ans} + \text{PreAns}$

3166815962

$2 \times \text{Ans} + \text{PreAns}$

7645370045

To calculate the ratio, use the Ans and PreAns functions.

$\text{Ans} \div \text{PreAns}$

2.414213562

So $\frac{P_{28}}{P_{27}} \approx 2.41421$.

Does this number look familiar?
(See the screen opposite. Intriguing hey!)

$\sqrt{2}$

1.414213562

You have most likely heard about the golden ratio, but have you heard about the *silver ratio*? Look it up, and discover what Pell numbers are used for.

7.2 Unit conversions

The fx-100AU PLUS is able to calculate forty different unit conversions automatically.

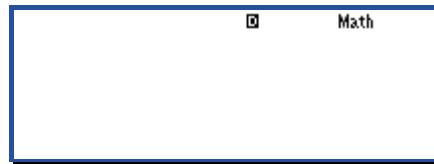
Convert 60 kmhr^{-1} to ms^{-1} .

Set the calculator to **Comp** mode. Press:

MODE

then

1 - for **COMP**.



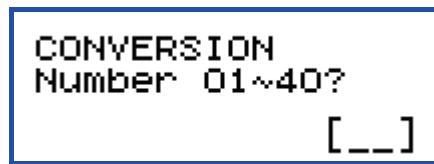
Enter **6** **0**.



Press:

SHIFT

CONV - use **8**.



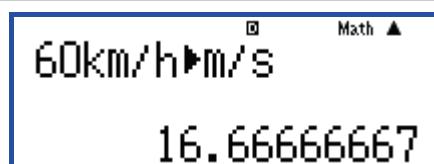
The conversion we require is number 19.
Consult the calculator's manual to see all 40 conversions, and their numbers.



Enter **1** **9**.



Press **=**.



So 60 kmhr^{-1} is approximately equal to 16.7 ms^{-1} .

7.3 Normal probability calculations

When in STAT(istics) mode, and with single variable calculations chosen, normal probability values can be calculated from Z-scores.

Let $Z \sim N(0, 1)$.

Calculate,

- a) $P(Z < -1)$
- b) $P(Z > -2.1)$
- c) $P(0 < Z < 1.8)$

Set the calculator to STAT mode. Press:

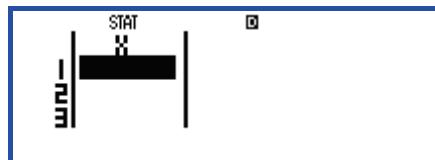
MODE

then

3 - for STAT.

1:1-VAR	2:A+BX
3:_+CX ²	4:ln X
5:e ^{^X}	6:A·B ^{^X}
7:A·X ^{^B}	8:1/X

Press **1** for 1-VAR.



AC



SHIFT
STAT – use **1**



1:Type	2:Data
3:Sum	4:Var
5:Distr	6:MinMax

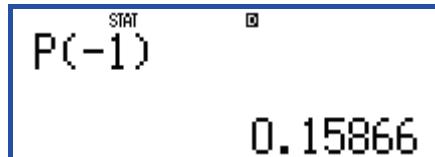
5 for Distr

$P($ will calculate $P(Z < z)$.

1:P(2:Q(
3:R(4:t

Enter **1** for P(then

(
1
)
=



So $P(Z < -1) \approx 0.15866$.

R(will calculate $P(Z > z)$
Q(will calculate $P(0 < Z < z)$

1:P(2:Q(
3:R(4:t

The calculations to parts b) and c) are seen below.

R(-2.1)
0.98214

Q(1.8)
0.46407

7.4 Complex number calculations

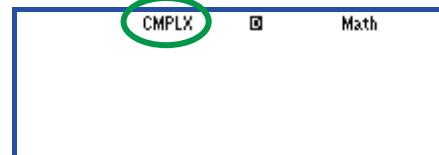
When in CMPLX(complex) mode, various calculations with complex numbers can be done.

Set the calculator to CMPLX mode. Press:

MODE

then

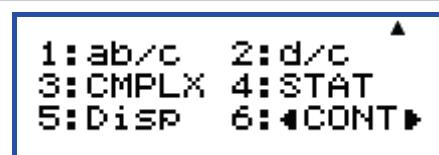
2 – for CMPLX.



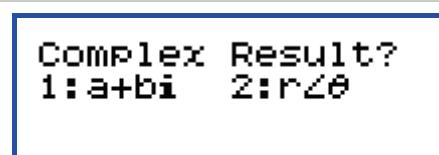
Results can be displayed in either cartesian (default) or polar form.

To change the default setting. Press:

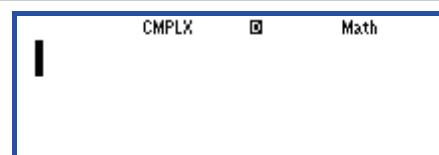
SHIFT SET UP – use **MODE**
▼



3 – for CMPLX.

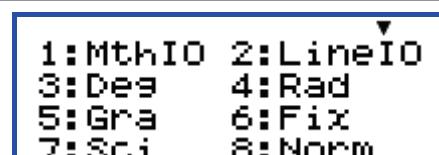


1 – for a+bi (cartesian form)

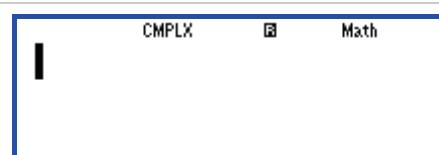


Set the calculator to work in radians.

SHIFT SET UP – use **MODE**



4 – for Rad.



Note that **R** is seen on the top centre of the screen to indicate the calculator will calculate in radians.

Let $z = 2 + i\sqrt{3}$.

- Calculate $\arg(z)$
- Express z in polar form.

Open the CMPLX menu. Press:

SHIFT
CMPLX – use **2**



1: arg 2: Conjugate
3: ►r►θ 4: ►a+bi

1 – for **arg**

then:

2 **+**
SHIFT
(i) – use **ENG**
✓ **3**
▶
D **=**

CMPLX Math ▲
arg(2+i $\sqrt{3}$)
0.7137243789

So, $\arg(z) \approx 0.714^\circ$.

To convert to polar form we could now find the modulus, or use the automatic conversion feature as follows:

2 **+**
SHIFT
(i) – use **ENG**
✓ **3**
▶

SHIFT
CMPLX – use 2

CMPLX Math ▲
2+i $\sqrt{3}$ ►r►θ
2.645751311∠0.714°

So, $2 + i\sqrt{3} \approx 2.65 \text{ cis}(0.714^\circ)$.

7.5 Vector calculations

Set the calculator to VECTOR mode. Press:

MODE

then

6 - for **VECTOR**.

Vector?
1:VctA 2:VctB
3:VctC

Press **AC** to open the calculation screen.

Note that **VCT** is seen at the top centre of the screen to indicate the mode setting.

| VCT 0

Given points P(1,2,3), Q(3,3,1) and R(8,4,11)

- Calculate $\overrightarrow{PQ} \cdot \overrightarrow{QR}$
- Calculate $\overrightarrow{PQ} \cdot \overrightarrow{PR}$
- Calculate a vector perpendicular to both \overrightarrow{PQ} and \overrightarrow{PR} .

Firstly, $\overrightarrow{PQ} = (2, 1, -2)$, $\overrightarrow{QR} = (5, 1, 10)$ and $\overrightarrow{PR} = (7, 2, 8)$.

Open the VECTOR menu. Press:

SHIFT

VECTOR – use **5**

VECTOR
5
CMPLX

1:Dim 2:Data
3:VctA 4:VctB
5:VctC 6:VctAns
7:Dot

To set the dimension for each vector,
press **1** – for **Dim**

Vector?
1:VctA 2:VctB
3:VctC

Now press **1** – for **VctA**

VctA(m) m?
1:3 2:2

Then press **1** – for **:3** (dimensions).

Enter each dimension, pressing **EXE** after each.

A [2 | -] EXE
-2

Press:

[AC] to open the calculation screen and then

[ALPHA] then **VECTOR** – use **[5]**

1:Dim	2:Data
3:VctA	4:VctB
5:VctC	6:VctAns
7:Dot	

Repeat the process to enter \vec{QR} and \vec{PR} as

VctB and **VctC** respectively.

Press **[AC]** when you are done.

To calculate $\vec{PQ} \cdot \vec{QR}$ (the scalar (or dot) product), first press:

[SHIFT]

VECTOR – use **[5]**

1:Dim	2:Data
3:VctA	4:VctB
5:VctC	6:VctAns
7:Dot	

Now:

[3] – for **VctA** then

[SHIFT] **VECTOR** – use **[5]** then

[7] – for **Dot** then

[SHIFT] **VECTOR** – use **[5]** then

[4] – for **VctB** then

[=]

Now calculate $\vec{PQ} \cdot \vec{PR}$ (**VctA** · **VctC**).

Note that pressing **[▶]** will insert the cursor into the working line, so it can be edited.

So $\vec{PQ} \cdot \vec{PR} = 0$, meaning that \vec{PQ} and \vec{PR} are

perpendicular.

To calculate a vector perpendicular to both \vec{PQ} and \vec{PR} we can calculate the vector product (or cross product) of \vec{PQ} and \vec{PR} , denoted as $\vec{PQ} \times \vec{PR}$ (**VctA** × **VctC**)

Use the **[X]** key to enter the **×**.

So, $\vec{PQ} \times \vec{PR} = (12, -30, -3)$.

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