

Mastering the CALCULATOR



CASIO *fx-82TL*

USQ
AUSTRALIA

UNIVERSITY OF SOUTHERN QUEENSLAND

The Learning Centre | Learning and Teaching Support Unit

MASTERING THE CALCULATOR USING THE CASIO *fx*-82TL

Learning and Teaching Support Unit (LTSU)
The Learning Centre

Guide book

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Introduction

This is one in a series of booklets prepared to assist students who are learning to use a calculator. They have been prepared by staff in The Learning Centre from Learning and Teaching Support Unit (LTSU) at USQ. The series comprises:

Mastering the calculator



- Using the Casio *fx*-100s (also suitable for Casio *fx*-570)
- Using the Casio *fx*-100AU
- Using the Casio *fx*-82LB
- Using the Casio *fx*-82TL
- Using the Casio *fx*-82MS
- Using the Sharp EL-531LH
- Using the Sharp EL-556L
- Using the Sharp EL-531RH


The instructions in this booklet only explain **some** of the keys available on your calculator necessary for basic work in data manipulation. If you require more assistance please contact The Learning Centre. If you would like information about other support services available from **The Learning Centre**, please contact




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A word about starting out

- Make sure you are in the correct mode selection and that all previous data is cleared.

- For e.g. To perform arithmetic operations press  

- To clear all values press 

- To clear memory press   

- If your calculator has FIX or SCI on the display press  three times



appears on the screen

press 3 then 2 so you are in Normal mode.

- If your calculator has RAD or GRAD on the display press  twice

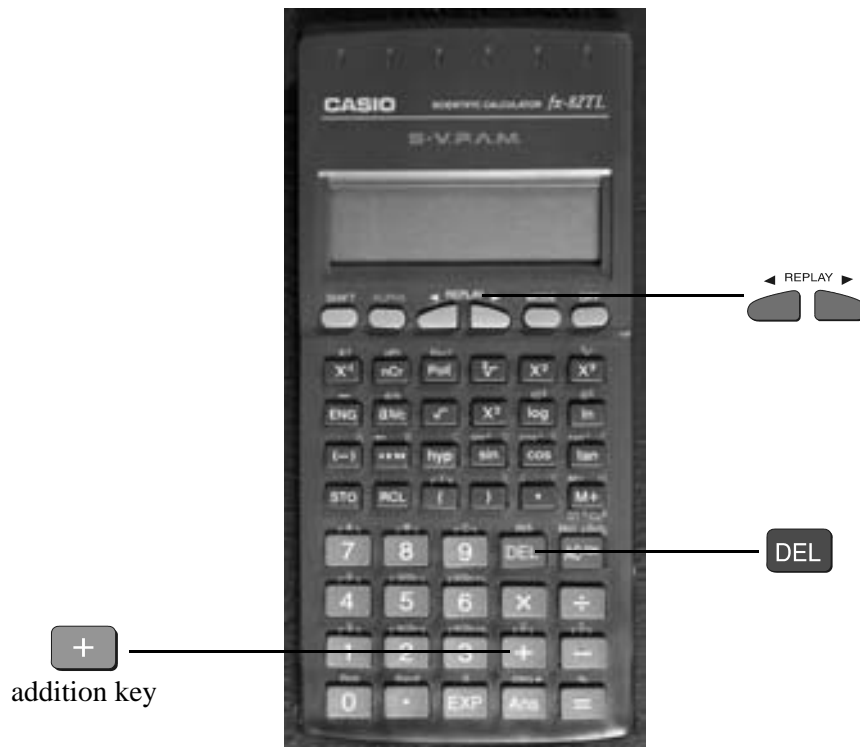


appears on the screen

press 1 so you are in Degree mode.

1. Addition and subtraction

1.1 To add numbers



Find the  key

(it is shown on the photograph of the calculator here).

Example

To add 7 and 3, type

The display should read 10

Example

I want to find the total amount I earned in the past four weeks. If I earned \$471, \$575, \$471 and \$528, the key strokes would be




               

The display should read 2045.

1.2 Sometimes you make an error when typing in a number

If this happens use the **DEL** key to cancel the number and then type in the correct number and continue.

Example

If you want to enter $3 + 4$ but accidentally type   
press **DEL** to cancel the 5.

Now type  

Example

If I want to add 471 and 575 but I typed

I can cancel 6 by typing **DEL** and then typing  

The display should read 1 046.

'Try practising cancelling with the **DEL** key until you are comfortable with its use.'



1.3 The keys are used when you to delete other data

Example

If you typed:

$471 + 546$

but you wanted $471 + 576$

press the  key twice. The 4 flashes. Press . The 7 now replaces the 4.

Press .

The display should read 1 047.

Practice using this key when replacing digits, operation keys (+ - × ÷), or more than one digit (use the DEL key).

You can also use the insert key   to insert anything you omitted.


Example

If you typed $471 + 56$

but you wanted $471 + 576$, press      

the display should read 1047.

1.4 To subtract numbers

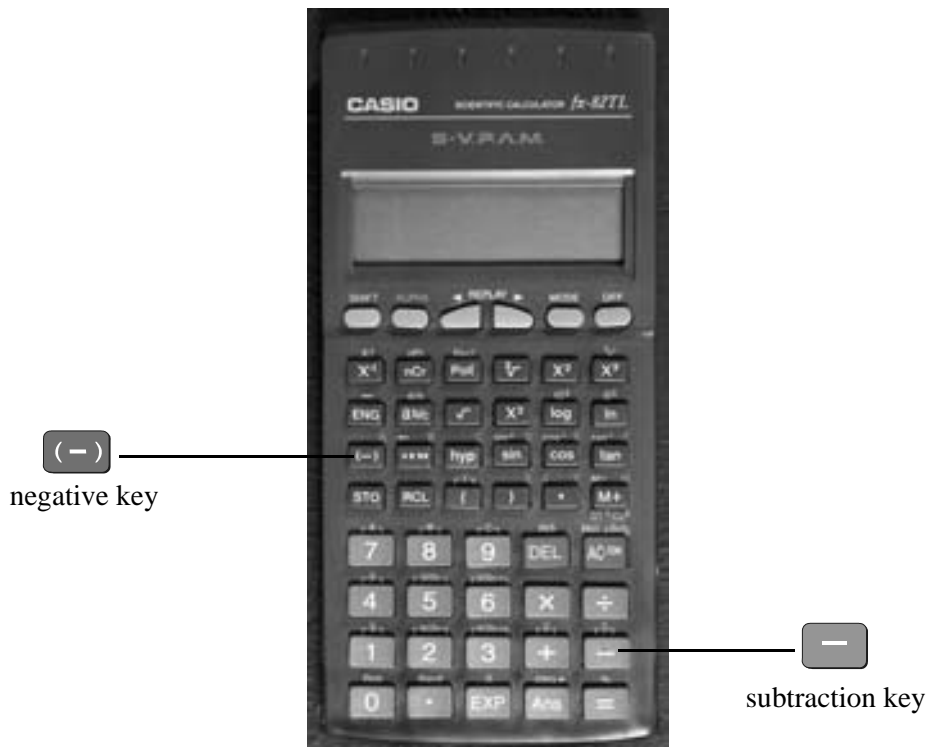
Find the  key (it is shown on the photograph of the calculator following).

Example

To subtract 35 from 257, type

The display should read 222



Example

$$348 - 24 - 19$$


The keystrokes are



The display should read 305.

Sometimes you may have a sum like this:


$$-7 + 4$$

You can use the  key.

The key strokes are




The display should read -3.

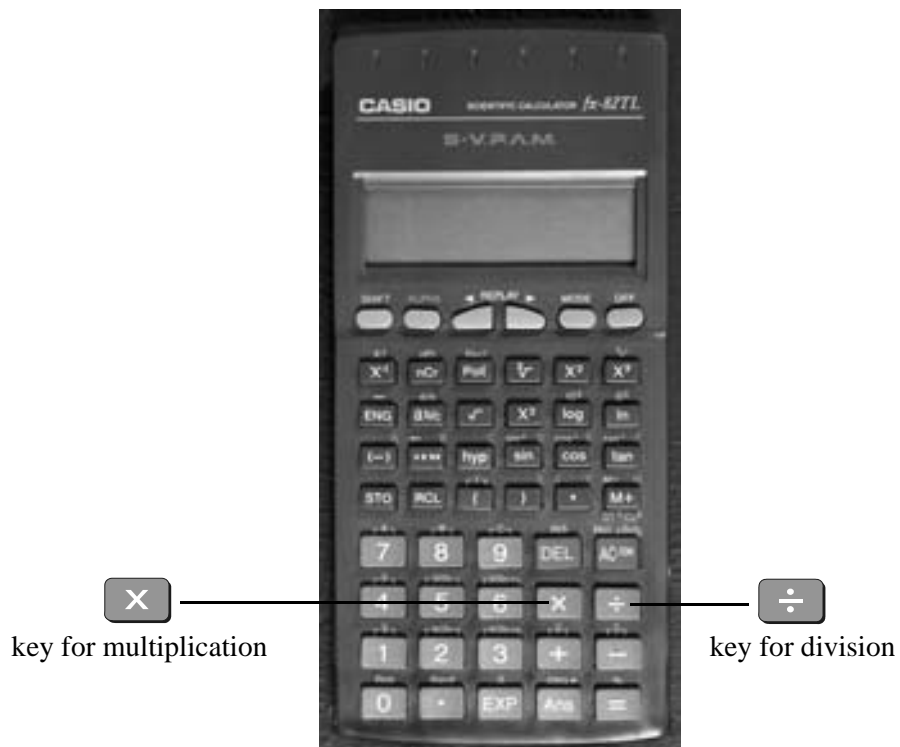
You could also use the keystrokes 

In this case the calculator recognises the - as a negative (not recommended to do it this way).

2. Multiplication and division

2.1 To multiply numbers

Find the  key (it is shown on the photograph of your calculator here).



Example

To multiply 7 and 3, type

$$7 \times 3 =$$


The display should read 21

To find 753×492 , type

$$753 \times 492 =$$

The display should read 370 476

2.2 To divide numbers

Find the  key (it is shown on the photograph of the calculator)

Example

To divide 35 by 7, type



The display should read 5

To divide 7 905 by 85, type



The display should read 93

To divide 56 by 23947 type



The display should read 0.002338497

If it reads 2.3385×10^{-03} or something similar, then your calculator is in SCI (Scientific mode). See page 2 to change to NORM (normal mode).

2.3 Combining multiplication and division

Example

If the question is

$$\frac{27}{7 \times 4} \text{ then}$$

it is really $27 \div 7 \div 4$.

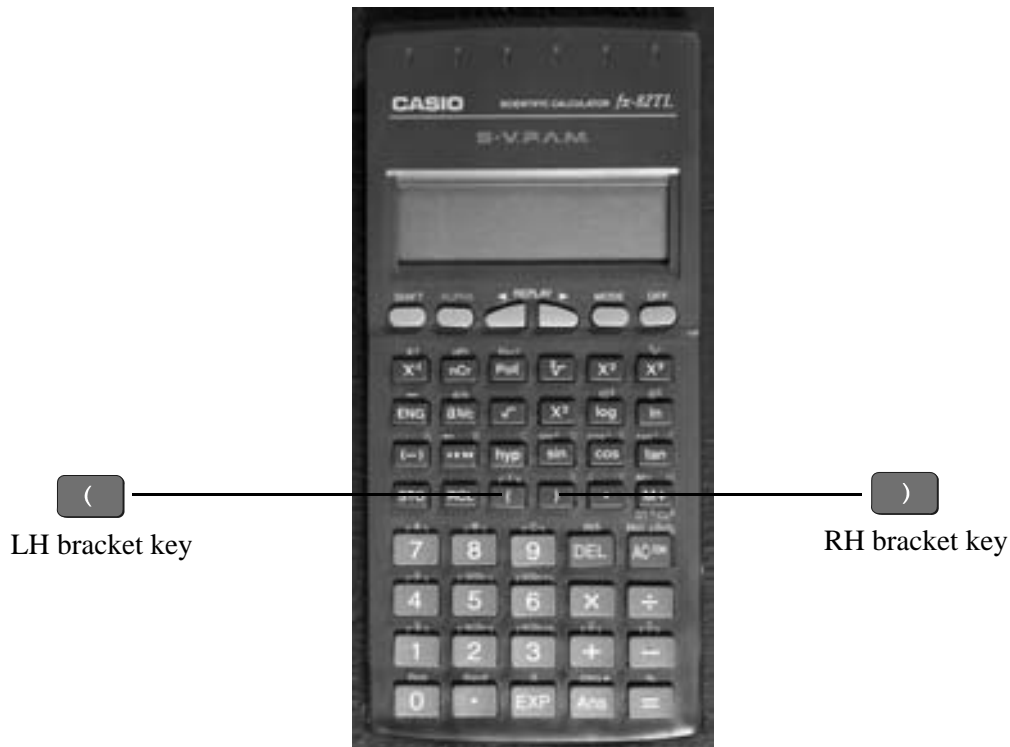
Try it.

The display should read 0.964285714



3. Brackets

Find the set of bracket keys on your calculator.

The fx-82TL allows you to use many sets of brackets.



Example

Do the calculation $471 - (93 + 11 + 2)$ on the calculator. (Make sure your calculation is in ordinary comp. mode press  )

The keystrokes required are



The display should read 365.

Sometimes in calculations you will see other grouping symbols, for example, { } (called braces), [] (called square brackets).

Try these examples:

Exercise 1

(a) $25 + (7 + 2 - 4)$

(b) $18(3 + 7)$ [a multiplication sign is understood $18 \times (3 + 7)$]

(c) $4 + 5[2(3 + 7)]$ [to use two sets of brackets just press the same button]

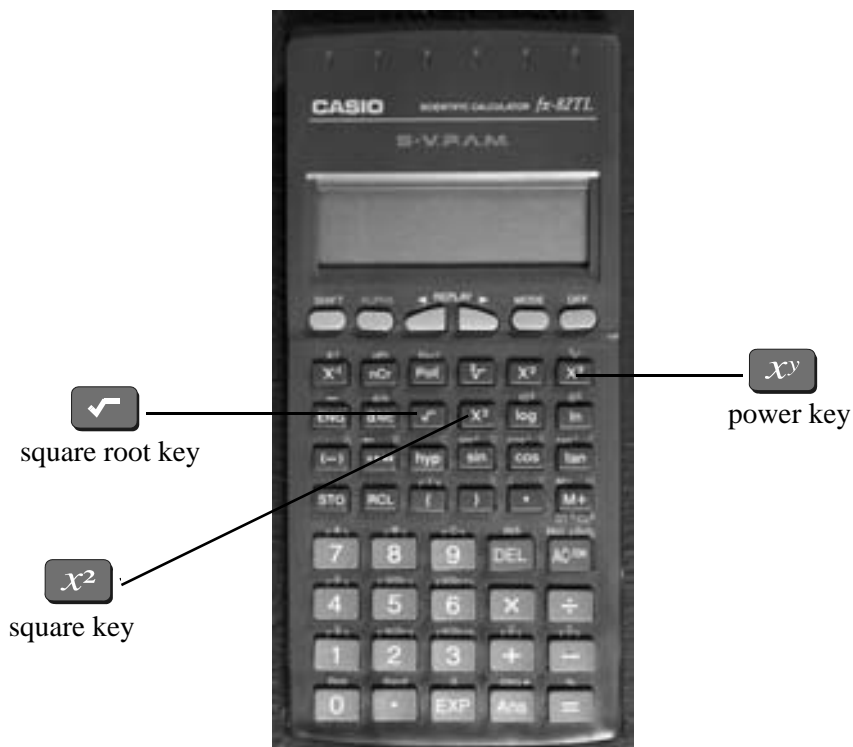
(d) $\frac{5}{(3 + 2)}$

Answers: 30; 180; 104; 1

4. Powers

4.1 Squaring and higher powers

6^2 means 6×6 . You can use the square key to do this calculation. (It is shown on the photograph of your calculator here.)



Press $\boxed{6} \boxed{x^2} \boxed{=}$

the display should read 36.

Or you can use the power key on your calculator.

Find the x^y key on your calculator.

Example

To square 6,

that is, find 6^2 , type



The display should read 36

[The first number you put in is the 6. This is the x and the second number you put in (2) is y . That is why it is called the x^y key.]

To find 27^3 the required key strokes are



and the display should read 19683.

If you have learnt your multiplication tables you will already know the squares of the whole numbers from 1 to 12 and thus be able to complete much of the following table.

Exercise 2

Use your calculator to find the squares of the whole numbers from 13 to 25 and any other squares you are unsure of.

| | | |
|-----------|----------|--------------|
| $1^2 = 1$ | $11^2 =$ | $21^2 =$ |
| $2^2 = 4$ | $12^2 =$ | $22^2 =$ |
| $3^2 = 9$ | $13^2 =$ | $23^2 = 529$ |
| $4^2 =$ | $14^2 =$ | $24^2 = 576$ |
| $5^2 =$ | $15^2 =$ | $25^2 = 625$ |
| $6^2 =$ | $16^2 =$ | |
| $7^2 =$ | $17^2 =$ | |
| $8^2 =$ | $18^2 =$ | |
| $9^2 =$ | $19^2 =$ | |
| 10^2 | 20^2 | |

Exercise 3

You can use this key for other powers as well. Try these examples

- (a) 7^4
 (b) 8^{10}
 (c) $(0.4)^6$ (you **do not** have to type the brackets in)
 (d) $(-7)^6$ (you need to type the brackets in)
 (e) $5^{0.4}$
 (f) 5^{-4}
-

Answers:

- (a) 2401
 (b) 1073741824
 (c) 4.096×10^{-3} or 0.004096 (you move the decimal 3 places to the left)

(d)  117649

(e) 1.903653939

(f) 0.0016 [Just press  5^{-4} is the same as

$\frac{1}{5^4}$ so you could press  to get the same answer]

4.2 Square root

Finding the **square root** of a number ‘undoes’ or ‘neutralises’ the squaring of the number and vice versa. The symbol for square root is

$\sqrt{\quad}$ (This is called the radical sign)

The square root of 36 is written as $\sqrt{36}$

Now because $6^2 = 36$, $\sqrt{36} = 6$.

Find the square root key on your calculator and type



The display will read 6.

What do you think $\sqrt{81}$ is? $\sqrt{81} =$

You should have said 9 because $9^2 = 81$

(Check your calculator)

What do you think $\sqrt{-49}$ will be? You should have said 'you can't find the square root of a negative' since you can't find a number that squares to give a positive. Your calculator will say Ma ERROR.

Exercise 4

Try these by looking at the table of squares you completed on the previous page and then check your answers on your calculator

- | | |
|--------------------|--------------------|
| (a) $\sqrt{16} =$ | (e) $\sqrt{49} =$ |
| (b) $\sqrt{144} =$ | (f) $\sqrt{169} =$ |
| (c) $\sqrt{100} =$ | (g) $\sqrt{121} =$ |
| (d) $\sqrt{441} =$ | (h) $\sqrt{361} =$ |
-

The answers are 4, 12, 10, 21, 7, 13, 11, 19.

Let's now check that taking the square root neutralises squaring.

Try this on your calculator.

Find the square root of 3 squared that is, $\sqrt{3^2}$

The key strokes required are



The display should read 3

Because **squaring** and taking **square roots** are **inverse operations**, the **order** of the operators **can be reversed** and the number is unaffected.

So the square, of the square root of 3, should also equal 3

Try it on your calculator. The key strokes required are



Exercise 5

Complete the following without using the calculator

(a) $\sqrt{7^2} =$

(b) $\sqrt{7^2} =$

(c) $\sqrt{10^2} =$

(d) $\sqrt{\square}^2 = 10$

(e) $\sqrt{\square}^2 = 625$

(f) $\sqrt{\square}^2 = 144$

(g) $\sqrt{64} = \square$, because $8^2 = \square$

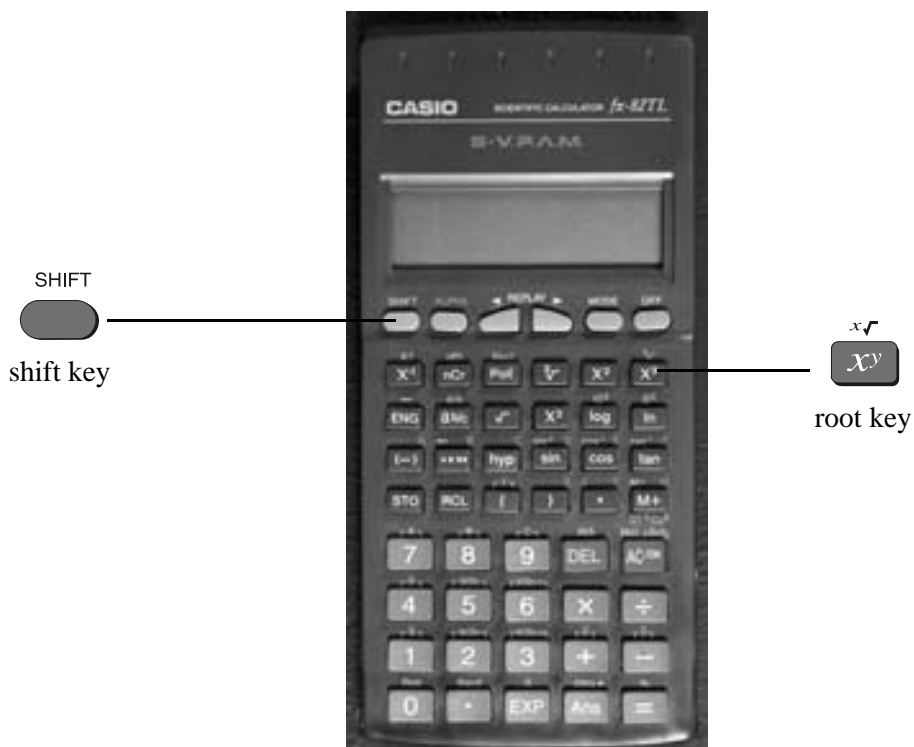
(h) $\sqrt{121} = \square$, because $\square = 121$

(i) $\sqrt{225} = \square$, because $\square = \square$

Check your answers on the calculator.

4.3 Other roots

You can also use the root key on the calculator. Find the $\sqrt[x]{}$ on your calculator. To get to this key you must press **shift** first.



Look at the examples below.

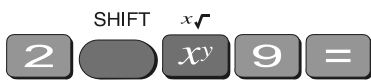
Examples

(a) $9^{1/2}$



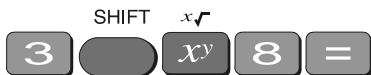
and the display should read 3.

or



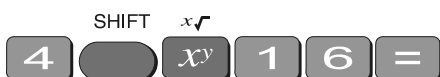
and the display should read 3.

(b) $8^{1/3}$



and the display should read 2.

(c) $16^{1/4}$



and the display should read 2.

Note:

- Root key is a function at the back of the power key, so you will need to activate it with the SHIFT key
- See the key $\sqrt[x]{}$. The x stands for the root you want to take so it is typed first.
- From the examples above you may have seen that $8^{1/3} = \sqrt[3]{8}$. $8^{1/3}$ is called a fractional index.

5. Fractions

How do you add $\frac{1}{12}$ and $\frac{4}{63}$? Normally you would have to find a common denominator of 252.

So:

$$\frac{1}{12} + \frac{4}{63} = \frac{21}{252} + \frac{16}{252} = \frac{37}{252}$$

Or you can use your calculator to add fractions. Find the

$a\frac{b}{c}$ key



fraction key

On the $a\frac{b}{c}$ key the 'a' represents the whole part of a mixed number and the ' $\frac{b}{c}$ ', represents the fraction part of a mixed number.

When the number you are typing is a proper or improper fraction the 'a' is zero and there is no need to type a value for it.

The key strokes required for the calculation $\frac{1}{12} + \frac{4}{63}$ are:



and the display will show $37 \downarrow 252$ which is read as $\frac{37}{252}$



Example


Find $8\frac{1}{9} + \frac{63}{72}$

Using the calculator the key strokes are:



and the display will show $8 \downarrow 71 \downarrow 72$ which is read as $8\frac{71}{72}$

Note if you now press   the display will read $\frac{647}{72}$. So this key turns a mixed fraction into an improper fraction.

If you press the  key a second time the decimal equivalent is displayed, i.e. 8.9861111

Example

Find $25^{\frac{3}{2}}$

(This means the square root of 25 cubed).

The calculator strokes are:



The display should read 125.

6. Using the x^{-1} key

This is a very useful key in more complex calculations. Find the x^{-1} key on your calculator.

(x^{-1} really means $\frac{1}{x}$; e.g. $7^{-1} = \frac{1}{7}$)

Example

Look at this example

$\frac{4}{7}$ is the same as $4 \times \frac{1}{7}$ or $\frac{1}{7} \times 4$

You can input this in your calculator by pressing



The answer should be 0.571428571. This would be the same as if you just typed $4 \div 7$

Take another example

$$\frac{4}{(8+3) \times 7}$$

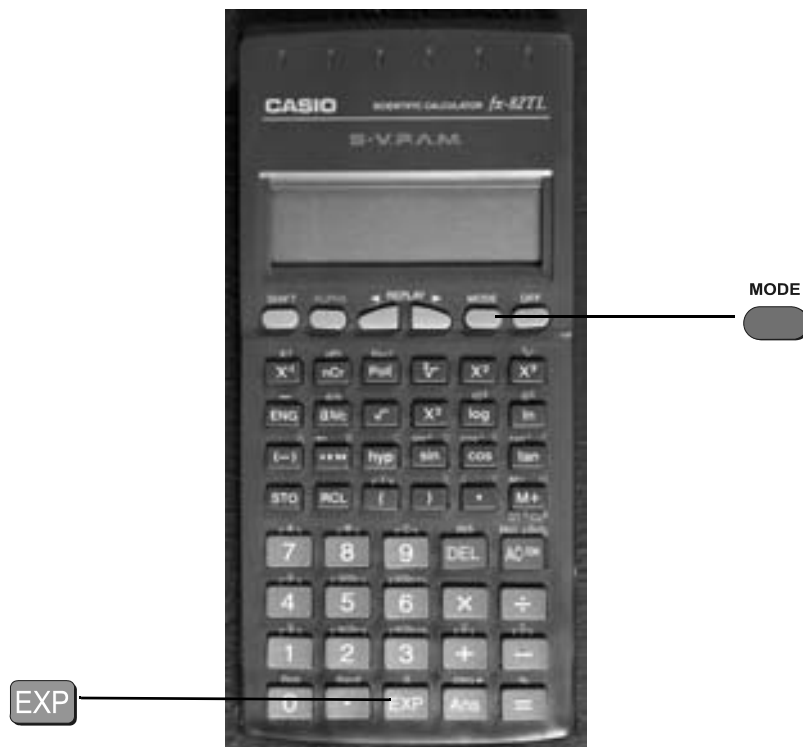
Type:



The answer should be 0.051948051

7. Scientific notation

Sometimes you may have numbers expressed in scientific notation, i.e., 7.24×10^3 instead of 7240. When a number is multiplied by 10^3 , you move the decimal point three places to the right. You can do this on the calculator by using the **EXP** key.








Press **7** **.** **2** **4** **EXP** **3** **=**, the display should read 7240.



If you want to multiply two numbers e.g. $8.34 \times 10^{-2} \times 4.28 \times 10^5$. Press








and the display will read 35695.2



If you press      the display will read 3.569520000^{04} which means 3.56952×10^4 . Pressing the mode three times gives you the display



The  puts the calculator in scientific notation. The calculator then asks SCI 0~9? This gives the option of how many digits are displayed. The  gives you 10 digits. Notice a small sci appears in the screen.



If you press      the display will read 3.570^{04} which means 3.570×10^4 . This rounds the number to 4 digits.

Practise using the  and  keys on your calculator

8. Factorial $x!$

Look at your calculator and find the key with the symbol $x!$ on it. You will come across this symbol when doing the Binomial Distribution. This is called the factorial key.



Use it to find the 3! and 5!. Press $\boxed{3}$ $\boxed{\text{SHIFT}}$ $\boxed{X^{-1}}$ $\boxed{=}$

3! means $3 \times 2 \times 1$ and $5! = 5 \times 4 \times 3 \times 2 \times 1$

$3! = 6$ $5! = 120$

How many ways would you guess that we could arrange ten people?
That is, how large would you estimate 10! to be? Use your calculator to find 10!
You should get 3 628 800.

$$10! = 10 \times 9 \times 8 \times \dots \times 3 \times 2 \times 1$$

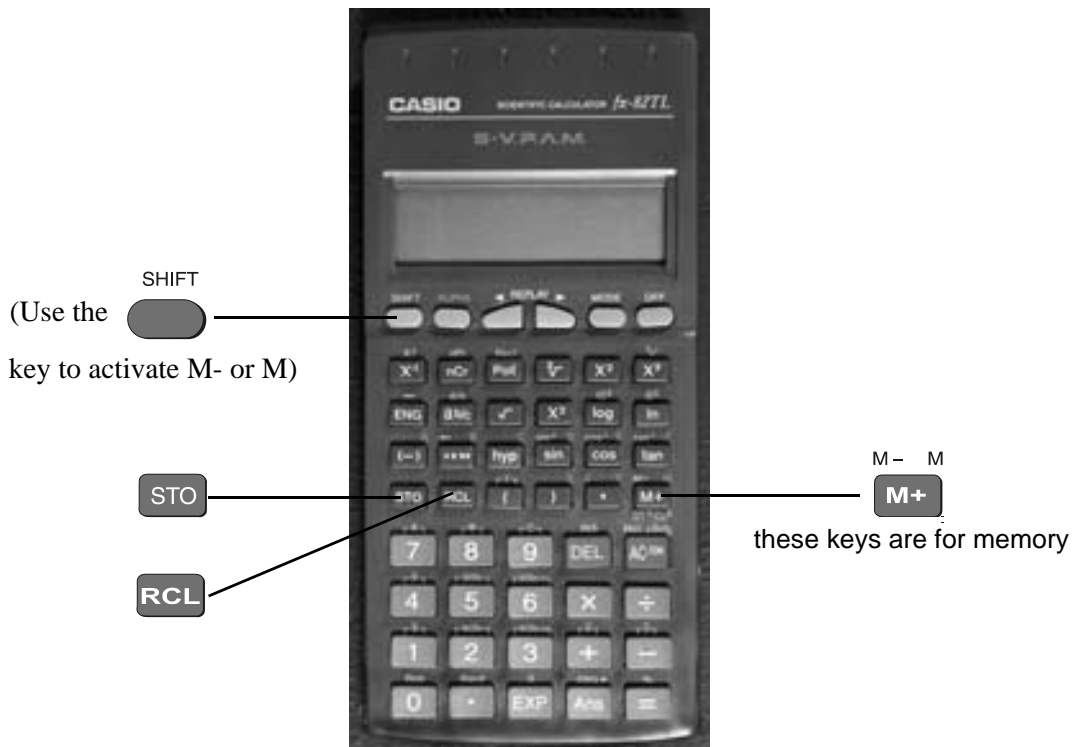
(Thank goodness this can be done on the calculator.)

9. Using memory

To calculate the following it may be useful to use the memory key for each term:

Example:

$$\frac{(9 - 16)^2}{16} + \frac{(23 - 16)^2}{16} + \frac{(17 - 16)^2}{16}$$



To make sure memory is clear, first press



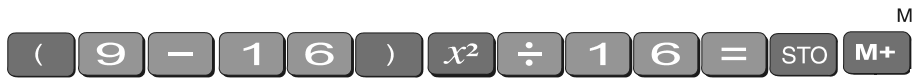
or



and make sure you are in normal calculation mode [may need to press mode 1].

A small m appears in the display when you put something in memory.

To do the calculation above, press the following keys



- this puts the first term (3.0625) into the memory

then press



- this adds the second term (3.0625) into memory

then press



- this adds the third term 0.0625 to memory.

To find the answer press **RCL** **M+**

The answer should be 6.1875.

Example 2

calculate the following:

$$\frac{18}{\sqrt{17}} + \frac{17}{\sqrt{17}} + \frac{12}{\sqrt{17}}$$

first **SHIFT** **AC/ON** **=** to clear the memory then

press the following keys:



your answer should be 11.39917438

(There are other memory keys in your calculator – the A to F keys, accessed by using SHIFT STO and RCL – try them yourselves.)

10. Statistics

10.1 Mean and standard deviation – single data

The formula for the mean is $\bar{x} = \frac{\sum x}{n}$

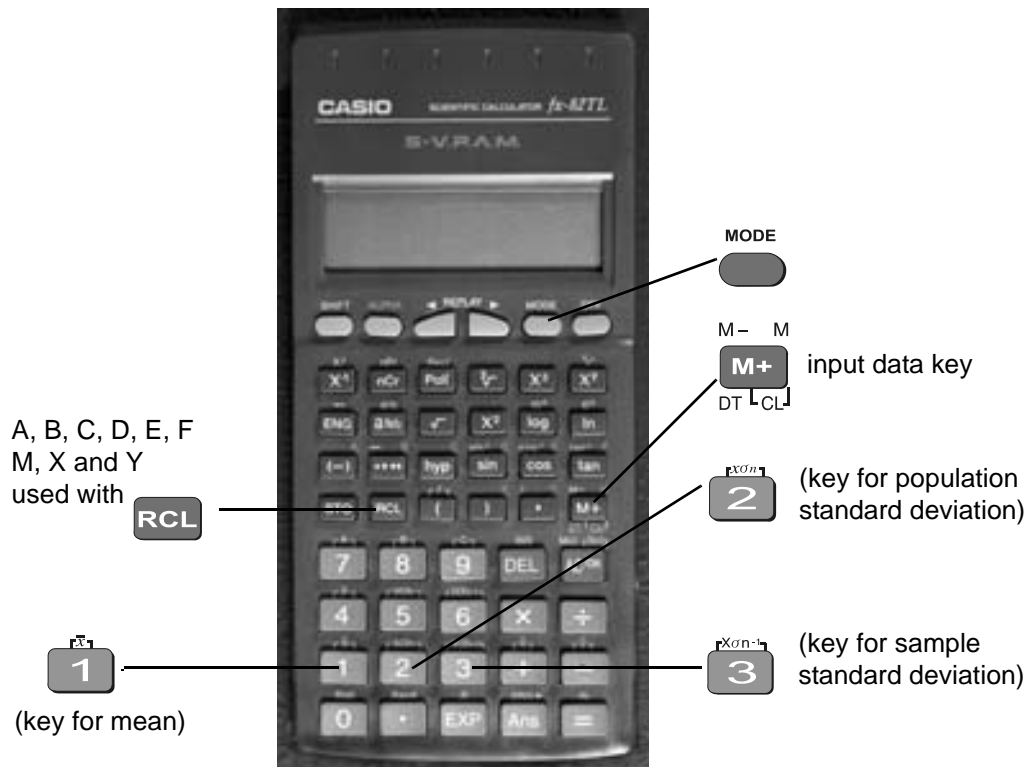
The formulas for the sample standard deviation are

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n - 1}} \quad \text{(Theoretical formula)}$$



$$s = \sqrt{\frac{\sum x_i^2 - (\sum x_i)^2/n}{n - 1}} \quad \text{(Working formula)}$$

Your calculator will calculate the mean and standard deviation for you (the population standard deviation σ_n or the sample standard deviation σ_{n-1} – in data calculations you will usually use the sample standard deviation.)





The differentiation between σ and s varies with different calculators. On the Casio fx-82TL, σ is denoted by σ_n and s is denoted by σ_{n-1} . The positions of these keys is shown on the diagram below.




To find the mean and standard deviation,



firstly you must access the statistics mode of the calculator by using the keys  followed by  SD will appear in the centre of the screen.

Note that once you are in the statistics mode, the keys shown within the blue lines and pink letters are active. There are 14 blue keys and 9 pink keys on the Casio fx-82TL. Make sure you can locate them. Before starting any computations always clear the statistic's memories using

Mcl. Press    

I will use the data set A (-5, 2, 3, 4, 11) to demonstrate the use of the calculator. Note that I have shown the use of the  key where necessary.

Step 1: Input the observations.

Use the  key to input data (no need to press ).




           

Step 2: Check that the correct number of observations have been inputted. [Note this is shown on the inside cover of your calculator under statistical data.]




Press  

The display should read 5.

Step 3: Display the mean

   and the display should read 3

Step 4: Display the standard deviation (assume the data set is a sample)

   and the display should read 5.7008771

Example

Use your calculator to find the mean, standard deviation and variance for data set B: -18, 1, 3, 9, 20.

(the variance is the square of the standard deviation)

After you are in the statistics mode and cleared the statistics memories, the keystrokes required are:

RCL ^C**hyp** and the display will read 5

SHIFT ^{\bar{x}} **1** **=** and the display will read 3

SHIFT ^{σ_{n-1}} **3** **=** and the display will read 13.87443693

x^2 and the display will read 192.5

The mean is 3, the standard deviation is 13.87 and the variance is 192.5.

The **RCL** button accesses a number of extra statistical functions. (M, Y and X you will rarely use in basic statistics.)

^A**(-)** = Σx^2

^D**sin** = Σy^2

^M**M+** = Σx^3

^B**o, , ,** = Σx

^E**cos** = Σy

^Y**,** = $\Sigma x^2 y$

^C**hyp** = n

^F**tan** = Σxy

^X**)** = Σx^4

In the example below, the progressive calculations are shown simply to give you some understanding of the underlying processes – you should do one or two examples in detail and then check them by calculator.

10.2 Mean and standard deviation of frequency distribution

Given below is the frequency table for the weights (kg) of a random sample of 30 first year university female students. Find the standard deviation, the variance and the mean.

| Graduate's weight (kg) | Frequency | Cumulative frequency |
|------------------------|-----------|----------------------|
| 60 | 2 | 2 |
| 61 | 14 | 16 |
| 62 | 8 | 24 |
| 63 | 1 | 25 |
| 64 | 5 | 30 |

The calculations needed to obtain the standard deviation without statistical keys for these data are:

$$\Sigma x^2 = 60^2 \times 2 + 61^2 \times 14 + 62^2 \times 8 + 63^2 \times 1 + 64^2 \times 5 = 114\,495$$

$$\Sigma x = 60 \times 2 + 61 \times 14 + 62 \times 8 + 63 \times 1 + 64 \times 5 = 1\,853$$

$$s = \sqrt{\frac{\Sigma x_i^2 - (\Sigma x_i)^2/n}{n-1}}$$

$$= \sqrt{\frac{114\,495 - (1\,853)^2/30}{29}} = \sqrt{\frac{114\,495 - 114\,453.6333}{29}} = \sqrt{1.4264}$$

Thus: $s = 1.2$ kg and $s^2 = 1.4$ kg²

$$\bar{x} = \frac{\Sigma x}{n} = \frac{1853}{30} = 61.8 \text{ kg}$$

Note: In calculations like the above you should carry as many decimals as possible until the final result. The number of decimals to be retained at the end depends on the accuracy of the data values – one rule of thumb is to have one more decimal than in the original data.

Notice how the frequencies were used in the above calculation.

The calculator usage now has a small modification because we have been given the frequencies for the variable values. (There is no need to input each single observation.)

The keystrokes required are:

SHIFT ; 6 0 , 2 M+ 6 1 SHIFT ; , 1 4 M+ 6 2

SHIFT ; , 8 M+ 6 3 M+ 6 4 SHIFT ; Y , 5 M+

C
RCL hyp and the display should read 30

SHIFT \bar{x} 1 = and the display should read 61.766667

SHIFT σ_{n-1} 3 = and the display should read 1.1943353

x^2 = and the display should read 1.4264369

Thus, as expected

$$s = 1.2 \text{ kg}, s^2 = 1.4 \text{ kg}^2 \text{ and } \bar{x} = 61.8 \text{ kg}$$

Exercise 6

Find the mean, standard deviation and variance of

(a) The annual rainfall data for the years 1971 – 1990

| | | | | | | | | | | |
|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Year | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
| Rain (mm) | 1 340 | 990 | 1 120 | 1 736 | 260 | 1 100 | 1 379 | 1 125 | 1 430 | 1 446 |
| Year | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
| Rain (mm) | 1 459 | 1 678 | 1 345 | 978 | 1 002 | 1 110 | 1 546 | 1 672 | 1 467 | 1 123 |

(b) The sample of snail foot lengths

| Snail foot length (cm) | | | | | | | |
|------------------------|-----|-----|-----|-----|-----|-----|-----|
| 2.2 | 4.1 | 3.5 | 4.5 | 3.2 | 3.7 | 3.0 | 2.6 |
| 3.4 | 1.6 | 3.1 | 3.3 | 3.8 | 3.1 | 4.7 | 3.7 |
| 2.5 | 4.3 | 3.4 | 3.6 | 2.9 | 3.3 | 3.9 | 3.1 |
| 3.3 | 3.1 | 3.7 | 4.4 | 3.2 | 4.1 | 1.9 | 3.4 |
| 4.7 | 3.8 | 3.2 | 2.6 | 3.9 | 3.0 | 4.2 | 3.5 |

Answers:

(a) Rainfall statistics

mean:

$$\mu = 1\,265.3 \text{ mm}$$

standard deviation:

$$\sigma_{n-1} = 336.4 \text{ mm}$$

variance:

$$\sigma^2 = 113141.7 \text{ mm}^2$$

(b) Snail statistics

mean:

$$\bar{x} = 3.4 \text{ cm}$$


standard deviation:

$$s = 0.70 \text{ cm}$$

variance:

$$s^2 = 0.49 \text{ cm}^2$$

11. Linear regression



Put into linear regression mode and a small REG appears

MODE **3** **1**

SHIFT accesses the keys with [] in blue

The **RCL** key is used to access other statistical data

For entering the first set of data **,**

RCL ^C **hyp** will display the number of observations. Other functions of the **RCL** button should be marked on the calculator cover

for entering the second set of data **M+** _{DT} **CL**

Example

Suppose we had a sample of 10 of the same type of banana. Their lengths and skin thicknesses were measured. Below is a summary of the results.

| | | | | | | | | | | |
|----------------|------|------|------|------|------|------|------|------|------|------|
| Banana | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Length (mm) | 16.2 | 15.8 | 16.5 | 14.9 | 16.9 | 16.8 | 15.6 | 15.6 | 15.7 | 15.4 |
| Thickness (mm) | 1.1 | 1.2 | 1.1 | 1.0 | 0.9 | 1.2 | 1.1 | 1.2 | 0.9 | 0.8 |


STEPS


1. To put the calculator into regression mode press **MODE** **3** **1**
2. Think of the sample of bananas as having two variables
 - let x be the variable length of banana
 - let y be the variable thickness of banana

For each banana you have to put in both numbers.

To put in the first set of numbers, press the following keys:





 is used for the 1st variable

 is used for the 2nd variable
DT

Continue in this manner






After you have input all the numbers, check to see you have 10 samples.




Press  ^C. The display should read 10




To find the linear regression equation in the form

$$y = a + bx$$

you need to find the value of a and b. These keys are formed as A and B under the  and

 keys. The  button is used for all buttons with a blue [] symbol under it.

Press  ^A  a is 0.3651









Press  ^B  b is 0.0430



∴ the equation is $y = 0.3651 + 0.0430x$

To find the correlation coefficient press  ^r 

$$r = 0.1928$$

There is not a high correlation between the thickness of bananas and the length of bananas tested.

The calculator will also give you other statistics about this sample. Use    to get the mean thickness (1.055mm) or use   to get the standard deviation (0.64mm) or use    to get $\sum x$ (sum of all lengths = 159.4mm).



You can also use the   to predict the length, given the thickness.

Example

If 0.6 is the thickness

Press    

The display will read 5.46625

Similarly you can use   to predict the thickness, given the length.

Example

If 12mm is the length

Press    

The display will read 0.8807

12. Trigonometric functions

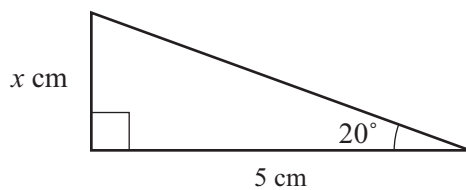
The keys involved are:



Important: Make sure that your calculator is in the correct mode. For example, if your calculator has R or G on the display and you wish to work in degrees, press mode twice and then select 1 for degrees. Your screen should now display D.

Example 1

In the right-angled triangle below, the length of the side opposite the 20° angle needs to be calculated.

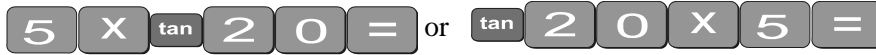


To find the length of the side labelled x cm, use

$$\tan 20^\circ = \frac{x}{5}$$

$$\Rightarrow x = 5 \tan 20^\circ$$

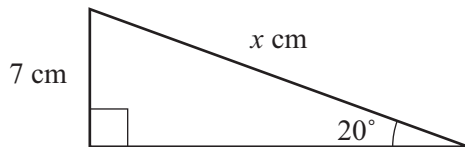
The keystrokes on the calculator are:



The display should read 1.819851171, so the length of x is about 1.8 cm.

Example 2

In the right-angled triangle below, the length of the hypotenuse needs to be calculated.



To find the length of the side labelled x cm, use:

$$\sin 20^\circ = \frac{7}{x}$$

$$\Rightarrow x = \frac{7}{\sin 20^\circ}$$

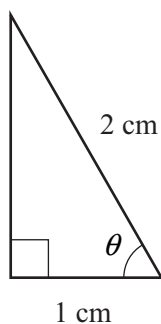
The keystrokes on the calculator are:



The display should read 20.466631, so the length of the hypotenuse is about 20.5 cm.

Example 3

Given the lengths of two of the sides in the right-angled triangle below, find the value of the angle θ in degrees:



In the diagram, $\cos \theta = \frac{1}{2}$ so $\theta = \cos^{-1}\left(\frac{1}{2}\right)$

To find the value of θ , you need to use the \cos^{-1} key. The calculator keystrokes are:

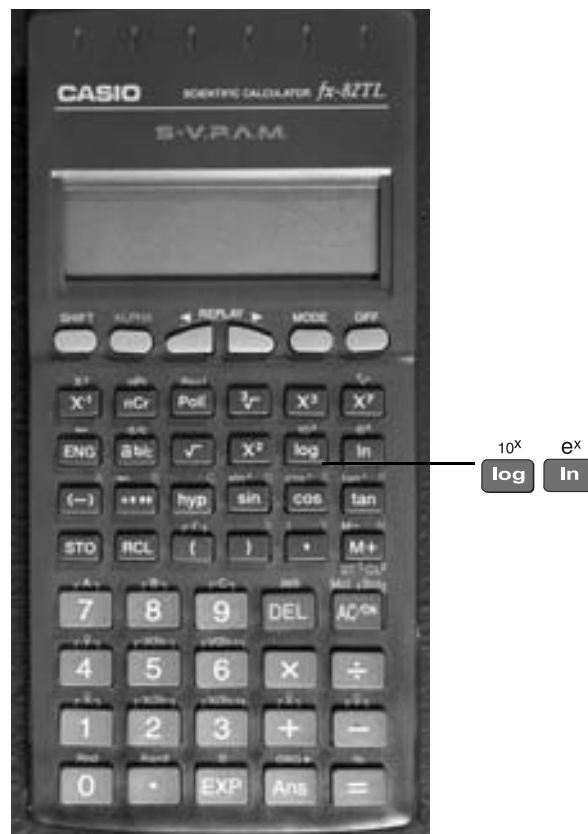


Note: You must first get the value of the division by using the brackets.

Your display should read 60° . If it does not, check that you are in degree mode.

13. Exponential and logarithmic functions

There are two log keys on your calculator, with their associated exponential keys. The latter are accessed by first using the shift key:



The 'log' key uses base 10 and the 'ln' key uses base e (natural logarithm).

Example 1

Solve equation $2^a = 20$

Taking logs of both sides;

$$\log 2^a = \log 20$$

$$\Rightarrow a \log 2 = \log 20$$

$$\Rightarrow a = \frac{\log 20}{\log 2}$$

To find the value of a , the keystrokes are:

The display should read 4.3219281.

So, $2^{4.32} \approx 20$. Confirm this by using the x^y key.

Example 2

Given $\log y = 1.584$, find the value of y

$$\log y = 1.584$$

$$\Rightarrow y = 10^{1.584}$$

The 10^x key is above the log key. Hence the keystrokes are:

The display should read 38.370725

Example 3 (harder)

Given $\log_x 6 = 1.5$, find the value of x

$$\log_x 6 = 1.5$$

$$\Rightarrow \frac{\log 6}{\log x} = 1.5$$

$$\Rightarrow \frac{\log 6}{1.5} = \log x$$

To find $\log x$, the calculator keystrokes are:

The display should read 0.5187675.

Since this is the value of $\log x$, you still need to find x where $x = 10^{0.5187675}$

Without removing the answer of 0.5187675 on your display, press:



Your display should now read 3.3019272

Note: You could use the 'ln' key instead of the 'log' key – the answer would still be the same. Try it!



14. Degrees, minutes, seconds

The key involved is



This key can be used for problems involving degrees, minutes and seconds or hours, minutes and seconds.

Example 1

Suppose that you have a trigonometric problem where the angle involved is given in degrees and minutes. e.g. Find x where $x = 4 \times \sin 25^\circ 36'$

The keystrokes involved are:



The display should show 1.728343, so x is approximately 1.73

Example 2

If you wish to convert an angle in degrees to its equivalent in degrees, minutes and seconds:

e.g. 34.88° , the keystrokes are:



The display should read $34^\circ 52' 48''$

Example 3

To find the sum of 5 hours 52 minutes 30 seconds and 7 hours 45 minutes 49 seconds:

The keystrokes are:



The display should read $13^\circ 38' 19''$ which is 13 hours 38 minutes and 19 seconds.

To convert this number on the display into hours and the decimal part of an hour, press



The display should read 13.638611 (hours).

Review calculator exercises

1. Perform the following calculations

(i) $(5 + 4) \times 3$

(ii) $12.5 - 8 \div 0.5$

(iii) $\frac{3 \times 6 - 8}{4}$

(iv) $\frac{12.8}{16.5 - 3.8}$

(v) $\frac{7 \times 0.41 + 17}{(4 + 7) \times 2}$

(vi) $\frac{2.4}{\frac{3}{4}}$

(vii) $\sqrt{145.6 - 17.2^2} / 5$

(viii) $\sqrt{345.6 - 17.2^2} / 5$

(ix) $25 + \frac{3 \times 27}{1.02\sqrt{30}}$

(x) $(4.1333 - 3.000) \pm 2.015 \sqrt{\frac{0.1366^2}{6} + \frac{0.2000^2}{6}}$

(xi) $\frac{(100 - 90)^2}{90} + \frac{(50 - 60)^2}{60} + \frac{(20 - 30)^2}{30}$

2. The following data is on growth (in \$m) in an economy over a 8 year period:

2.5 6.2 -2.1 0.04 8.2 7.4 2.1 -1.7

Calculate (i) Σx (ii) Σx^2 (iii) $(\Sigma x)^2$ Explain in words what each of these mean.

Calculator solutions

1.

(i) $(5 + 4) \times 3 = 27$
 Make sure your calculation is in comp mode.

(ii) $12.5 - 8 \div 0.5 = -3.5$

(iii) $\frac{3 \times 6 - 8}{4} = 2.5$
 Either $(3 \times 6 - 8) \div 4 =$, or $3 \times 6 - 8 = \div 4 =$

(iv) $\frac{12.8}{16.5 - 3.8} = 1.007874$
 Either $12.8 \div (16.5 - 3.8) =$, or $16.5 - 3.8 = x^{-1} \times 12.8 =$

(v) $\frac{7 \times 0.4 + 17}{(4 + 7) \times 2} = 0.9$
 Either $\dots \div ((4 + 7) \times 2) =$ or $\dots \div (4 + 7) \div 2 =$

(vi) $\frac{2.4}{\frac{3}{4}} = 3.2$
 Either $2.4 \div (3 \div 4) =$, or $2.4 \div 3 \text{ ab/c } 4 =$

(vii) $\sqrt{145.6 - 17.2^2} / 5 = 9.296..$
 Either $145.6 - 17.2x^2 \div 5 = \sqrt{=} =$, or $\sqrt{(145.6 - 17.2x^2 \div 5)} =$

(viii) $\sqrt{345.6 - 17.2^2} / 5 = 1.41..$
 Either $345.6 - 17.2x^2 = \sqrt{=} \div 5 =$, or $(345.6 - 17.2x^2) = \sqrt{=} \div 5$

(ix) $25 + \frac{3 \times 27}{1.02 \sqrt{30}} = 39.4985$
 $25 + 3 \times 27 \div 1.02 \div \sqrt{30}$

(x) $(4.1333 - 3.000) \pm 2.015 \sqrt{\frac{0.1366^2}{6} + \frac{0.2000^2}{6}} = 1.3325 \text{ or } 0.9341$

Calculator keys: $0.1366 x^2 \div 6 + .2 x^2 \div 6 = \sqrt{=} x 2.015 = M+$
 $+ 4.1333 - 3$
 $= AC 4.1333 - 3 - RCL M+ =$

$$(xi) \frac{(100-90)^2}{90} + \frac{(50-60)^2}{60} + \frac{(20-30)^2}{30} = 6.1111$$

Calculator keys: $(100-90) x^2 \div 90 + (50-60) x^2 \div 60 + (20-30) x^2 \div 30 =$




2. The following data is on growth (in \$m) in an economy over a 8 year period:

2.5 6.2 -2.1 0.04 8.2 7.4 2.1 -1.7




Calculate (i) Σx (ii) Σx^2 (iii) $(\Sigma x)^2$ Explain in words what each of these mean.

To do this on the calculator, you must be in SD mode. Enter the data:

mode 2 2.5 M+ 6.2 M+ 2.1 (-) M+ .04 M+ 8.2 M+ 7.4 M+ 2.1 M+ 1.7 (-) M+

(i) 22.64 Press the key that says Σx (  )

This gives the total growth over the last 8 years

(ii) 178.4016 Press the key that says Σx^2 (  ) This gives the sum of the squares of the growth in each year

(iii) 512.5696 Press Σx and x^2 . This gives the square of the sum of the growth.

