Mastering the calculator: using the Sharp EL-531XH

Student Learning and Development

UNIVERSITY OF SOUTHERN QUEENSLAND
AUSTRALIA

Contents

Introduction

This is one in a series of calculator booklets prepared to assist students who are learning to use a scientific or financial calculator. They have been prepared by staff in Student Learning and Development from Library Services at USQ. The series comprises:

- Using the Casio *fx*-100s (also suitable for Casio fx-570)
- Using the Casio *fx*-100AU
- Using the Casio *fx*-100AU PLUS
- Using the Casio *fx*-82LB
- Using the Casio *fx*-82MS
- Using the Casio *fx*-82TL
- Using the Casio *fx*-82AU
- Using the Casio*fx*-82AU PLUS
- Using the Sharp EL-531LH
- Using the Sharp EL-556L
- Using the Sharp EL-531RH
- Using the Sharp EL-531WH
- Using the Sharp EL-531XH
- Using the Sharp EL-738F (in press)
- Using the Texas Instruments T130XIIB

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

Telephone:	1800 063 632 (AU)
Email:	library@usq.edu.au
Home page:	https://library.usq.edu.au

Note the calculator booklets are also available online at the above website.

A word about starting out

- Make sure you are in the correct mode selection and that all previous data is cleared. Modes available:
  - NORMAL for normal calculations
  - STAT for statistics calculations.
- For example: To perform arithmetic operations press 

- To clear all values press 

- To clear memory press 

- If your calculator has FIX or SCI on the display, to reset your calculator to **normal** mode press 

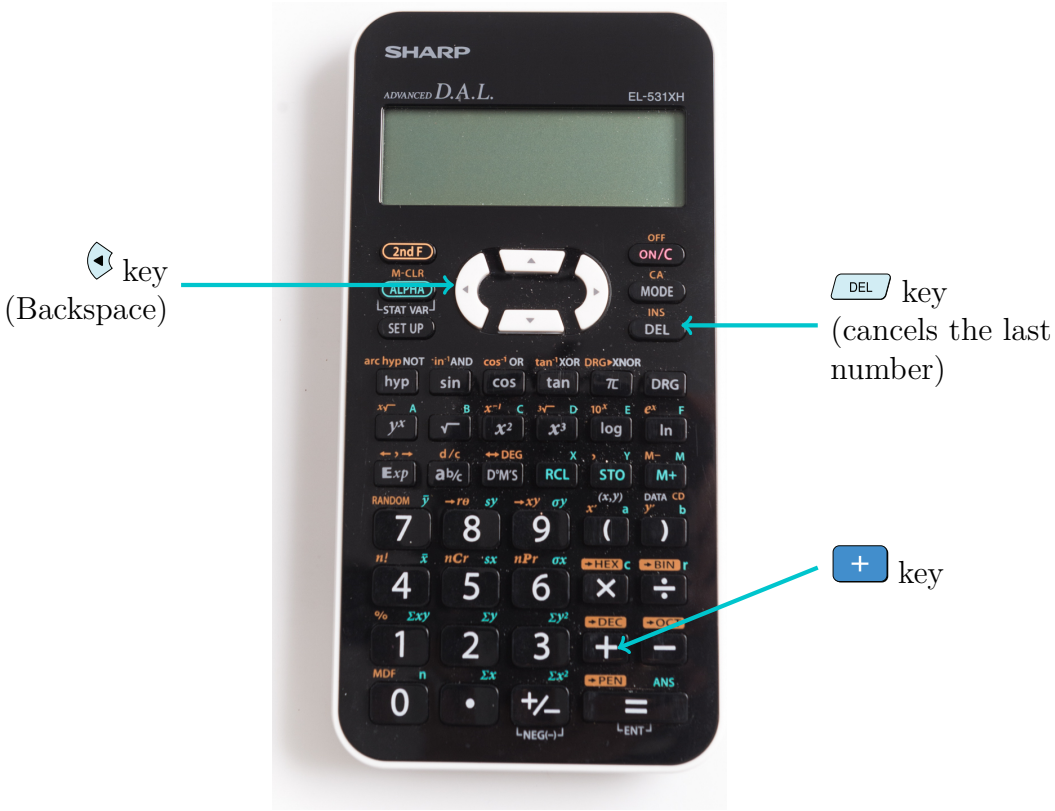
- If your calculator has RAD or GRAD on the display then press 

. This will put your calculator in degree (DEG) mode.
- If all else fails press the RESET button on the back of your calculator.

Chapter 1

Addition and subtraction

1.1 To add numbers



Find the [+] (addition) key (it is shown on the photograph of the calculator above).

Example 1.1

To add 7 and 3, type

The display should read 10.

Example 1.2

To add 7 and 3.1, type

The display should read 10.1.

Example 1.3

I want to find the total amount I earned for the past four weeks. If I earned \$471, \$575, \$471 and \$528, the keystrokes would be:

the display should read 2045. This means that the total amount earned over the past four weeks is \$2 045.

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 1.4

If you want to enter $3 + 4$ but accidentally type 3 + 5, press DEL once to cancel the 5. Now type 4 =.

Note that the DEL key cancels just the last digit.

Example 1.5

If I want to add 471 and 575, but I typed

I can cancel the 6 by pressing the DEL key once and then pressing 5 =. The display should read 1046.

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

1.3 The arrow keys are used when you delete other data

Example 1.6

If you typed

$$471 + 546$$

but you wanted

$$471 + 576$$

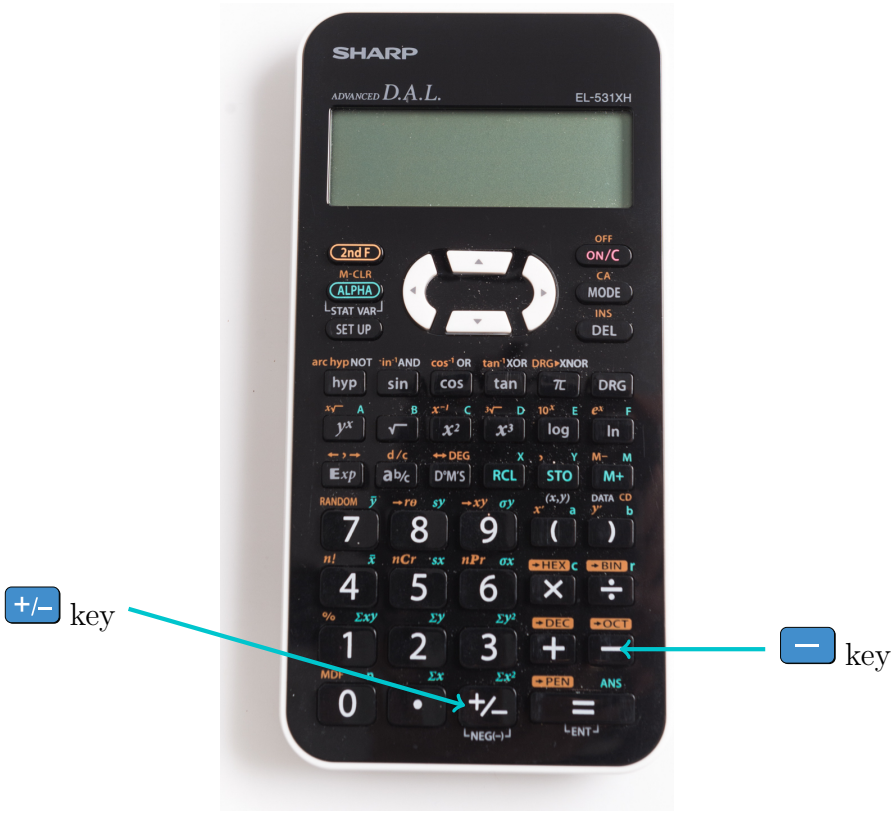
press the ◀ key to navigate to the number you wish to change, that is, the 4. Then press DEL once to delete the 4 then press 7. The 7 now replaces the 4. Press =. The display should read 1047.

Practice using this key when replacing digits, operation keys $(+, -, \times, \div)$, for more than one digit (use the DEL key).

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

1.4 To subtract numbers

Find the [−] (subtraction) key (it is shown on the photograph of the calculator below).



Note: the [+/−] (plus/minus) key is only used for entering negative numbers.

Example 1.7

To subtract 35 from 257, type

[2] [5] [7] [−] [3] [5] [=]

The display should read 222.

Example 1.8

$$348 - 24 - 19$$

The keystrokes are:

[3] [4] [8] [−] [2] [4] [−] [1] [9] [=]

The display should read 305.

Example 1.9

Sometimes you may have a sum like this:

$$-7+4$$

You use the 

key. The keystrokes are:

The display should read -3.

Note: Avoid using the 

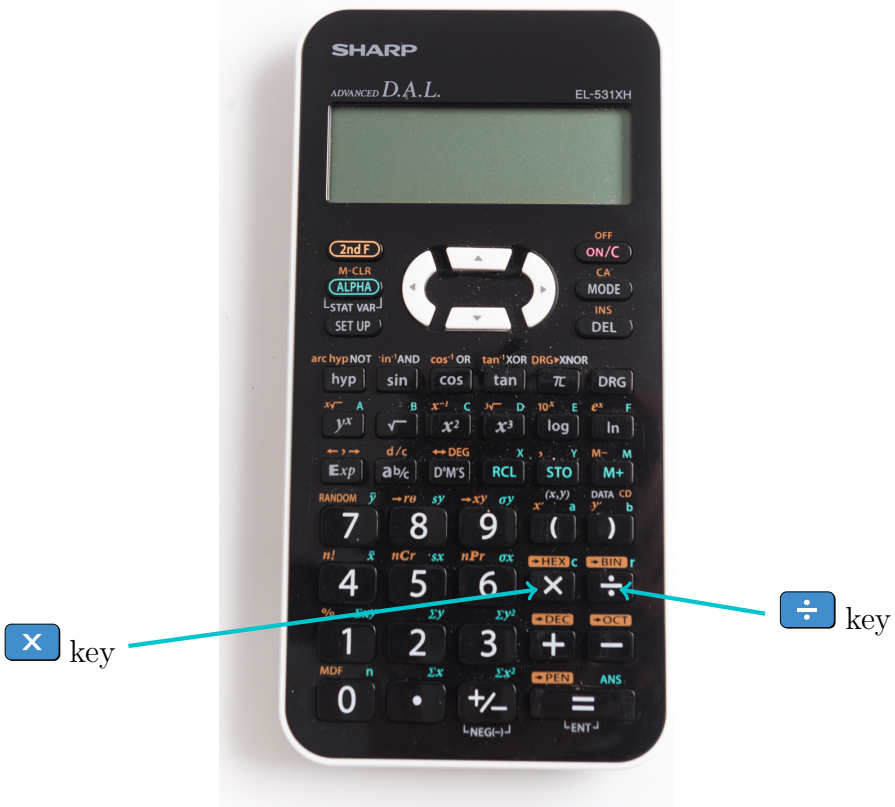
(subtraction) key to enter negative numbers!

Chapter 2

Multiplication and division

2.1 To multiply numbers

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



Example 2.1

To multiply 7 by 3, type:

The display should read 21.

Example 2.2

To find 753×492, type

The display should read 370476.

2.2 To divide numbers

Find the 

(division) key (it is shown the photograph of the calculator 11).

Example 2.3

To divide 35 by 7, type

.

The display should read 5.

Example 2.4

To divide 7 905 by 85, type

.

The display should read 93.

Example 2.5

To divide 60 by 5 and then by 4, type:

.

The display should read 3.

2.3 Combining multiplication and division

Example 2.6

If the question is

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

then it is really

$$27 \div (7 \times 4)\,.$$

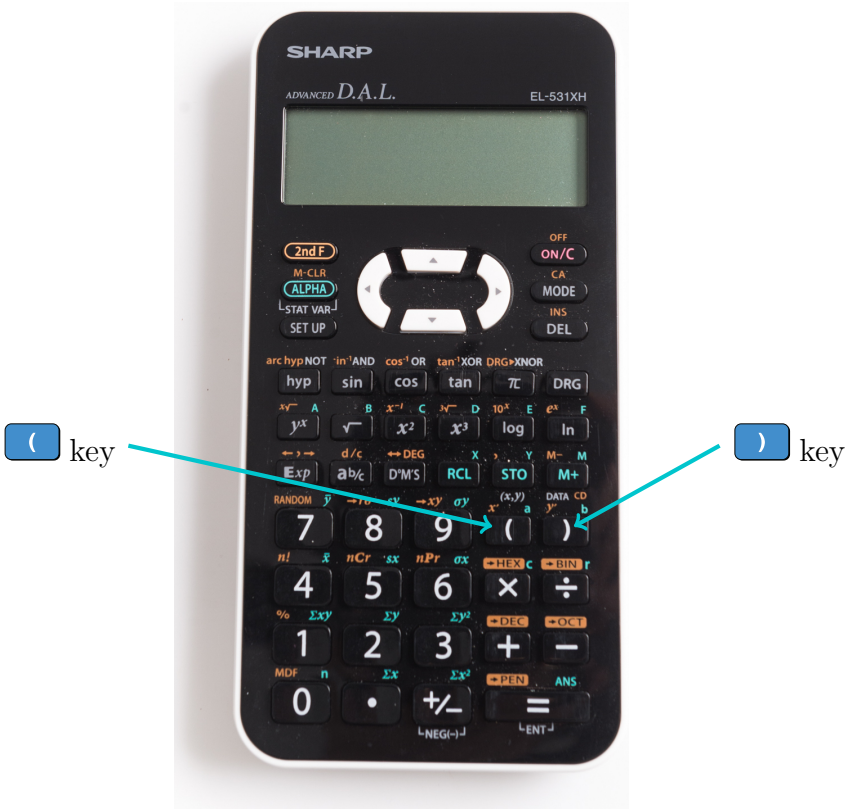
Try it.

The display should read 0.964285714.

Chapter 3

Brackets and order of calculation

Find the brackets on your calculator. The EL-531XH allows you to use many sets of brackets.



Example 3.1

Do the calculation

$$471 - (93 + 11 + 2)$$

on your calculator.

The keystrokes required are:

The display should read 365.

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

Misplaced or omitted brackets can give an incorrect result due to the priorities given to operations by the calculator.

Example 3.2

While $5 \times (3 + 4) = 3$,

$$5 \times 3 + 4$$

is equivalent to $(5 \times 3) + 4$ and will give a result of 19.

Exercise 1

Do these calculations:

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

(b) $18(3 + 7)$

Note: a multiplication sign is understood i.e. $18 \times (3 + 7)$ but you don't need to press the  key.

(c) $4 + 5\,[2\,(3 + 7)]$

Note: to use two sets of brackets just press the same button.

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

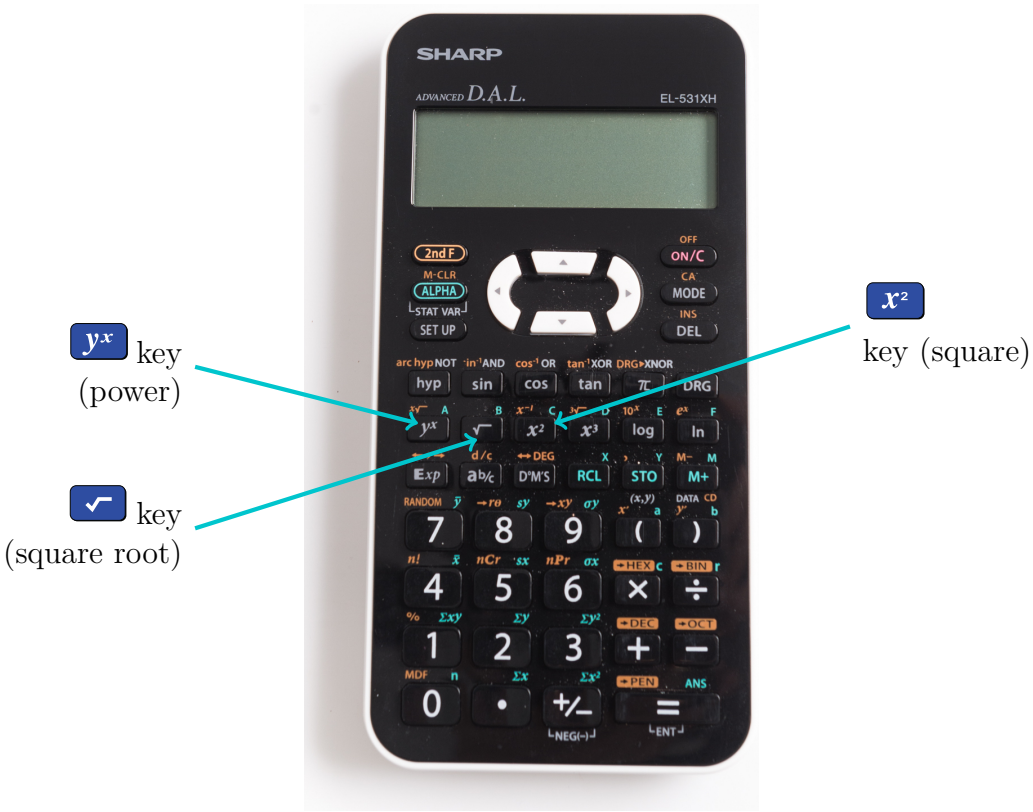
Answers: 30; 180; 104; 1.

Chapter 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.)



To evaluate 6^2 press [6] [x^2] [=], the display should read 36.

Or you could use the power key on your calculator. To do this, find the [y^x] key on your calculator.

Example 4.1

To square 6 using the power key, you type:

The display should read 36.

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

Example 4.2

To find 27^3 the required keystrokes 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 square of the whole numbers from 13 to 25 and any other squares you are unsure of:

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

Exercise 3

You can use the y^x 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 do not need to type the brackets if you use the +/– key).

(e) $5^{0.4}$

(f) 5^{-4}

Answers:

(a) 2401

(b) 1 073 741 824

(c) 4.096×10^{-3} or 0.004 096 (You move the decimal place 3 places to the left.)

(d) 117 649

+/– 7 y^x 6 =

(e) 1.903 653 939

(f) 0.0016

4.2 Square root

Finding the **square root** of a number 'undoes' or 'neutralises' the squaring of the number and vice versa. They symbol for the square root is: $\sqrt{\ }$ (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:

$\sqrt{\ }$ 3 6 =

The display should read 6.

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

You should have said 9 because $9^2 = 81$. (Check on your calculator.)

Exercise 4

Try these by looking at the table of squares you completed on page 18.

(a) $\sqrt{16} =$ (c) $\sqrt{100} =$ (e) $\sqrt{49} =$ (g) $\sqrt{121} =$

(b) $\sqrt{144} =$ (d) $\sqrt{441} =$ (f) $\sqrt{169} =$ (h) $\sqrt{361} =$

Answers: 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 keystrokes required are:

The display should read 3.

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

Therefore, the square, of the square root of 3, should also equal 3. Try it on your calculator. The keystrokes required are:

Exercise 5

1. Complete the following without using the calculator:

   (a) $\sqrt{7}^2 =$ (e) $\sqrt{\square}^2 = 144$

   (b) $\sqrt{10^2} =$ (f) $\sqrt{64}^2 = \square$, because $8^2 = \square$

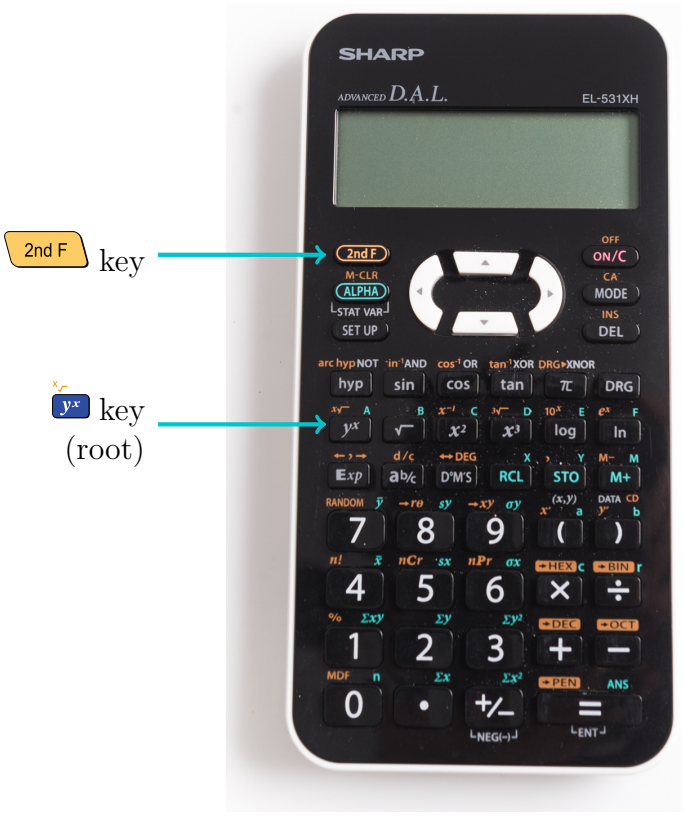
   (c) $\sqrt{\square}^2 = 10$ (g) $\sqrt{121} = \square$, because $\square = 121$

   (d) $\sqrt{\square^2} = 625$ (h) $\sqrt{225} = \square$, because $\square^2 = \square$

2. Check your answers on the calculator.

4.3 Other roots

You can also use the root key on the calculator. Find the $\sqrt[x]{\ }$ key on your calculator. To get this key, you must press 2nd F first.



Example 4.3

(a) $9^{\frac{1}{2}}$

Recognising that the power of a $\frac{1}{2}$ is the same as taking the square root, the keystrokes required are:

$\sqrt{\ }$ 9 =.

The display should read 3.

Alternatively, you could have used:

2 2nd F $\sqrt[x]{\ }$ 9 =,

and the display should read 3, as before.

(b) $8^{\frac{1}{3}}$

Recognising that $8^{\frac{1}{3}}$ is the same as the taking the cube root of 8, the keystrokes required are:

,

and the display should read 2.

(c) $16^{\frac{1}{4}}$

Similarly the power of $\frac{1}{4}$ is the same as finding the fourth root, that is, $\sqrt[4]{16}$.

,

and the display should read 2.

Note:

- The root key is found above the power key, that is, you use it by first pressing the 2nd F first.
- See the x^3. The 3 stands for the root you want to take so it is typed first.
- From the examples above, you may have seen that

$$8^{\frac{1}{3}} = \sqrt[3]{8}\,.$$

This is called a fractional index as the index (power) is a fraction (one third).

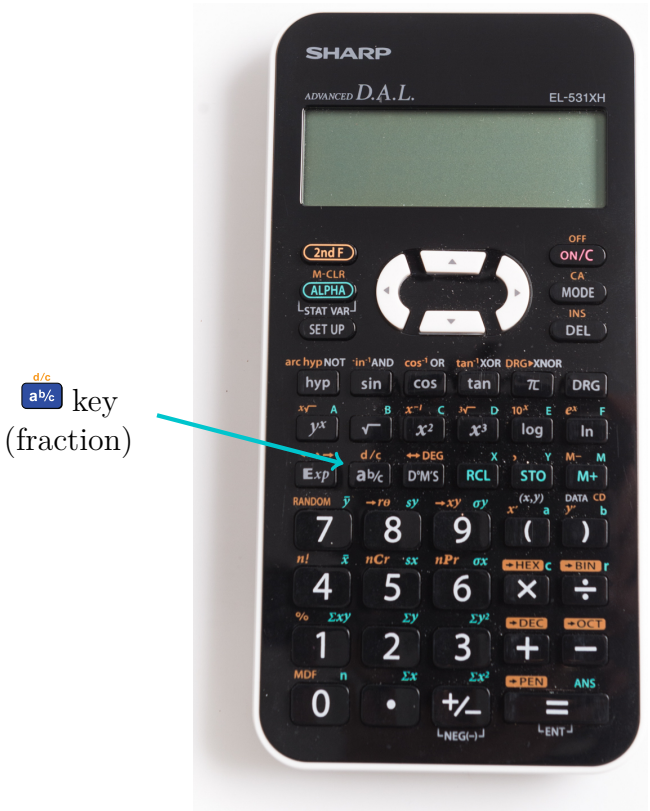
Chapter 5

Fractions

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

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

Alternatively, you can use your calculator to add these fractions. Find the $a\frac{b}{c}$ (fraction) key on your calculator.



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

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

Example 5.1

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

Using the calculator the keystrokes are:

,

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

Note if you new press the 

the display will read 647 r 72 . So this key turns a mixed nubmer into an improper fraction.

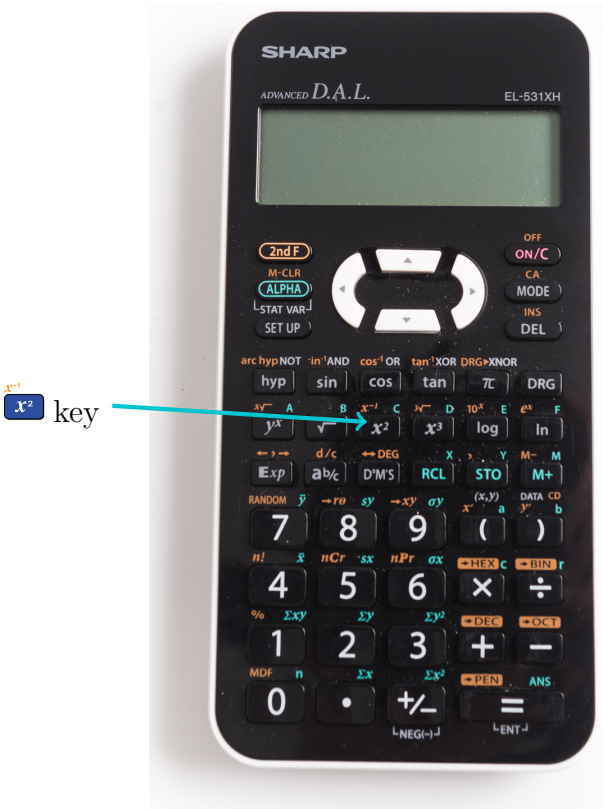
If you press the 

key a second time the decimal equivalent is displayed, that is, 8.986111111 .

Repeating this once again returns the answer to a mixed number.

Chapter 6

Using the reciprocal key



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

Example 6.1

Look at this simple example: $\frac{4}{7}$ is the same as $4 \times \frac{1}{7}$.

You can input this in your calculator by pressing:

7 2nd F x^{-1} × 4 =

Your answer should be 0.571428571 . This is the same as if you just typed

Example 6.2

Take another example:

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

To evaluate this, type:

The answer should be 0.051948051 .

Chapter 7

Scientific notation

Sometimes you may have numbers expressed in scientific notation, that is,

$$7.24 \times 10^3 \,,$$

instead of 7240. When a number is multiplied by 10^3, you move the decimal point three places to the right. To complete calculations with scientific notation you can do this on the calculator by using the Exp key.

Press

7 · 2 4 Exp 3 =

and the screen shows:

Where 7.24E03 is the calculator's computation symbols for 7.24×10^3.

Example 7.1

If you want to multiply two numbers in scientific notation

$$8.34 \times 10^{-2} \times 4.28 \times 10^5$$

press

and the display will read 35695.2.

If you press

the display will read read 3.56952×10^{04}.

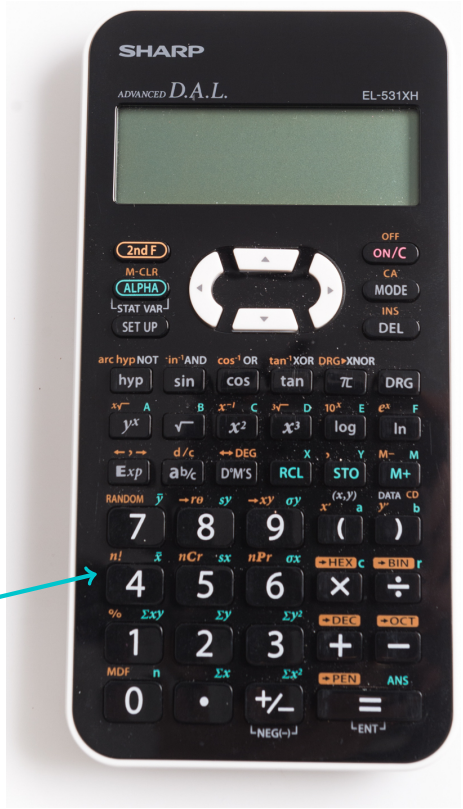
Practise using the 

key on your calculator.

Chapter 8

Factorial $n!$

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



Use 2nd F to activate $n!$

4 key

Example 8.1

Use the factorial key to find 3! and 5!

To do this you need to press

3 2nd F 4 =

$$3! \quad = \quad 3 \times 2 \times 1 = 6$$

To calculate 5 factorial:

and the answer should be 120 as

$$5! \quad = \quad 5 \times 4 \times 3 \times 2 \times 1 = 120\,.$$

Example 8.2

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 .

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

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

Factorial rule

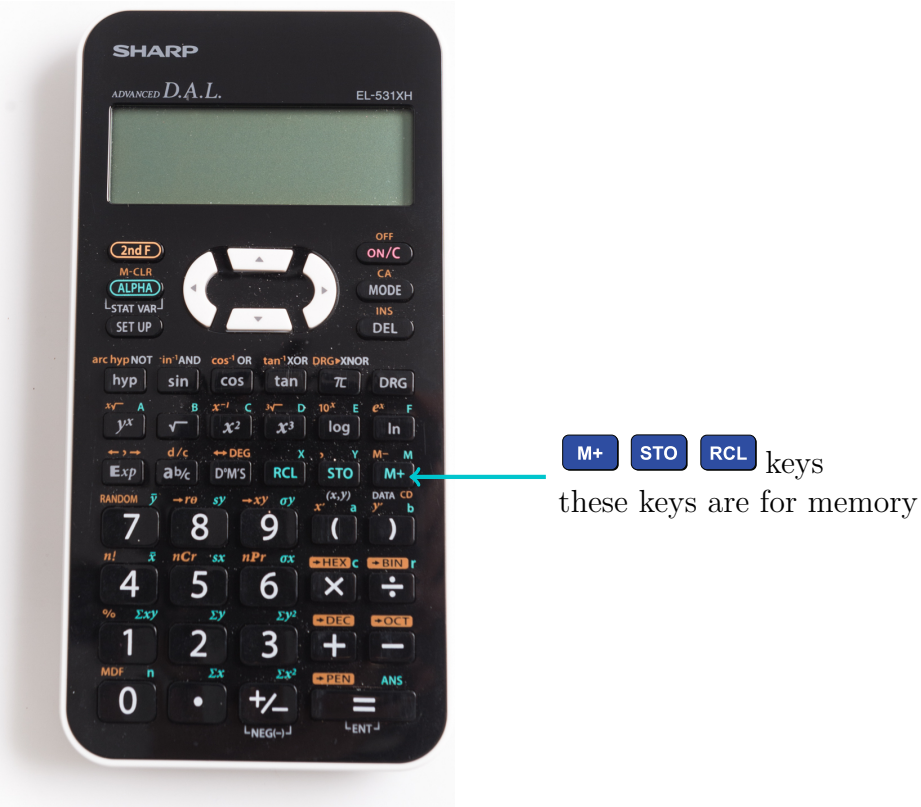
The number of ways of arranging n items in order is known as 'factorial n' which is symbolised as $n!$ where:

$$n! = n \times (n–1) \times (n–2) \times \ldots \times 3 \times 2 \times 1$$

Chapter 9

Using memory

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



Example 9.1

$$\frac{(9-16)^2}{16}+\frac{(23-16)^2}{16}+\frac{(17-16)^2}{16} \tag{9.1}$$

Before starting, make sure the memory is clear, press:

An M appears in the display when you put something in memory.

To do the calculation in Equation 9.1, press the following keys:

this put the first term (3.0625) into the memory. Then press

to add the second term (3.0625) into memory. Now press

to add the third term to memory. To now find the final answer press

The answer should be 6.1875.

Note:

- For the **Sharp EL-531XH**, just pressing RCL M+ gives you the answer to the above calculation.
- To clear memory, press 0 STO M+ and 'M' will disappear.
- To store a number in memory, press STO after the number, and where you want to store it (green alpha keys), and pressing RCL followed by where you stored it (green alpha keys), will recall the number.

Example 9.2

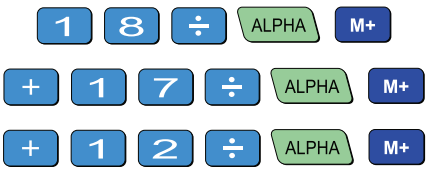
Calculate the following:

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

First clear the memory:

Firstly, as the denominators are the same, we will put that into memory:

Now for the calculations:



Your answer should be 11.399 174 38 .

There are other memory keys on your calculator, the A, B, C, D, E, F, X, Y (green) keys, accessed by using SHIFT, STO, ALPHA and RCL — try them for yourself.

Chapter 10

Statistics

10.1 Mean and standard deviation — single variable data

The formula for the mean is

$$\bar{x} = \frac{\sum x}{n}$$

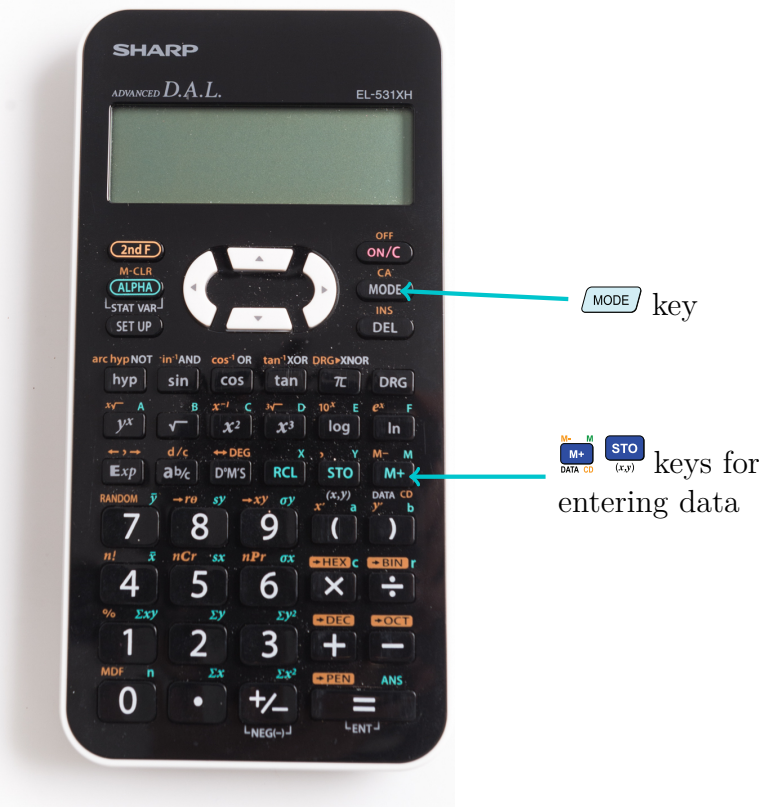
The formulas for the standard deviations are:

$$s_x = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} \qquad \text{(Sample)}$$

$$\sigma_x = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}} \qquad \text{(Population)}$$

Your calculator will calculate the mean and standard deviation for you (the population standard deviation σ_x or the sample standard deviation s_x — in data calculations you will usually use the sample standard deviation.)

On the Sharp EL-531WH, σ and s are found in STAT. The positions of keys needed are shown on the diagram.



To find the mean and standard deviation, firstly you must access the statistics mode of the calculator by using the keys MODE, followed by 1 and 0, and STAT 0 will appear on the screen.

Note that once you are in the statistics mode, the keys shown in green are active. Make sure you can locate them.

IMPORTANT: Before starting any computations always clear the statistic's memories using 2nd F MODE.

Example 10.1

The data set we will use to to demonstrate the use of the calculator for finding the mean and standard deviation is:

$$-5,\ 2,\ 3,\ 4,\ 11\,.$$

Note: I will show the use of the 2nd F key where necessary.

Step 1: Input the data/observations:

Use the M+ key to input data — no need to press 2nd F or ALPHA.

+/− 5 M+ 2 M+ 3 M+ 4 M+ 1 1 M+

Step 2: Check that the correct number of observations have been inputted. The screen should show DATA SET = 5. Or press

The display should read $n = 5$.

Step 3: Access the statistics keys to find the mean and standard deviation.

To find the mean, you need to press

.

The display should read $\bar{x} = 3$.

To find the population standard deviation (σ_x), press

.,

which gives, $\sigma_x = 5.099019514$.

To find the sample standard deviation (s_x), press

,

which gives, $s_x = 5.700877126$.

Note: to clear the STAT data, press 

again.

Example 10.2

Use your calculator to find the mean, sample standard deviation and variance for data set:

$$-18,\ 1,\ 3,\ 9,\ 20\,.$$

Note: the variance is the square of the standard deviation. After you are in the statistics mode (and cleared the statistics memories) and inputted the new data set,

- the keystrokes required are to find the mean are

  ,

  and the display will read 3.

- To find the sample standard deviation (s_x), press

  ,

  and the display will read 13.87443693.

- To now find the variance, press

  and the display will read 192.5.

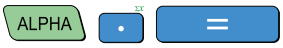
Therefore, the mean is 3, the sample standard deviation is approximately 13.87 and the sample variance is 192.5 .

You can also access a number of extra statistical functions.

- The sum of the data points squared:

$$\sum x^2 = 815\,.$$

- The sum of the data points:



$$\sum x = 15\,.$$

- The number of data points:

$$n = 5\,.$$

If you have made an **error** with inputting your data you can correct it by going back to the data.

For example, you inputted 4, 5, 60, 7, 9 and you meant 6 instead of 60. Go to the data number 3, then press 

. You now have the correct data.

10.2 Mean and standard deviation of frequency distribution

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.

Example 10.3

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:

$$\begin{aligned}\sum x^2 &= 60^2 \times 2 + 61^2 \times 14 + 62^2 \times 8 + 63^2 + 64^2 \times 5 \\ &= 114495 \\ \sum x &= 60 \times 2 + 61 \times 14 + 62 \times 8 + 63 + 64 \times 5 \\ &= 1853\,.\end{aligned}$$

To calculate the mean:

$$\begin{aligned}\bar{x} &= \frac{\sum x}{n} \\ &= \frac{1853}{30} \\ &\approx 61.8\,.\end{aligned}$$

To calculate the sample standard deviation:

$$\begin{aligned}s &= \sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}} \\ &= \sqrt{\frac{114495 - (1853)^2/30}{29}} \\ &= \sqrt{\frac{114495 - 114453.6333}{29}} \\ &\approx \sqrt{1.4264} \\ &\approx 1.194\,.\end{aligned}$$

Therefore, the mean is approximately equal to 61.8 kilograms and the sample standard deviation is approximately equal to 1.2 kilograms.

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.)

You need to set up your display for inputting frequencies:

Press: MODE 1 0 for single variable statistics mode then input the data using the STO (x,y) key to separate the data points and the frequencies.

Now press:

6 0 STO 2 M+

To find the mean, standard deviation and variance press:

- To find the mean:

  and the display should read 61.76666667 .

- To find the sample standard deviation:

  and the display should read 1.1943353 .

- To find the standard deviation squared (variance):

  and the display should read 1.4264369 .

Thus, as expected

$$\begin{aligned} s &\approx 1.2 \text{ kg} \\ s^2 &\approx 1.4 \text{ kg} \\ \bar{x} &\approx 61.8 \text{ kg.} \end{aligned}$$

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: $\bar{x} = 1\,265.3$ mm
standard deviation $s = 336.4$ mm
variance: $s^2 = 113141.7$ mm^2.

(b) Snail statistics:

mean: $\bar{x} = 3.4$ cm
standard deviation: $s = 0.70$ cm
variance: $s^2 = 0.49$ cm^2.

Chapter 11

Linear regression

To access the linear regression mode you press MODE key followed by 1 1.

Example 11.1

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. 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 by using the STO key.

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

   1 6 • 2 STO 1 • 1 M+

   Continue in this manner.

2. To find the linear regression equation in the form

   $$\hat{y} = a + bx$$

   you need to find the value of a and b. These keys are found much like the mean and standard deviation.

   To find the value for a press:

   ALPHA (=

thus, $a \approx 0.3651$.

To find the value for b press:

thus, $b \approx 0.0430$.

Therefore, the equation is

$$\hat{y} = 0.3651 + 0.0430x$$

where y is the thickness of the bananas (in mm) and x is the length of bananas (in mm).

3. To find the correlation coefficient (r) press

$$r \approx 0.1928$$

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 find the mean length of bananas:

which gives:

$$\bar{x} = 15.94 \text{ mm}.$$

- To find the sample standard deviation of the length of bananas:

which gives:

$$s_x \approx 0.6433 \text{ mm}.$$

- To find the mean thickness of bananas:

which gives:

$$\bar{y} = 1.05 \text{ mm}.$$

- To find the sample standard deviation of the thickness of bananas:

which gives:

$$s_y \approx 0.1434 \text{ mm}.$$

You can also use the (to predict the length, given the thickness. If 0.6 is the thickness then press

The display reads: 5.46625, so therefore predicted length for a banana with thickness of 0.6 mm is approximately 5.47 mm.

Similarly, if the length is 12 mm then press

The display reads: 0.8807196563, so therefore predicted thickness for a banana with length of 12 mm is approximately 0.88 mm.

Chapter 12

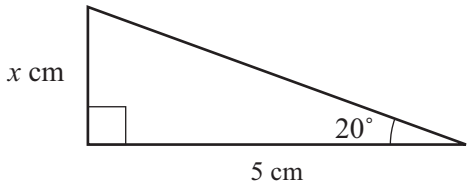
Trigonometric functions

The keys involved are:

Important: Make sure that your calculator is in the correct mode. For example, if your calculator has RAD or GRAD on the display and you wish to work in degrees, press DRG until DEG appears on the screen.

Example 12.1

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

$$\begin{aligned} \tan 20^\circ &= \frac{x}{5} \\ x &= 5 \tan 20^\circ \end{aligned}$$

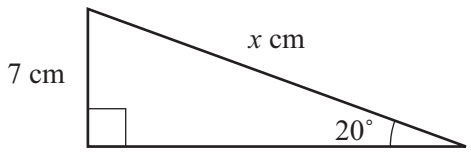
The keystrokes on the calculator are:

or

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

Example 12.2

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:

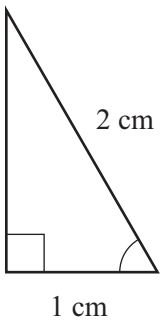
$$\begin{aligned} \sin 20^\circ &= \frac{7}{x} \\ x &= \frac{7}{\sin 20^\circ} \end{aligned}$$

The keystrokes on the calculator are:

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

Example 12.3

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,

$$\cos\theta = \frac{1}{2}$$

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.

Chapter 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 13.1

Solve equation $2^a = 20$.

Taking logarithms of both sides:

$$\begin{aligned} 2^a &= 20 \\ \log 2^a &= \log 20 \\ a \log 2 &= \log 20 \\ a &= \frac{\log 20}{\log 2} \end{aligned}$$

To find the value of a, the keystrokes are:

The display should read 4.321928095.

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

Example 13.2

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

$$\begin{aligned} \log y &= 1.584 \\ y &= 10^{1.584} \end{aligned}$$

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

The display should read 38.370725 .

Example 13.3

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

$$\begin{aligned} \log_x 6 &= 1.5 \\ \frac{\log 6}{\log x} &= 1.5 \\ \log x &= \frac{\log 6}{1.5} \end{aligned}$$

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

The display should read 0.5187675.

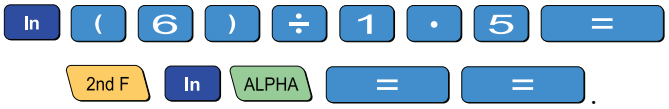
Since this is the value of $\log x$, you still need to find x where $10^{0.5187675}$.

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!



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Chapter 14

Degrees, minutes, seconds

The key involved is the D°M'S key.

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

Example 14.1

Suppose that you have a trigonometric problem where the angle involved is given in degrees and minutes. e.g. Find x where

$$x = 4 \times \sin 25°36'$$

The keystrokes involved are:

The display should show 1.728343, so x is approximately 1.73 .

Example 14.2

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°52′48″.

Example 14.3

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°38′19″.

Press 

and the display should read 13.63861111.

Review calculator exercises

1. Perform the following calculations:

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

   (b) $12.5 - 8 \div 0.5$

   (c) $\dfrac{3\times 6-8}{4}$

   (d) $\dfrac{7\times 0.41+17}{(4+7)\times 2}$

   (e) $\dfrac{12.8}{16.5-3.8}$

   (f) $\dfrac{2.4}{\frac{3}{4}}$

   (g) $\sqrt{145.6-\dfrac{17.2^2}{5}}$

   (h) $\dfrac{\sqrt{345.6-17.2^2}}{5}$

   (i) $25+\dfrac{3\times 27}{1.02\sqrt{30}}$

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

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

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:

   (a) $\sum x$ (b) $\sum x^2$ (c) $(\sum x)^2$

   Explain in words what each of these mean.

Calculator solutions

1. (a) $(5+4)\times 3 = 27$

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

   (c) $\dfrac{3\times 6 - 8}{4} = 2.5$

   (d) $\dfrac{7\times 0.41 + 17}{(4+7)\times 2} = 0.9$

   (e) $\dfrac{12.8}{16.5 - 3.8} = 1\dfrac{1}{127} \approx 1.0079$

   (f) $\dfrac{2.4}{\frac{3}{4}} = 3.2$

   (g) $\sqrt{145.6 - \dfrac{17.2^2}{5}} \approx 9.2969$

   (h) $\dfrac{\sqrt{345.6 - 17.2^2}}{5} \approx 1.4109$

   (i) $25 + \dfrac{3\times 27}{1.02\sqrt{30}} \approx 39.4985$

   (j) $(4.1333 - 3.000) \pm 2.015\sqrt{\dfrac{0.1366^2}{6} + \dfrac{0.2000^2}{6}} \approx 0.9341$ or 1.3325

   Note, you have to do both the subtraction (minus) an the addition (plus)

   (k) $\dfrac{(100-90)^2}{90} + \dfrac{(50-60)^2}{60} + \dfrac{(20-30)^2}{30} = 6\dfrac{1}{9} \approx 6.1111$

2. (a) $\sum x = 22.64$

   (b) $\sum x^2 = 178.4016$

   (c) $(\sum x)^2 = 512.5696$

Your notes