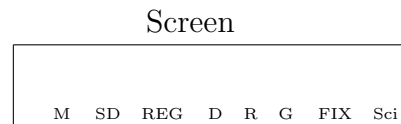


# Calculator Skills

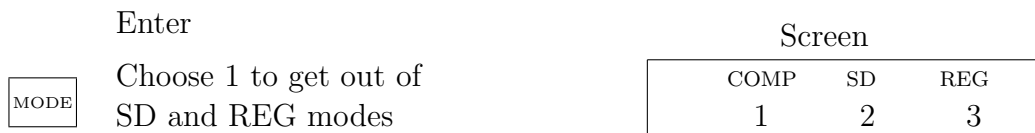
Most of this worksheet refers to the Casio brand of calculators. Much of the information carries over to other brands and where possible I have included information for different brands. Most of the differences will appear when we are accessing the statistics mode in the calculator.

Firstly we will familiarise ourselves with the calculator. Find the key with SHIFT written on it or above it. On some calculators this button will have 2nd Function written on or above it instead. This key accesses the functions written above the keys, as opposed to the functions written on the keys. Find the key marked MODE, this is a separate key for many calculators but some people may need to use the SHIFT key to access the mode key. The MODE key lets us to determine what mode the calculator is operating in. There are many choices other than the normal computational mode that is the default mode for your calculator. We will discuss various modes as we work through this material. For now we will stay in normal mode. To check that you are in normal mode you should look at the screen of your calculator for the small letters at the bottom.

You may have any of the following appearing on the bottom of your screen. For what we are about to do you want only one of D,R or G and possibly an M.



You will always have a D,G or R appearing on your calculator screen. This tells you what measurement you are using when you put in angles and use them to do calculations. Since you are mostly Statistics students we are not going to bother with this stuff. The M indicates that you have something in memory. The other letters indicate that your calculator is working in a particular mode. SD is Statistics mode, REG (on Sharps these appear respectively as *Statx* and *Statxy*) indicates that you are in regression mode. The letters FIX and Sci stand for a fixed number of decimal places and scientific notation respectively. We want to be in normal mode for this first section so you should find the mode button (it is near the top of the calculator on Casios and appears as a second function on Sharps). Choose mode NORM or COMP to get out of the SD and REG modes. Choose NORM to get out of the FIX and Sci modes. On the Casios you will see the following screens



Enter

MODE MODE You can make any choice here

Screen

| Deg | Rad | Gra |
|-----|-----|-----|
| 1   | 2   | 3   |

Enter

MODE MODE MODE Choose 3 and then 1 here to get out of Fix and Sci mode

Screen

| Fix | Sci | Norm |
|-----|-----|------|
| 1   | 2   | 3    |

Hopefully you now know how to get into normal computational mode. For the next section we will stay in this mode.

## Order of Operations

Modern calculators have been programmed to observe the correct order of operations. For example:

Enter

4 + 3 × 2 =

Screen

|                  |    |
|------------------|----|
| $4 + 3 \times 2$ | 10 |
|------------------|----|

This means you can enter long, complicated expressions and the calculator will work out what should be done first. If your calculator does not give you the answer 10 above then it does not follow the order of operations and you will need to be careful when calculating an expression with many parts to it. To enter a negative number in the calculator you do one of two things depending on which calculator you have. Look for a button marked  $(-)$  or  $+/-$ . If you have the button marked  $(-)$  then to enter a negative number press  $(-)$  and then the number. For example to enter  $-5$  press  $(-)$  5. (If your calculator has the  $+/-$  button you first enter the number and then press  $+/-$ . So to enter  $-5$  you would press 5  $+/-$ .) For example, if we wanted to calculate  $-4 \times -5$  we would do the following:

Enter

$(-)$  4  $\times$   $(-)$  5  $=$

Screen

|                |    |
|----------------|----|
| $-4 \times -5$ | 20 |
|----------------|----|

## Bracket Buttons

Most modern calculators also come equipped with a bracket function. Find the buttons marked  $[$  and  $]$ . These open and close brackets and you just enter the brackets in the appropriate spots as you enter the calculation. Suppose we wanted to calculate  $4 \times (3 + 2)^2 \div 20$ , then

| Enter                              | Screen                            |
|------------------------------------|-----------------------------------|
| $4 \times ( 3 + 2 ) x^2 \div 20 =$ | $4 \times (3 + 2)^2 \div 20$<br>5 |

Note that sometimes we can mislead our calculators into doing the wrong thing. In these expressions

$$\frac{4 + 2}{3} \quad , \quad \frac{4}{2+2} \quad , \quad \sqrt{4 + 8} \quad ,$$

there are brackets implied even though they are not written. So we need to put them in when we enter them into the calculator So we enter

$$\frac{(4 + 2)}{3} \quad , \quad \frac{4}{(2+2)} \quad , \quad \sqrt{(4 + 8)} \quad ,$$

Let's do the last one on the calculator

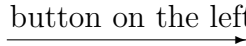


| Enter                | Screen                          |
|----------------------|---------------------------------|
| $\sqrt{( 4 + 8 )} =$ | $\sqrt{(4 + 8)}$<br>3.464101615 |

## Replay

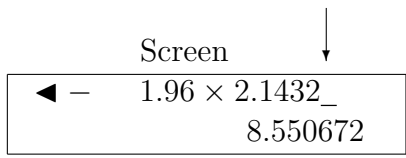
Sometimes in Statistics you will need to do a calculation like  $4.35 \pm 1.96 \times 2.1432$ . Recall that the  $\pm$  in the expression means you want to calculate both the expression with a plus and the one with a minus. You can use the replay button to make this easier.

| Enter   | Screen  |
|---|---|
| $4 \cdot 35 + 1 \cdot 96 \times 2 \cdot 1432 =$ | $4.35 + 1.96 \times 2.1432$ $\blacktriangleright$<br>8.550672 |

The replay buttons are at the top of the panel on the front of your calculator.

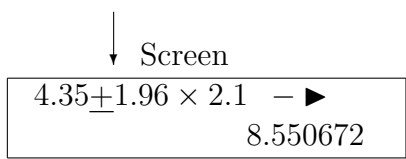
Press the  button on the left  



Notice the screen now has a flashing line at the end of the expression



As you push the left button the line moves along the expression and whatever it is under flashes. Move it until it is under the +.






The plus sign + will be flashing

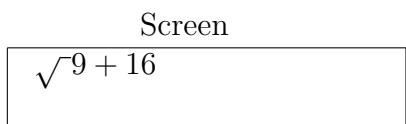


Now push the  button. The screen now has a minus instead of a plus. Push  and you have calculated  $4.35 - 1.96 \times 2.1432 = 0.149328$ .

You can also use these buttons to insert or delete things in the expression. For example, suppose I want to calculate  $\sqrt{9 + 16}$  and I do the following:





Enter

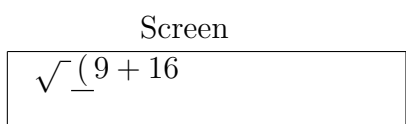
    



and then I realise that I forgot to put in the brackets. Use the replay buttons until you are under the 9 and then use the delete and insert functions. these functions may be combined in one button or on separate buttons. On the Casio calculators the button is red, next to the ON button and has DEL written on it and INS above it. To insert a bracket before the 9 we move the cursor as described above and then do the following:

Enter



Use the replay button (right) to get to the end of the expression and put in another bracket. Enter

Enter

$\boxed{)} \boxed{=}$

Screen

$\sqrt{(9 + 16)}$   
5

## Fractions

To enter a fraction find the button  $\boxed{a \frac{b}{c}}$ . To enter  $\frac{4}{5}$  and  $2\frac{1}{2}$ :

Enter

$\boxed{4} \boxed{a \frac{b}{c}} \boxed{5}$

Screen

$4 \div 5$   
0

Enter

$\boxed{2} \boxed{a \frac{b}{c}} \boxed{1} \boxed{a \frac{b}{c}} \boxed{2}$

Screen

$2 \div 1 \div 2$   
0

At this point you have entered  $2\frac{1}{2}$ . Now lets do some more things with this number.

Enter

$\boxed{=}$  to get the screen

Screen

$2 \div 1 \div 2$   
 $2 \div 1 \div 2$

To change  $2\frac{1}{2}$  from a mixed number to an improper fraction;

Enter

$\boxed{\text{SHIFT}} \boxed{a \frac{b}{c}}$  to get the screen

Screen

$2 \div 1 \div 2$   
 $5 \div 2$

Enter

$\boxed{a \frac{b}{c}}$  to get the screen

Screen

$2 \div 1 \div 2$   
2.5

Now we get the decimal equivalent of  $2\frac{1}{2}$ , that is 2.5. Enter  $\boxed{a \frac{b}{c}}$  again and we get back to the mixed number form of the fraction.

Enter

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

to get the screen

Screen

|                   |                   |
|-------------------|-------------------|
| $2 \div 1 \div 2$ | $2 \div 1 \div 2$ |
|-------------------|-------------------|

Try this one:

Enter

|   |                   |   |   |
|---|-------------------|---|---|
| 4 | $a^{\frac{b}{c}}$ | 5 | = |
|---|-------------------|---|---|

Screen

|            |            |
|------------|------------|
| $4 \div 5$ | $4 \div 5$ |
|------------|------------|

Enter

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

Screen

|            |     |
|------------|-----|
| $4 \div 5$ | 0.8 |
|------------|-----|

Enter

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

Screen

|            |            |
|------------|------------|
| $4 \div 5$ | $4 \div 5$ |
|------------|------------|

## Scientific Notation

Do this calculation

Enter

|   |        |   |   |   |   |   |   |   |   |   |   |
|---|--------|---|---|---|---|---|---|---|---|---|---|
| 1 | $\div$ | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | = |
|---|--------|---|---|---|---|---|---|---|---|---|---|

Screen

|                    |                |
|--------------------|----------------|
| $1 \div 987654321$ | $1.0125^{-09}$ |
|--------------------|----------------|

Notice the little  $-09$  in the corner of the bottom part of the screen. This means that the answer to this calculation is  $1.0125 \times 10^{-9}$ . This says that the number is really 1.0125 with the decimal place shifted 9 places to the left, i.e.

$$0.0000000010125$$

Now do the calculation  $98765 \times 987654321$  to get the answer  $9.754567901^{13}$  on your screen. The little 13 tells you that the answer is 9.75456790 with the decimal place shifted 13 places to the right, i.e.

$$97545679010000$$

Keep an eye out for those little numbers!!

## Memory

You have 10 memory slots in your calculator if you have a Casio *fx-82 TL*. They are called A,B,C,D,E,F,X,Y,M and ANS.

A,B,C,D,E,F,X and Y all work the same way when you are in Comp mode as we are in now. They are accessed by using the  $\boxed{\text{STO}}$  and  $\boxed{\text{RCL}}$  buttons in combination with the letters which are written above some of the keys on the upper section of your calculator in a different colour font than the functions accessed by the  $\boxed{\text{SHIFT}}$  key. To put something into one of these memories you first need to have it as an answer on the screen. For example:

|  |  |
|--|--|
| Enter  | Screen   |
| $\boxed{4} \boxed{\times} \boxed{6} \boxed{=}$ | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <math>4 \times 6</math><br/> <span style="float: right;">24</span> </div> |

To store in memory A.

|  |   |
|--|---|
| Enter  | Screen  |
| $\boxed{\text{STO}} \boxed{\overset{\text{A}}{(-)}}$ | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> A=<br/> <span style="float: right;">24</span> </div> |

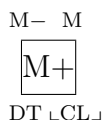
and 24 will be placed in A. To recall it use;

|  |   |
|--|---|
| Enter  | Screen  |
| $\boxed{\text{RCL}} \boxed{\overset{\text{A}}{(-)}}$ | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> A=<br/> <span style="float: right;">24</span> </div> |

To use it in an equation you don't need to recall it you can tell the calculator to use whatever is in the particular memory slot you want to use by using the key with ALPHA written above it. So suppose we now wanted to do  $120 \times 24$  where 24 is the number in A.

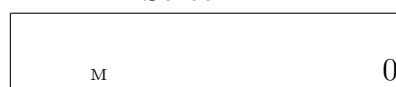
|  |   |
|--|---|
| Enter  | Screen  |
| $\boxed{1} \boxed{2} \boxed{0} \boxed{\times} \boxed{\overset{\text{ALPHA}}{\square}} \boxed{\overset{\text{A}}{(-)}} \boxed{=}$ | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <math>120 \times \text{A}</math><br/> <span style="float: right;">2880</span> </div> |

Memory slot M works a little differently. You can do all the same things with M that we just mentioned for A but a bit more as well. Find the button above the AC button that looks like this:

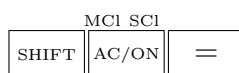


If you press  $\boxed{M+}$  it will add whatever is on the screen to whatever is already in M. If you press  $\boxed{SHIFT} \boxed{M+}$  it will activate the M- and subtract what is on the screen from whatever is already in the memory M. To determine if M already has something in it look for a small M on your screen.

Screen

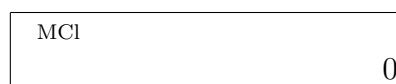


Enter



will clear the memory M

Screen

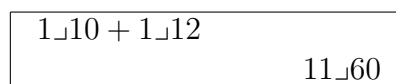


Finally the memory slot  $\boxed{ANS}$ . This is a very short term memory slot. It has in it the last thing shown as an answer on the bottom line of the screen.

Enter



Screen

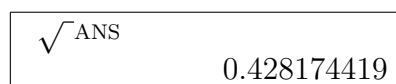


The number  $\frac{11}{60}$  is now in memory ANS. By the way the calculation I just did was  $\frac{1}{10} + \frac{1}{12}$ . Suppose the sum I wanted to do now was  $\sqrt{\frac{1}{10} + \frac{1}{12}}$ . I can do this by doing the following

Enter



Screen



Once I press the  $\boxed{=}$  button the new answer will get put into the ANS memory.

## Statistics Mode

We will now get our calculators into Stats Mode. Find the mode button on your calculator. For most of you this will be a separate button (on some calculators it appears as a second function above another button). Most calculators will either give you a choice when you press the MODE button or will have the various modes written somewhere on the calculator face. For the Casio *fx-82 TL* when you press the mode button a choice will appear on the screen

| Enter   | Screen   |      |    |     |   |   |   |
|---|--|------|----|-----|---|---|---|
| <div style="border: 1px solid black; padding: 5px; display: inline-block;">MODE</div> | <table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px 10px;">COMP</th> <th style="padding: 2px 10px;">SD</th> <th style="padding: 2px 10px;">REG</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 2px 10px;">1</td> <td style="text-align: center; padding: 2px 10px;">2</td> <td style="text-align: center; padding: 2px 10px;">3</td> </tr> </tbody> </table> | COMP | SD | REG | 1 | 2 | 3 |
| COMP  | SD   | REG  |    |     |   |   |   |
| 1   | 2  | 3    |    |     |   |   |   |

Choose 2 here by pressing the 2 button. For other calculators you want to choose the SD mode or for Sharps the STAT mode or  $STATx$  mode. Somewhere on your screen there should now appear a small SD or STAT. Once we are in SD mode the memory of the calculator works differently. M is now working as a place to store your list of data and most of the other memories are used by the calculator to store various numbers associated with that data. The only memory available to you when you are in SD mode is the ANS memory. The inside of the lid of your calculator is often a useful source of information. In some calculators there is a double sided card slotted into the lid with information on both sides; for others it is just a one sided sticker. The Casio *fx-82*'s have a list of things that are stored in each memory slot when the calculator is in SD mode.

The first thing we are going to do is check whether we already have data stored in the calculator. Remember that turning the calculator off does not clear the memory!!! To check the number of data on a Casio 82

| Enter   | Screen              |                     |   |
|---|---------------------|---------------------|---|
| <table style="margin: auto; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 2px 10px;">RCL</td> <td style="border: 1px solid black; padding: 2px 10px; text-align: center;"> <sup>C</sup><br/>hyp         </td> </tr> </table> | RCL                 | <sup>C</sup><br>hyp | <div style="border: 1px solid black; padding: 5px; display: inline-block;">           n = <span style="float: right;">0</span> </div> |
| RCL   | <sup>C</sup><br>hyp |                     |   |

For other calculators look for a small n above one of your keys, it may be a number key or a function key. Access it by pressing SHIFT or 2nd Fn and then the key. If you don't get zero appearing on your screen it means you already have something in the memory and you need to clear it. To clear the Stats memory you do the same as when you cleared the M memory i.e.

| Enter  | Screen                      |                             |   |   |
|--|-----------------------------|-----------------------------|---|---|
| <table style="margin: auto; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 2px 10px;">SHIFT</td> <td style="border: 1px solid black; padding: 2px 10px; text-align: center;"> <sup>MCI SCI</sup><br/>AC/ON         </td> <td style="border: 1px solid black; padding: 2px 10px; text-align: center;">=</td> </tr> </table> | SHIFT                       | <sup>MCI SCI</sup><br>AC/ON | = | <div style="border: 1px solid black; padding: 5px; display: inline-block;">           SCI <span style="float: right;">0</span> </div> |
| SHIFT  | <sup>MCI SCI</sup><br>AC/ON | =                           |   |   |

Now we are ready to start entering data. The  $\boxed{M+}$  button puts a piece of data into the stats memory. Lets enter the numbers 10,12 and 14

$\boxed{1} \boxed{0} \boxed{M+} \boxed{1} \boxed{2} \boxed{M+} \boxed{1} \boxed{4} \boxed{M+}$

Pushing the  $\boxed{M+}$  button will enter whatever is written at the top of the screen into your data list. So if you push M+ twice it will enter the number twice, etc. If you make a mistake then you can correct the last piece of data, but only the last. Pressing  $\boxed{SHIFT} \boxed{M+}$  will clear the last piece of data that you entered. To check that you have entered the correct number of data, recall the number of data to the screen. On a Casio this means entering

|                             |   |
|-----------------------------|---|
| Enter                       | Screen  |
| $\boxed{RCL} \boxed{hyp}^c$ | $n =$<br><span style="float: right;">3</span> |

To get the mean of the data you have entered you need to find the key that has  $\bar{x}$  above it. On the *fx-82*'s this is the  $\boxed{1}$  button. To get the mean use the SHIFT or 2nd FN buttons to access this function. On the Casios

|   |  |
|---|--|
| Enter   | Screen   |
| $\boxed{SHIFT} \boxed{1}^{\bar{x}} \boxed{=}$ | $\bar{x}$<br><span style="float: right;">12</span> |

To get the standard deviation of the data you need to find the button that has  $x\sigma_{n-1}$  above it, or it might have just *s* written above it or it might have *sx* written above it. All of these symbols mean the standard deviation of the sample you have entered as data. To get the standard deviation use the SHIFT or 2nd FN buttons in combination with the button that this symbol is above to get the standard deviation. On the Casios

|   |   |
|---|---|
| Enter   | Screen  |
| $\boxed{SHIFT} \boxed{3}^{x\sigma_{n-1}} \boxed{=}$ | $x\sigma_{n-1}$<br><span style="float: right;">2</span> |

Your calculator can give you further information about your data which you wont really need for STAT170. The most common things that it will also calculate for you are the sum of all the data and the sum of the squares of the data, these will appear as the expressions  $\sum x$  and  $\sum x^2$ . These sums are accessed using the RCL button on the Casios (check on the lid to see which memory slot they are held in) and on the Sharps they appear as 2nd Functions above buttons.

Most calculators, if they are not very old will have the ability to do another type of Stats calculation that you will meet later in STAT170. This is Linear Regression, but since you will mostly be using a computer to deal with the sort of data that is required to do linear regression we will not learn how to do these calculations on the calculator.

This is the end of the calculator section. Don't forget to clear your data.

|   |         |         |       |   |  |     |   |
|---|---------|---------|-------|---|--|-----|---|
| Enter   | Screen  |         |       |   |  |     |   |
| <table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">SHIFT</td> <td style="padding: 2px; text-align: center; font-size: small;">MCI SCI</td> <td style="padding: 2px;">AC/ON</td> <td style="padding: 2px;">=</td> </tr> </table> | SHIFT   | MCI SCI | AC/ON | = | <table border="1" style="margin: auto; border-collapse: collapse; width: 80%;"> <tr> <td style="padding: 5px;">SCI</td> <td style="padding: 5px; text-align: right;">0</td> </tr> </table> | SCI | 0 |
| SHIFT   | MCI SCI | AC/ON   | =     |   |  |     |   |
| SCI   | 0       |         |       |   |  |     |   |

And to get back into comp mode use the MODE button and choose COMP or NORM. On the Casios you would choose 1 when you see the screen below

|   |        |  |      |    |     |   |   |   |
|---|--------|--|------|----|-----|---|---|---|
| Enter   | Screen |  |      |    |     |   |   |   |
| <table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">MODE</td> </tr> </table> | MODE   | <table border="1" style="margin: auto; border-collapse: collapse; width: 80%;"> <tr> <td style="padding: 5px; text-align: center;">COMP</td> <td style="padding: 5px; text-align: center;">SD</td> <td style="padding: 5px; text-align: center;">REG</td> </tr> <tr> <td style="padding: 5px; text-align: center;">1</td> <td style="padding: 5px; text-align: center;">2</td> <td style="padding: 5px; text-align: center;">3</td> </tr> </table> | COMP | SD | REG | 1 | 2 | 3 |
| MODE  |        |  |      |    |     |   |   |   |
| COMP  | SD     | REG  |      |    |     |   |   |   |
| 1   | 2      | 3  |      |    |     |   |   |   |