

Working with the TI-83

Introduction

These notes are specifically designed for use with the TI-83, a graphic calculator manufactured by Texas Instruments.

It is suitable for

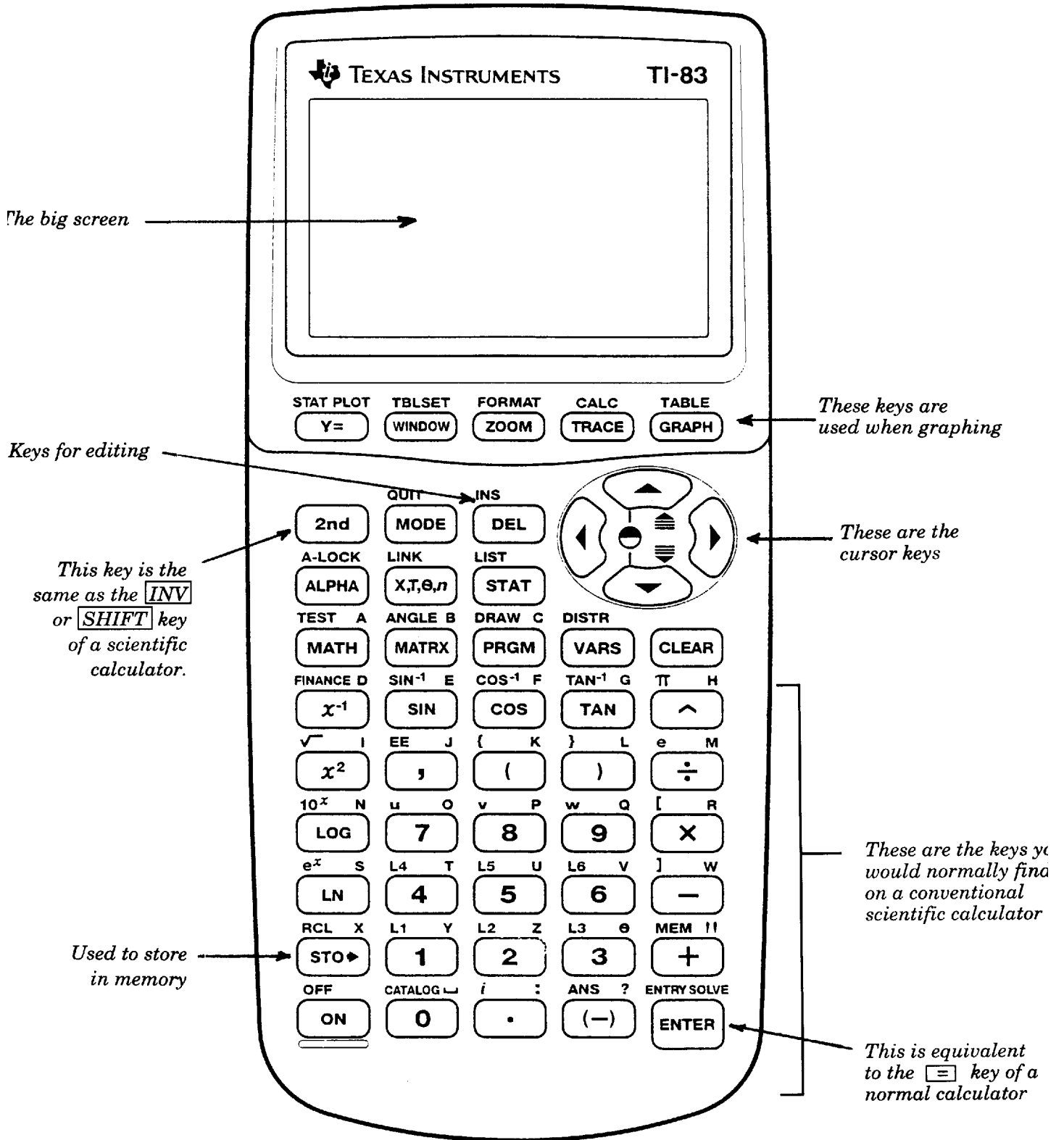
- those who already have some knowledge about graphics calculators, but are looking for directions with specific operations
- those who have only just found the **ON** button.

If you have limited previous experience with a graphics calculator, it is advisable to complete the exercises on **Calculating with the TI-83** as well as reading the introductory section.

These notes are just the beginning. Hopefully you will soon feel very comfortable using the many capabilities of a graphics calculator, and will look to extend your use to many other operations.



The keyboard



First things first

On/Off

The calculator is turned on by pressing the **ON** button; press **2nd** **ON** (i.e. OFF) when you have finished.

The calculator will turn itself off if not used for a short time, but nothing is lost when this happens. Just turn it back on and you will return to your work where you last left it.

Notice that the **2nd** key is yellow. When you need to use any function or value which is printed in yellow above a particular key, first press **2nd** and then the corresponding key.

The Home screen

The Home screen is the main screen which is used to display operations and to enter expressions and instructions.

It is the first screen you will see when the calculator is first turned on.

Screen contrast

If the screen is difficult to read then adjust the contrast. To make the screen display darker press **2nd** and then hold down the **↑** key. Pressing **2nd** and then **↓** will lighten the display.

You will see a number in the top right hand corner of the screen at this stage. The numbers range from 1 (for lightest) to 9. If the screen is showing the number 9 and the contrast is only adequate, you should replace the AAA batteries soon. (Refer to the manual for instructions.)

Cursor

A flashing square appears in the position where the next entry is to be made. You can access previous entries by using the cursor keys (they are the four keys with little triangle arrows found at the top right of the keyboard) to move about the screen.

Important keys

ENTER

There is **no** $\boxed{=}$ key on a graphics calculator. When you want to carry out a calculation, enter the complete expression and then press **ENTER**



These are the cursor keys. In these notes they are referred to using the symbols $\boxed{\uparrow}$ $\boxed{\downarrow}$ $\boxed{\rightarrow}$ and $\boxed{\leftarrow}$

These keys will enable you to move around the screen.

DEL

This key is used to correct a little mistake. Using the cursor keys, place the cursor over the item to be deleted and then press **DEL**

CLEAR

This key clears bigger mistakes. It will clear all of the line that you are currently working on. But if you have already pressed **ENTER** then pressing **CLEAR** clears the whole screen.

QUIT

To access this feature you need to press **2nd** **MODE** These keystrokes will always return you to the Home Screen. If necessary use these when you are stuck and can't see how to recover.

2nd

This key has already been mentioned. It is used to access any feature which is printed in yellow at the top left of most keys. For example, to use the value of π in a calculation, press **2nd** $\boxed{\wedge}$

MODE

This key fixes the way the calculator operates. For example you can choose to display answers with a fixed or floating number of decimal places, you can have a graph which is joined or just a series of points and so on. These will be considered in more detail when needed.

Calculations

Calculations are performed by entering the numbers in the usual manner, keeping in mind that **rule of order** is obeyed. You can make use of the brackets on the keypad to enter quite complex computations.

But first look at how some simple calculations are entered.

Try this simple addition. $345 + 678$

When you press the addition remains on the screen and the answer appears on the right hand side of the next line.

It is not necessary to press before the next calculation.

In the following table, an example is given followed by the required keystrokes. The final column shows the answer you should see on the screen.

	Example	Keystrokes	Answer
1.	$2(5^2 - 1)$	2 <input type="button" value("("=""/> 5 <input type="button" value="x<sup>2</sup>"/> <input type="button" value="-"/> 1 <input type="button" value=")"/> <input type="button" value="ENTER"/>	48
2.	8^{-1}	8 <input type="button" value="x<sup>-1</sup>"/> <input type="button" value="ENTER"/>	0.125
3.	6^5	6 <input type="button" value="^"/> 5 <input type="button" value="ENTER"/> <i>The ^ symbol is used to raise to a power.</i>	7776
4.	$(-2) + (-5)$	<input type="button" value="(-)"/> 2 <input type="button" value="+"/> <input type="button" value="(-)"/> 5 <input type="button" value="ENTER"/>	-7
5.	$(-2) - (-5)$	<input type="button" value="(-)"/> 2 <input type="button" value="-"/> <input type="button" value="(-)"/> 5 <input type="button" value="ENTER"/> <i>Notice the difference between a negative sign associated with a number and the subtract operation.</i>	3
6.	5π	5 <input type="button" value="2nd"/> <input type="button" value="^"/> <input type="button" value="ENTER"/> <i>Notice that you do not need to enter a multiplication sign between π and a constant.</i>	15.707... (only 3 d.p. are shown)
7.	$\pi \times 10^2$	<input type="button" value="2nd"/> <input type="button" value="^"/> 10 <input type="button" value="x<sup>2</sup>"/> <input type="button" value="ENTER"/>	314.159...

Worksheet 1

In the following table, examples are given for you to practice. The answers are shown in the final column so that you can quickly check your answers.

	Example	Answer
1.	$65 - 4^2 \times 7$	-47
2.	$\frac{1}{24} + 6.4$	$6.44166\dots$
3.	$10.36 - 8.5 \div 4 + 3.674$	11.909
4.	$2.3 \times (3.1 + 4.98)$	18.584
5.	$24 + (6 - 4.5) \times 3$	28.5
6.	$6.2 \times (-4.8) + 3 \cdot 2^2$	-19.52
7.	$\frac{789}{123 \times 456}$	0.140671801
8.	$\frac{789}{123 + 456}$	1.362694301
9.	$\frac{123 + 789}{456}$	2
10	$\frac{12.62 + 3.8172}{6.5 + 1.04}$	2.18
11.	$(6.2 + 5)^3$	1404.928
12.	34.95^2	1221.5025
13.	$16^2 + 18^2$	580
14.	$\pi(7.5)^2$	176.7145868
15.	$5^{-1} + 3.45 \times 2$	7.1
16	$\frac{35.52}{-2.4}$	-14.8

Editing

Editing is how you correct your mistakes, or change your mind about a calculation.

Suppose you have entered the calculation

$$\frac{35 \times 1.63 - \frac{1}{3} \text{ of } 25}{1 + 48 \div 14.5} \quad \dots \text{ and then pressed } \boxed{\text{ENTER}}$$

The answer given on the right hand side of the screen is 11.30226...

But perhaps you have now realized that instead of 25 (in the numerator) you should have entered 35.

Since you can see what you have done on the screen, these kind of mistakes are easy to spot!

Press $\boxed{2\text{nd}}$ $\boxed{\text{ENTER}}$ and you will see the calculation repeated (you have recalled the previous entry) - but there is no answer this time.

Use the $\boxed{\leftarrow}$ key repeatedly (or $\boxed{\uparrow}$ $\boxed{\rightarrow}$) so that the cursor is blinking on top of the 2. Then press 3 (which changes 25 to 35) and $\boxed{\text{ENTER}}$

The corrected answer is given - 10.52893...

Using the DEL key

Suppose that the calculation above should have been

$$\frac{35 \times 1.3 - \frac{1}{3} \text{ of } 25}{1 + 48 \div 14.5} \quad \text{i.e. the } 1.63 \text{ should have been simply } 1.3$$

Press $\boxed{2\text{nd}}$ $\boxed{\text{ENTER}}$, place the cursor over the 6 and then press $\boxed{\text{DEL}}$ followed by $\boxed{\text{ENTER}}$ - the answer is now 8.6226...

Inserting a number

If you need to insert a number, move the cursor until it is to the immediate right of where you need to insert, press $\boxed{2\text{nd}}$ $\boxed{\text{DEL}}$ (this is equivalent to $\boxed{\text{INS}}$), followed by the number (or numbers) to be inserted. Complete the calculation by pressing $\boxed{\text{ENTER}}$

Powers and roots

You may have noticed on page 5 that the $\boxed{\wedge}$ key is used to indicate that something is raised to a power. However, if you wish to square a number then $\boxed{x^2}$ is an option which uses one less keystroke.

Example $7 \cdot 6^2$ can be found by either of these methods.

$$7 \cdot 6 \boxed{x^2} \boxed{\text{ENTER}}$$

or $7 \cdot 6 \boxed{\wedge} 2 \boxed{\text{ENTER}}$ The answer is 57.76

The square root key is accessed by $\boxed{2\text{nd}} \boxed{x^2}$ but these must be pressed **before** the number is entered.

Example $\sqrt{64}$ is entered as $\boxed{2\text{nd}} \boxed{x^2} 64$

$\sqrt{25 + 144}$ is entered using brackets like this.

$$\boxed{2\text{nd}} \boxed{x^2} \boxed{(} 25 \boxed{+} 144 \boxed{)} \boxed{\text{ENTER}} \quad (\text{Answer} = 13)$$

The final bracket is optional here, though there may be times when it is essential. You need to think about the calculation and the rule of order to decide when the closing bracket is essential.

To find the cube of a number, we simply need to raise that number to the power of 3

Example $2 \cdot 4^3$ can be found by

$$2 \cdot 4 \boxed{\wedge} 3 \boxed{\text{ENTER}} \quad \text{The answer is 13.824}$$

There is another method, though the above method is more straightforward. However, you might like to try it this way.

$$2 \cdot 4 \boxed{\text{MATH}}$$

You will now see another screen - this gives you many alternatives, but if you look down the list you will see that number 3 is the one which will raise something to the power 3.

Choose this option from the menu, either by scrolling down with the cursor keys until option number 3 is highlighted, followed by $\boxed{\text{ENTER}}$

, or by pressing the number 3 directly from the keypad. We will choose the latter method.

$$\text{press } \boxed{3} \boxed{\text{ENTER}}$$

The answer of 13.824 is displayed.

Using the MATH key

In working through the alternative calculation for $2 \cdot 4^3$, you met the options from the menu which are shown by the MATH key. One of these is used to find the cube root of a number.

Example $\sqrt[3]{2 \cdot 4}$ can be found by

MATH 4 *You will immediately be returned to the Home screen with the symbol $\sqrt[3]{}$ shown. This gives the instruction to find the cube root of the number which is entered next.*

2.4 ENTER The answer 1.33886... is displayed.

To find higher order roots (that is, other than the square root or cube root), we use the $\sqrt[x]{}$ option from the MATH menu.

Example $\sqrt[6]{50}$ can be found by

6 MATH 5 *You will be immediately returned to the Home screen with the symbol $\sqrt[x]{}$ shown. This gives the instruction to find the sixth root of the number which is entered next.*

50 ENTER The answer 1.91938... is displayed.

There are many other operations that can be done from the MATH menu, but we will only consider some of them here. They will be discussed later as needed

Working with fractions

Example Evaluate $\frac{2}{3} + \frac{4}{5}$ and give the answer as a fraction.

There is no fraction key on the TI-83, however this is not a problem. The sum is entered in conventional manner using the 'divide' symbol. Here are the keystrokes.

2 $\boxed{\div}$ 3 $\boxed{+}$ 4 $\boxed{\div}$ 5 $\boxed{\text{ENTER}}$

The answer is given as 1.46666... but we can change this to fraction form by using the following keystrokes.

$\boxed{\text{MATH}}$ 1

You will be returned to the Home screen and see that the calculator has been instructed to change the answer to a fraction.

$\boxed{\text{ENTER}}$

The answer is given as $\frac{22}{15}$

If you want to change this back to a decimal form, press $\boxed{\text{MATH}}$ 2

If a calculation involves a mixed numeral (for example $6\frac{2}{5}$) then you can change it to an improper fraction ($\frac{32}{5}$) or recognize that $6\frac{2}{5}$ means $(6 + \frac{2}{5})$

Worksheet 2

In the following table, examples are given for you to practice. The answers are shown in the final column so that you can quickly check your results. (You may need to think carefully about how you will enter some of the fractions.)

	Example		Answer (to 4 d.p. where necessary)
1.	$\frac{1}{\sqrt{3 \cdot 56}} + 2 \cdot 6^2$		7.2900
2.	$\sqrt{8 \cdot 64^2 + 3 \cdot 58^2}$		9.3523
3.	$\frac{-7 + \sqrt{7^2 - 4 \times 2 \times 3}}{2 \times 2}$		-0.5
4.	$\sqrt[4]{61 \cdot 4656}$		2.8
5.	$16^2 + \{(2 \cdot 5^2 - \sqrt{6400} \times 3) \div 2\}$		139.125
6.	Find x if $x^8 = 65 \cdot 536$		1.6868
7.	$(\sqrt[3]{14 \cdot 8} + 2 \cdot 75)^2$		27.0941
8.	$\frac{2}{5} + \frac{3}{7}$ (give answer as a fraction)		$\frac{29}{35}$
9.	$1 \frac{2}{3} + 4 \frac{5}{6}$ (give answer as a fraction)		$\frac{13}{2}$
10.	$9 \frac{3}{5} - 4 \frac{1}{8}$		$\frac{219}{40}$

Efficient use of the calculator

There are some features of the TI-83 which are very useful and ensure that you are using it with maximum efficiency.

Using the previous answer

Even though you can enter quite complex and lengthy calculations on the screen, there are times when you may need to note (or use) some of the 'in between' results.

The result of the most recent calculation is stored in memory as **Ans**. As you work through the next example, watch the screen and note the results.

Example

Perform the calculation

40 10

The answer of 50 appears on the right hand side of the screen

Now press

*As you press the multiplication key, the screen shows **Ans****

Since you did not start by entering a number, the calculator assumes you want to multiply the previous answer.

Press 2

This indicates that you want to multiply by 2, and the result is then shown.

Press

*The calculator assumes that you want to square the previous answer, so **Ans²** appears on the screen.*

... followed by

*The value of **Ans²** (10000) is shown.*

Sometimes you may wish to use the previous answer, but not immediately. The keystrokes $\boxed{2\text{nd}}$ $\boxed{(-)}$ recalls the previous answer when required. The next examples demonstrate this.

Example

$$3 \cdot 6^2 + 5 \cdot 4$$

The answer of 18.36 appears on the right hand side of the screen

Now if we wish to carry out the calculation

$$126 \div (3 \cdot 6^2 + 5 \cdot 4)$$

Notice that the numbers in the brackets are the answer to the previous entry.

*So after entering 126 $\boxed{\div}$ we need to recall **Ans**.*

Press

126 $\boxed{\div}$ $\boxed{2\text{nd}}$ $\boxed{(-)}$
 $\boxed{\text{ENTER}}$

***Ans** is recalled to the screen and when*

$\boxed{\text{ENTER}}$ is pressed the result is seen on the right hand side of the screen.

The answer is 6.8627...

Example

$$2 \cdot 456 + 3 \cdot 96 \quad \boxed{\text{ENTER}}$$

The answer of 6.416 is shown.

To find the square root of the previous answer,

first use the keystrokes

$\boxed{2\text{nd}}$ $\boxed{x^2}$

... followed by

$\boxed{2\text{nd}}$ $\boxed{(-)}$

... followed by $\boxed{\text{ENTER}}$

At this stage the square root sign is seen on the screen, and then we need to tell the calculator what to take the square root of - that is, recall the previous answer.

You will notice $\sqrt{(\text{Ans})}$ on the screen. (You do not need to complete the brackets.)

The result is 2.53298...

Repeat calculations

Most calculators have the ability to repeat an operation over and over. Let's see how the TI-83 does this.

Suppose we need to fill in a table of values like this.

x	0	1	2	3	4	5	6
y	100	120	144				

$\times 1.2$ $\times 1.2$ $\times 1.2$ $\times 1.2$ $\times 1.2$ $\times 1.2$

What we are doing is starting with 100 then multiplying it and each successive answer by 1.2, ie repeatedly increasing by 20%.

Here are the keystrokes that we would use.

100	<input type="text" value="ENTER"/>	<i>The starting number of 100 is shown.</i>
$\times 1.2$	<input type="text" value="ENTER"/>	<i>100 multiplied by 1.2 = 120</i>
	<input type="text" value="ENTER"/>	<i>120 \times 1.2 = 144</i>
	<input type="text" value="ENTER"/>	<i>144 \times 1.2 = 172.8</i>

... and so on.

Every time is pressed the previous answer is multiplied by 1.2

Complete the table above.

The next results that you should see are:

207.36
248.832
298.5984

Repeating similar calculations

Suppose we want to find the height of a cylinder which has a radius of 5 cm and has a volume of 500 cm³.

A *guess and check* method could be to use the formula $V = \pi r^2 h$, giving h different values until the answer is 500.

Use these keystrokes to try an initial value as $h = 3$ cm.

π 5 x^2 \times 3 ENTER

The value for V is 235.619... , obviously then $h = 3$ cm is too little.

So we could next try $h = 4$ cm.

Instead of entering the complete calculation again, simply press

2nd ENTER

You will now see the previous expression on the screen.

Use the cursor keys to replace 3 with 4, and again press ENTER

The key combination of 2nd ENTER recalls the previous expression. This can then be edited and an answer recalculated.

If you continue this process of recalling the previous expression and trying other values for h you should find that $h = 6.37$ cm (2 d.p.).