Graphics calculator instructions

Contents:

In this course it is assumed that you have a **graphics calculator**. If you learn how to operate your calculator successfully, you should experience little difficulty with future arithmetic calculations.

There are many different brands (and types) of calculators. Different calculators do not have exactly the same keys. It is therefore important that you have an instruction booklet for your calculator, and use it whenever you need to.

However, to help get you started, we have included here some basic instructions for the **Texas Instruments TI-83** and the **Casio fx-9860G** calculators. Note that instructions given may need to be modified slightly for other models.

GETTING STARTED

Texas Instruments TI-83

The screen which appears when the calculator is turned on is the **home screen**. This is where most basic calculations are performed.

You can return to this screen from any menu by pressing 2nd MODE .

When you are on this screen you can type in an expression and evaluate it using the ENTER key.

Casio fx-9860g

Press MENU to access the Main Menu, and select **RUN·MAT**.

This is where most of the basic calculations are performed.

When you are on this screen you can type in an expression and evaluate it using the EXE key.

A   BASIC CALCULATIONS

Most modern calculators have the rules for **Order of Operations** built into them. This order is sometimes referred to as BEDMAS.

This section explains how to enter different types of numbers such as negative numbers and fractions, and how to perform calculations using grouping symbols (brackets), powers, and square roots. It also explains how to round off using your calculator.

NEGATIVE NUMBERS

To enter negative numbers we use the **sign change** key. On both the **TI-83** and **Casio** this looks like (−) .

Simply press the sign change key and then type in the number.

For example, to enter -7, press (−) 7.

FRACTIONS

On most scientific calculators and also the **Casio** graphics calculator there is a special key for entering fractions. No such key exists for the **TI-83**, so we use a different method.

Texas Instruments TI-83

To enter common fractions, we enter the fraction as a division.

For example, we enter $\frac{3}{4}$ by typing   3 $\boxed{\div}$ 4.   If the fraction is part of a larger calculation, it is generally wise to place this division in brackets, i.e., $\boxed{(}$ 3 $\boxed{\div}$ 4 $\boxed{)}$.

To enter mixed numbers, either convert the mixed number to an improper fraction and enter as a common fraction *or* enter the fraction as a sum.

For example, we can enter $2\frac{3}{4}$ as $\boxed{(}$ 11 $\boxed{\div}$ 4 $\boxed{)}$ *or* $\boxed{(}$ 2 $\boxed{+}$ 3 $\boxed{\div}$ 4 $\boxed{)}$.

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To enter fractions we use the **fraction** key $\boxed{a\,{}^{b/_{c}}}$.

For example, we enter $\frac{3}{4}$ by typing   3 $\boxed{a\,{}^{b/_{c}}}$ 4   and $2\frac{3}{4}$ by typing   2 $\boxed{a\,{}^{b/_{c}}}$ 3 $\boxed{a\,{}^{b/_{c}}}$ 4. Press $\boxed{\text{SHIFT}}$ $\boxed{a\,{}^{b/_{c}}}$ $(a\frac{b}{c} \leftrightarrow \frac{d}{c})$ to convert between mixed numbers and improper fractions.
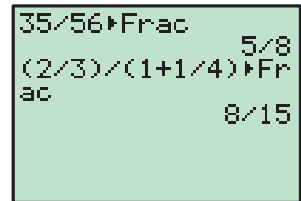
SIMPLIFYING FRACTIONS & RATIOS

Graphics calculators can *sometimes* be used to express fractions and ratios in simplest form.

Texas Instruments TI-83

To express the fraction $\frac{35}{56}$ in simplest form, press   35 $\boxed{\div}$ 56 $\boxed{\text{MATH}}$ **1** $\boxed{\text{ENTER}}$.   The result is $\frac{5}{8}$.

To express the ratio $\frac{2}{3} : 1\frac{1}{4}$ in simplest form, press $\boxed{(}$ 2 $\boxed{\div}$ 3 $\boxed{)}$ $\boxed{\div}$ $\boxed{(}$ 1 $\boxed{+}$ 1 $\boxed{\div}$ 4 $\boxed{)}$ $\boxed{\text{MATH}}$ **1** $\boxed{\text{ENTER}}$.

The ratio is   8 : 15.

```
35/56▶Frac
              5/8
(2/3)/(1+1/4)▶Fr
ac
             8/15
```

Casio fx-9860g

To express the fraction $\frac{35}{56}$ in simplest form, press   35 $\boxed{a\,{}^{b/_{c}}}$ 56 $\boxed{\text{EXE}}$.   The result is $\frac{5}{8}$.

To express the ratio $\frac{2}{3} : 1\frac{1}{4}$ in simplest form, press   2 $\boxed{a\,{}^{b/_{c}}}$ 3 $\boxed{\div}$ 1 $\boxed{a\,{}^{b/_{c}}}$ 1 $\boxed{a\,{}^{b/_{c}}}$ 4 $\boxed{\text{EXE}}$.   The ratio is 8 : 15.

```
35⌐56
              5⌐8
2⌐3÷1⌐1⌐4
             8⌐15

▶MAT
```
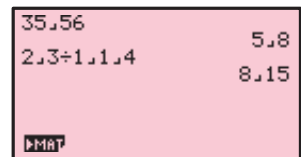
ENTERING TIMES

In questions involving time, it is often necessary to be able to express time in terms of hours, minutes and seconds.

Texas Instruments TI-83

To enter 2 hours 27 minutes, press   2 [2nd] [MATRX] **(ANGLE)**
1:° 27 [2nd] [MATRX] **2:′**.   This is equivalent to 2.45 hours.

To express 8.17 hours in terms of hours, minutes and seconds,
press   8.17 [2nd] [MATRX] **4:▸DMS** [ENTER] .
This is equivalent to 8 hours, 10 minutes and 12 seconds.
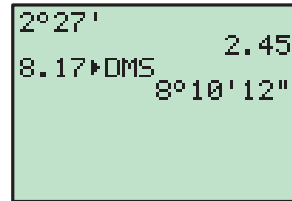
Casio fx-9860g

To enter 2 hours 27 minutes, press 2 [OPTN] [F6] [F5] **(ANGL)**
[F4] **(°‴)** 27 [F4] **(°‴)** [EXE] .   This is equivalent to 2.45 hours.

To express 8.17 hours in terms of hours, minutes and seconds,
press   8.17 [OPTN] [F6] [F5] **(ANGL)** [F6] [F3] **(▸DMS)** [EXE] .
This is equivalent to 8 hours, 10 minutes and 12 seconds.

B   BASIC FUNCTIONS

GROUPING SYMBOLS (BRACKETS)

Both the **TI-83** and **Casio** have bracket keys that look like [( ] and [ )] .

Brackets are regularly used in mathematics to indicate an expression which needs to be evaluated before other operations are carried out.

For example, to enter $2 \times (4 + 1)$ we type   2 [×] [( ] 4 [+] 1 [ )] .

We also use brackets to make sure the calculator understands the expression we are typing in.

For example, to enter $\frac{2}{4+1}$ we type   2 [÷] [( ] 4 [+] 1 [ )] .   If we typed   2 [÷] 4 [+] 1 the calculator would think we meant $\frac{2}{4} + 1$.

In general, it is a good idea to place brackets around any complicated expressions which need to be evaluated separately.

POWER KEYS

Both the **TI-83** and **Casio** also have power keys that look like [∧] . We type the base first, press the power key, then enter the index or exponent.

For example, to enter 25^3 we type   25 [∧] 3.

Note that there are special keys which allow us to quickly evaluate squares.

Numbers can be squared on both **TI-83** and **Casio** using the special key [x^2] .

For example, to enter 25^2 we type   25 [x^2] .

SQUARE ROOTS

To enter square roots on either calculator we need to use a secondary function (see the **Secondary Function and Alpha Keys**).

Texas Instruments TI-83

The **TI-83** uses a secondary function key $\boxed{\text{2nd}}$.

To enter $\sqrt{36}$ we press $\boxed{\text{2nd}}$ $\boxed{x^2}$ 36 $\boxed{)}$.

The end bracket is used to tell the calculator we have finished entering terms under the square root sign.

Casio fx-9860g

The Casio uses a shift key $\boxed{\text{SHIFT}}$ to get to its second functions.

To enter $\sqrt{36}$ we press $\boxed{\text{SHIFT}}$ $\boxed{x^2}$ 36.

If there is a more complicated expression under the square root sign you should enter it in brackets.

For example, to enter $\sqrt{18 \div 2}$ we press $\boxed{\text{SHIFT}}$ $\boxed{x^2}$ $\boxed{(}$ 18 $\boxed{\div}$ 2 $\boxed{)}$.

ROUNDING OFF

You can use your calculator to round off answers to a fixed number of decimal places.

Texas Instruments TI-83

To round to 2 decimal places, press $\boxed{\text{MODE}}$ then $\boxed{\blacktriangledown}$ to scroll down to Float.

Use the $\boxed{\blacktriangleright}$ button to move the cursor over the 2 and press $\boxed{\text{ENTER}}$. Press $\boxed{\text{2nd}}$ $\boxed{\text{MODE}}$ to return to the home screen.

If you want to unfix the number of decimal places, press $\boxed{\text{MODE}}$ $\boxed{\blacktriangledown}$ $\boxed{\text{ENTER}}$ to highlight Float.
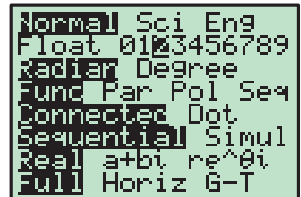
Casio fx-9860g

To round to 2 decimal places, select **RUN·MAT** from the Main Menu, and press $\boxed{\text{SHIFT}}$ $\boxed{\text{MENU}}$ to enter the setup screen. Scroll down to Display, and press $\boxed{\text{F1}}$ (**Fix**). Press 2 $\boxed{\text{EXE}}$ to select the number of decimal places. Press $\boxed{\text{EXIT}}$ to return to the home screen.
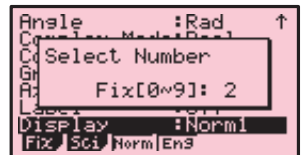
To unfix the number of decimal places, press $\boxed{\text{SHIFT}}$ $\boxed{\text{MENU}}$ to return to the setup screen, scroll down to Display, and press $\boxed{\text{F3}}$ (**Norm**).

INVERSE TRIGONOMETRIC FUNCTIONS

To enter inverse trigonometric functions, you will need to use a secondary function (see the **Secondary Function and Alpha Keys**).

Texas Instruments TI-83

The inverse trigonometric functions $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$ are the secondary functions of SIN , COS and TAN respectively. They are accessed by using the secondary function key 2nd .

For example, if $\cos x = \frac{3}{5}$, then $x = \cos^{-1}\left(\frac{3}{5}\right)$.

To calculate this, press 2nd COS 3 ÷ 5) ENTER .

Casio fx-9860g

The inverse trigonometric functions $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$ are the secondary functions of sin , cos and tan respectively. They are accessed by using the secondary function key SHIFT .

For example, if $\cos x = \frac{3}{5}$, then $x = \cos^{-1}\left(\frac{3}{5}\right)$.

To calculate this, press SHIFT cos (3 ÷ 5) EXE .

SCIENTIFIC NOTATION

If a number is too large or too small to be displayed neatly on the screen, it will be expressed in scientific notation, that is, in the form $a \times 10^n$ where $1 \leqslant a < 10$ and n is an integer.
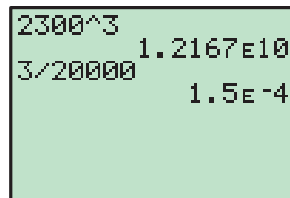
Texas Instruments TI-83

To evaluate 2300^3, press 2300 ∧ 3 ENTER . The answer displayed is 1.2167E10, which means 1.2167×10^{10}.

To evaluate $\frac{3}{20\,000}$, press 3 ÷ 20 000 ENTER . The answer displayed is 1.5E−4, which means 1.5×10^{-4}.
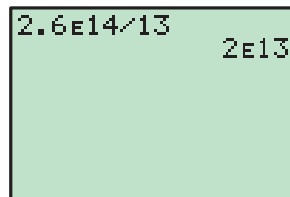
You can enter values in scientific notation using the EE function, which is accessed by pressing 2nd , .

For example, to evaluate $\frac{2.6 \times 10^{14}}{13}$, press 2.6 2nd , 14 ÷ 13 ENTER . The answer is 2×10^{13}.

Casio fx-9860g

To evaluate 2300^3, press 2300 [∧] 3 [EXE] . The answer displayed is 1.2167E+10, which means 1.2167×10^{10}.
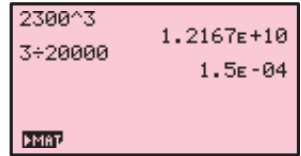
To evaluate $\frac{3}{20\,000}$, press 3 [÷] 20 000 [EXE] . The answer displayed is 1.5E−04, which means 1.5×10^{-4}.

You can enter values in scientific notation using the [EXP] key. For example, to evaluate $\frac{2.6 \times 10^{14}}{13}$, press 2.6 [EXP] 14 [÷] 13 [EXE] . The answer is 2×10^{13}.
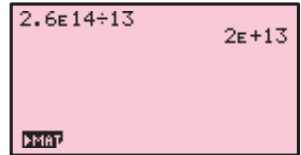
| **C** | **SECONDARY FUNCTION AND ALPHA KEYS** |

Texas Instruments TI-83

The **secondary function** of each key is displayed in yellow above the key. It is accessed by pressing the [2nd] key, followed by the key corresponding to the desired secondary function. For example, to calculate $\sqrt{36}$, press [2nd] [x^2] 36 [)] [ENTER] .

The **alpha function** of each key is displayed in green above the key. It is accessed by pressing the [ALPHA] key followed by the key corresponding to the desired letter. The main purpose of the alpha keys is to store values into memory which can be recalled later. Refer to the **Memory** section.

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The **shift function** of each key is displayed in yellow above the key. It is accessed by pressing the [SHIFT] key followed by the key corresponding to the desired shift function.

For example, to calculate $\sqrt{36}$, press [SHIFT] [x^2] 36 [EXE] .

The **alpha function** of each key is displayed in red above the key. It is accessed by pressing the [ALPHA] key followed by the key corresponding to the desired letter. The main purpose of the alpha keys is to store values which can be recalled later.

| **D** | **MEMORY** |

Utilising the memory features of your calculator allows you to recall calculations you have performed previously. This not only saves time, but also enables you to maintain accuracy in your calculations.

SPECIFIC STORAGE TO MEMORY

Values can be stored into the variable letters A, B, ..., Z using either calculator. Storing a value in memory is useful if you need that value multiple times.

Texas Instruments TI-83

Suppose we wish to store the number 15.4829 for use in a number of calculations. Type in the number then press $\boxed{\text{STO▶}}$ $\boxed{\text{ALPHA}}$ $\boxed{\text{MATH}}$ **(A)** $\boxed{\text{ENTER}}$.

We can now add 10 to this value by pressing $\boxed{\text{ALPHA}}$ $\boxed{\text{MATH}}$ $\boxed{+}$ 10 $\boxed{\text{ENTER}}$, or cube this value by pressing $\boxed{\text{ALPHA}}$ $\boxed{\text{MATH}}$ $\boxed{\wedge}$ 3 $\boxed{\text{ENTER}}$.

```
15.4829→A
            15.4829
A+10
            25.4829
A^3
       3711.563767
```

Casio fx-9860g

Suppose we wish to store the number 15.4829 for use in a number of calculations. Type in the number then press $\boxed{→}$ $\boxed{\text{ALPHA}}$ $\boxed{\text{X,}\theta\text{,T}}$ **(A)** $\boxed{\text{EXE}}$.

We can now add 10 to this value by pressing $\boxed{\text{ALPHA}}$ $\boxed{\text{X,}\theta\text{,T}}$ $\boxed{+}$ 10 $\boxed{\text{EXE}}$, or cube this value by pressing $\boxed{\text{ALPHA}}$ $\boxed{\text{X,}\theta\text{,T}}$ $\boxed{\wedge}$ 3 $\boxed{\text{EXE}}$.

```
15.4829→A
            15.4829
A+10
            25.4829
A^3
       3711.563767
▶MAT
```

ANS VARIABLE

Texas Instruments TI-83

The variable **Ans** holds the most recent evaluated expression, and can be used in calculations by pressing $\boxed{\text{2nd}}$ $\boxed{(-)}$.

For example, suppose you evaluate 3×4, and then wish to subtract this from 17. This can be done by pressing 17 $\boxed{-}$ $\boxed{\text{2nd}}$ $\boxed{(-)}$ $\boxed{\text{ENTER}}$.

```
3*4
             12
17-Ans
              5
```

If you start an expression with an operator such as $\boxed{+}$, $\boxed{-}$, etc, the previous answer **Ans** is automatically inserted ahead of the operator. For example, the previous answer can be halved simply by pressing $\boxed{÷}$ 2 $\boxed{\text{ENTER}}$.

If you wish to view the answer in fractional form, press $\boxed{\text{MATH}}$ **1** $\boxed{\text{ENTER}}$.

```
             12
17-Ans
              5
Ans/2
            2.5
Ans▶Frac
            5/2
```