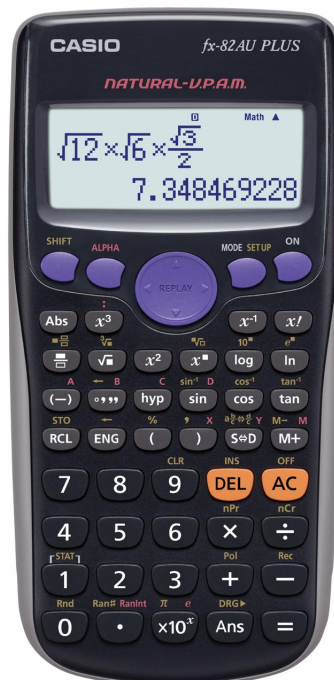# Using the Casio fx-82AU PLUS
Scientific Calculator
Techniques and activities

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The pages and activities included in this publication may be copied for classroom use.

1

Publishing information

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For secondary school students and teachers

Contents

Should you require further information refer to the booklet of instructions that was supplied with the calculator. Watch the Casio website www.casioed.net.au or contact casio.edusupport@shriro.com.au for more classroom activities with the *fx*-82AU PLUS.

Getting started

After you have turned the calculator on the first step is to choose whether you want to do a calculation or to work in statistics. Press the MODE key to enter your choice of calculations (i.e. computation) or statistics.

```
1:COMP   2:STAT
```
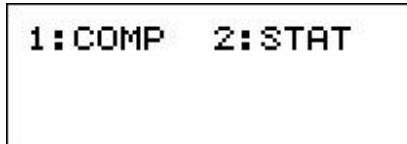
Press ① for calculation or ② for statistics.

The Comp (calculations) menus

The calculations menu offers you the choice of how you would like the maths displayed. The choices are MthIO, the way we write maths or Line IO the way calculators have traditionally displayed maths. The following screens show an example of the two options.

MthIO mode

$2\frac{3}{5}+\frac{4}{5}$

$3\frac{2}{5}$

LineIO mode

$2⌟3⌟5+4⌟5$

$3⌟2⌟5$
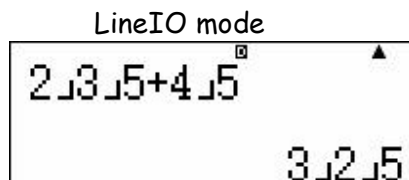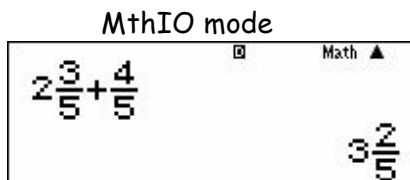
Selecting Math (MthIO) or LineIO

When you are in the comp mode press SHIFT MODE (SET UP) and the following screen will be displayed. Enter the Math mode by pressing ① and Line mode by pressing ②.

```
1:MthIO 2:LineIO
3:Deg    4:Rad
5:Gra    6:Fix
7:Sci    8:Norm
```

4
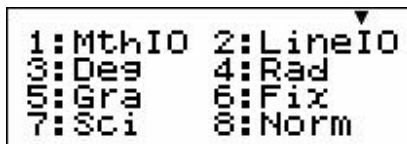
Set up information

Setting the calculator to degrees or radians

When you are in the comp mode press SHIFT MODE (SET UP) and the following screen will be displayed.

```
1:MthIO  2:LineIO
3:Deg    4:Rad
5:Gra    6:Fix
7:Sci    8:Norm
```

Press ③ for degrees or ④ for radians.

Setting decimal places and scientific notation

To fix the number of decimal places

When you are in the comp mode press SHIFT MODE (SET UP) and the above screen will be displayed. Press ⑥.

The screen then asks for the number of decimal places required. Press the number you want and the calculator will continue to display all numbers in this form until you instruct it to do otherwise. Refer to information on page 6 about toggling between fractions and decimals for answers in different forms.

Answers expressed in scientific notation

When you are in the comp mode press SHIFT MODE (SET UP) and the above screen will be displayed. Press ⑦.

The screen then asks for the number of significant figures required. Press the number you want and the calculator will continue to display all numbers in this form until you instruct it to do otherwise.

Setting the calculator back to 'normal'

When you are in the comp mode press SHIFT MODE (SET UP) and the above screen will be displayed. Press ⑧.

The screen then asks whether you would like Norm 1 or Norm 2.

The difference between Norm 1 and Norm 2 is the value when the calculator swaps from a display as a decimal to a decimal in scientific notation.

In norm 1, the answer to ① ÷ ② ⓪ ⓪ is displayed as 5×10^{-3}.

In norm 2, the answer to ① ÷ ② ⓪ ⓪ is displayed as 0.005.

Norm 2 doesn't use scientific notation until the display is of the order of 5×10^{-9}.

Fractions and decimals

The key strokes for fractions are slightly different in the Math mode than in the Line mode.

Fractions in the Line mode

Use the ⊞ button to enter any expression involving fractions in the same way as the 🔲 button was used in the past.

To enter $1\frac{1}{2} + 3\frac{3}{4}$ press ① ⊞ ① ⊞ ② ⊞ ③ ⊞ ③ ⊞ ④ ⊟.

```
1⌐1⌐2+3⌐3⌐4          ▲
                5⌐1⌐4
```

Answers in different forms

The calculator can display the answer as an improper fraction, mixed numeral or decimal and it can toggle between all three.

To change 5⌐1⌐4 to a decimal press ⓢ⊕ⓓ.

```
1⌐1⌐2+3⌐3⌐4          ▲
                 5.25
```

To change either 5.25 or 5⌐1⌐4 into an improper fraction press SHIFT ⓢ⊕ⓓ $\left(a\frac{b}{c} \leftrightarrow \frac{d}{c}\right)$.

```
1⌐1⌐2+3⌐3⌐4          ▲
                  21⌐4
```

Fractions in the Math mode

To enter a **traditional fraction**, for example $\frac{1}{2}$, press ⊞ ① then use the bottom of the replay button to position the cursor on the denominator and press ②.

To enter a **mixed numeral, for example** $5\frac{3}{4}$ press SHIFT ⊞ then
⑤ ▶ ③ ▼ ④ ⊟.

To enter $1\frac{1}{2} + 3\frac{3}{4}$ press
SHIFT ⊞ ① ▶ ① ▼ ② ▶ ⊞ SHIFT ⊞ ③ ▶ ③ ▼ ④ ⊟.
The picture of the screen for this calculation is on the following page.

6

$$1\tfrac{1}{2}+3\tfrac{3}{4}$$

$$5\tfrac{1}{4}$$

Remember you can toggle between the answer displayed as an improper fraction, mixed numeral and decimal. Refer to the section 'answers in different forms' on the previous page.

Simplifying fractions

In either mode the calculator will express a fraction in its simplest form. Enter the fraction followed by ▣.

$$\frac{8}{12}$$

$$\frac{2}{3}$$

OR

8⌐12

2⌐3

Reciprocals

The $\boxed{x^{\cdot}}$ button will find the reciprocal of a fraction. To find the reciprocal of $1\tfrac{1}{2}$ enter the fraction and press ▣, then $\boxed{x^{\cdot}}$ ▣.

Ans^{-1}

$$\frac{2}{3}$$

OR

Ans^{-1}

2⌐3

Fractional indices

The fraction button can be used as an index.

$$32^{\frac{3}{5}}$$

8

OR

32^(3⌐5)

8
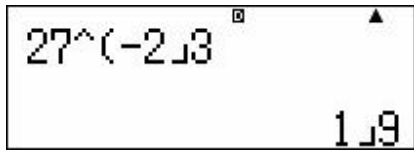
In the Math mode the button pressing is ③②$\boxed{x^{\cdot}}$▤③▽⑤▣.
In the line mode the button pressing is ③②$\boxed{x^{\cdot}}$③▤⑤▣. **Note!** The first bracket is supplied by the calculator and the second bracket can be omitted if it is the last entry before ▣.
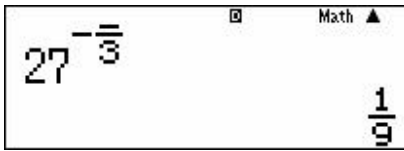
Negative, fractional indices

The calculator can execute an impressive range of calculations with negative and positive fractional indices.
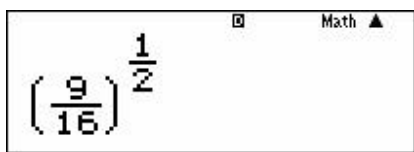
$$27^\wedge(-2\lrcorner 3 \qquad \frac{1}{9} \qquad \text{or} \qquad 27^{-\frac{2}{3}} \qquad \frac{1}{9}$$
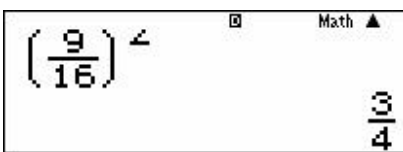
Occasionally the whole screen can't be displayed in the math mode, but the calculation remains possible. Naturally the following calculations can be executed in the line mode.

$$\left(\frac{9}{16}\right)^{\frac{1}{2}} \implies \left(\frac{9}{16}\right)^\angle \qquad \frac{3}{4}$$
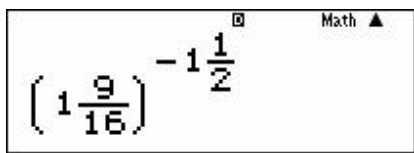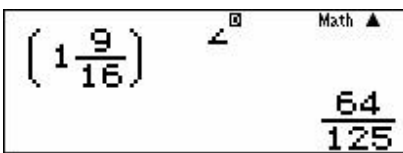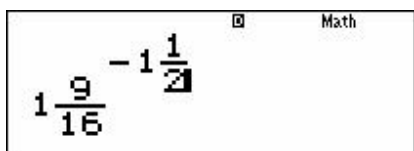
$$\left(1\frac{9}{16}\right)^{-1\frac{1}{2}} \implies \left(1\frac{9}{16}\right)^\angle \qquad \frac{64}{125}$$
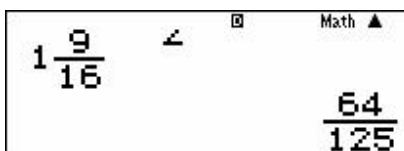
Powers, math mode and brackets

Provided the cursor is placed appropriately brackets can be omitted. Observe the above calculations in the math mode entered without brackets.

$$1\frac{9}{16}^{-1\frac{1}{2}} \implies 1\frac{9}{16}^\angle \qquad \frac{64}{125}$$

Powers and roots

Determining powers

Both screens show the value of 1.5^3. The button pressing is the same in both modes.
[1] [·] [5] [$x^■$] [3] [=].

 OR
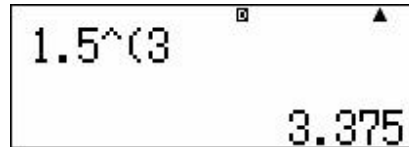
Determining roots

The ([$^■\sqrt{□}$]) button is used to determine roots. The screens show the value of the 5th root of 1024. The button pressing in each mode is shown below the screens.
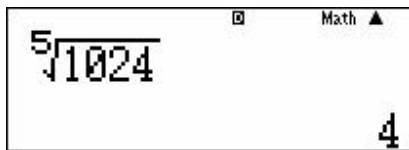
 OR
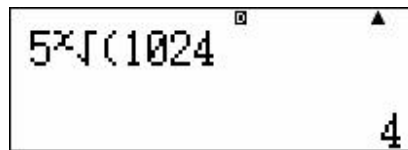
In the maths mode: SHIFT [$x^■$] [5] [▶] [1] [0] [2] [4] [=].
In the line mode: SHIFT [$x^■$] [1] [0] [2] [4] [◀] [◀] [◀] [◀] [◀] [5].

Using the [Ans] feature

The [Ans] button allows a calculation to proceed using the previous answer. In both modes the button pressing used to produce the following screens was:
[$\sqrt{■}$] [Ans] [=].

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Trigonometry

Before starting any calculations involving trigonometry always check the angle measure for degrees, radians or gradients. If the angle measure isn't consistent with the type of angle being used, all answers will be wrong. A D at the top of the screen indicates that the calculator is set to degrees. An R indicates radians and G gradients. Gradients are NEVER used in trigonometry in Australian schools.

Set in degrees   **Set in radians**

Instructions to change the calculator from degrees to radians or radians to degrees are on page 5.

Entering trigonometric expressions

Enter the trigonometric ratio followed by the angle. The calculator will insert a left hand bracket but entering a 'close brackets' is not required.

Degrees, minutes and seconds

The 🔘 button is used for entering degrees, minutes and seconds. The button sequence for entering 52° 36' 14" is ⑤ ② 🔘 ③ ⑥ 🔘 ① ④ 🔘 🟰.

Using inverse trig

The following button sequence is required to solve the equation tanθ = 1.56. SHIFT ⓣ ① · ⑤ ⑥. If the 1.56 is the result of the previous calculation the sequence SHIFT ⓣ (Ans) can be used.

10

Changing a decimal to degrees, minutes and seconds

Press SHIFT ⟨∘,,,⟩ to express 57.33908° in degrees, minutes and seconds.

```
tan⁻¹(1.56
              57°20'20.71"
```
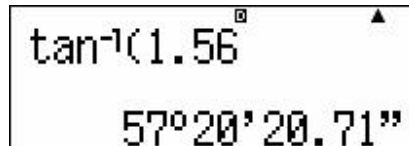
Changing radians into degrees or degrees into radians

When you are converting angle types you MUST have the calculator set to the type of angle you are converting INTO.

Radians to degrees

```
 π r
 —
 2
              90
```
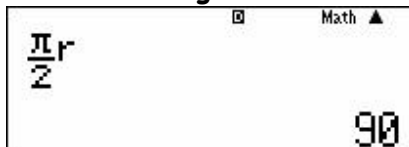
The calculator is set in degrees. In the Maths mode the button sequence used was:
▤ SHIFT ⟨x10ˣ⟩ ⟨▼⟩ ⟨2⟩ ⟨▶⟩ SHIFT ⟨Ans⟩ ⟨2⟩ ⟨=⟩.
In the line mode the sequence is:
⟨(⟩ SHIFT ⟨x10ˣ⟩ ▤ ⟨2⟩ ⟨)⟩ SHIFT ⟨Ans⟩ ⟨2⟩ ⟨=⟩.

Degrees to radians

```
50°
              0.872664626
```
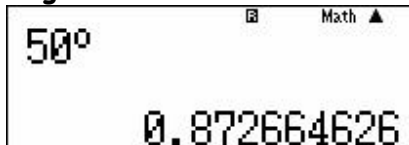
The calculator is set in radians. In Maths or line mode the button sequence is:
⟨5⟩ ⟨0⟩ SHIFT ⟨Ans⟩ ⟨1⟩ ⟨=⟩.

11
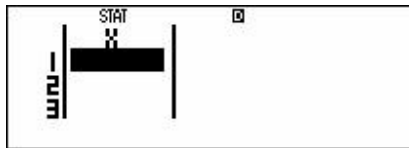
The statistics menu

Hint! When you are going to work in statistics start with the calculator turned off. Then you know all the statistics memories are empty. The data is cleared automatically when the calculator is turned off or the statistics menu is exited.

Turn the calculator on. After you have selected MODE 2 for statistics the following screen will be displayed.

```
1:1-VAR  2:A+BX
3:_+cX²  4:ln X
5:e^X    6:A·B^X
7:A·X^B  8:1/X
```

The only thing that is relevant is 1-VAR, or 1 variable statistics. When you press ☐1 for 1 variable statistics, one of two different screens will appear. The screen displayed will depend on whether frequency 'on' or 'off' was selected the previous time the calculator used statistics.

OR

The first screen allows you to enter scores one after the other. The second allows you to enter scores with their frequencies.

Turning frequency on or off

You can turn the frequency on or off in the SET UP menu, which is the second function on the MODE button. When you press SHIFT MODE (SET UP) the following screen will be displayed.

```
1:MthIO  2:LineIO
3:Deg    4:Rad
5:Gra    6:Fix
7:Sci    8:Norm
```

The little black arrow head, ⊙ above LineIO, indicates that there are further options below. Press the bottom edge of the round REPLAY button to bring up the next screen.

```
1:ab/c   2:d/c
3:STAT   4:Disp
5:◄CONT►
```

The options for statistics are in 3. Press ③ to view the options.

```
Frequency?
1:ON    2:OFF
```

Press ① if you want to have a separate list for frequencies and ② if you want to enter scores without frequencies.

Example
Let's find the summary statistics for the following set of scores.
4, 6, 2, 8, 3, 9, 12, 6, 4, and 5.

Step 1
Start with the calculator turned off. Turn the calculator on then set the calculator to statistics (MODE 2) and press ① for 1 variable statistics. If the calculator has a frequency column showing turn the frequency off by pressing SHIFT, MODE (SET UP), REPLAY down, ③ for statistics then ② for 'off'.

Step 2
Press ④ then ⊜ ⑥ ⊜ ② ⊜ and so on until you have pressed ⑤ ⊜. If you make a mistake, don't worry! Simply scroll up to the wrong score and type the correct value over it. If you've left a value out just put it at the end. If you've put in an additional score that you don't require, highlight the score and press ⒹⒺⓁ. The incorrect score will be removed and the following scores moved up one position.

Step 3
After you have finished entering the scores, press ⒶⒸ to indicate the completion of the data entering stage. ***Don't panic when the scores disappear!*** The data entering screen will disappear but can be brought back if required.

Step 4
The summary statistics are the second function on the number ①. Press SHIFT ①.

```
1:Type   2:Data
3:Sum    4:Var
5:MinMax
```

A summary of what each option does is on the following page.

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1 : **Type** takes you back to the first screen in this section of the notes.

2 : **Data** takes you back to the entered data. This is ideal for checking student data entries. Data also allows you to insert a score or delete all the scores. **Caution!** If you edit or change the data make sure that you press AC to indicate the changes are complete before you go to any data calculations.

3 : **Sum** gives the sum of the squares of the scores or the sum of the scores.

4 : **Var** gives the number of scores, mean, standard deviation and sample standard deviation.

5 : **MinMax** gives the smallest and largest score.

You can move backwards and forwards between these options using SHIFT, ①.

Continuing with the example from the previous page
The mean
The screen should be the same as at the bottom of page 13. Press ④ (Var), ② (for mean) then you <u>must</u> press ▣ to bring up the value of the mean.
The standard deviation
To find the standard deviation, press SHIFT, ①, ④ (Var), ③ for standard deviation then you <u>must</u> press ▣ to bring up the value.
The mean is 5.9 and the standard deviation is 2.8792 to 4 decimal places.

Entering scores with their frequency
Turn the calculator off to clear then memories. Turn it on then press MODE, select ② for statistics and ① for 1-VAR. If there is no frequency column press SHIFT, SET UP, replay down, ③ (for statistics) then ① to turn the frequency on.
Example

Scores	Frequency
4	9
5	12
6	5
7	2
8	1

Enter all the scores by pressing the value then ▣. The calculator automatically makes the frequencies 1. Use the replay button to highlight the frequencies one at a time then type the appropriate number followed by ▣.
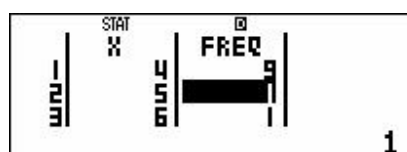
Press ⒶⒸ when you have completed the data entry stage. ***Don't panic when the scores disappear.*** The process for finding the mean and standard deviation is the same as outlined in the example using scores without frequencies. In the scores with frequencies example the mean is 5.1 and the standard deviation is 1.03.

The random number function

The calculator has two random number features. Ran# generates 3-digit pseudo random numbers between 0 and 1. RanInt generates random integers in a specified domain.

Using Ran#

If you want the number to be displayed as a decimal set the calculator to work in LineIO. In MathIO the random numbers are displayed as fractions. Press [SHIFT] [·] [=] and a random decimal will be displayed. Each time you press [=] another random number will be displayed.

Random number formulas

Random numbers can be incorporated into calculations.
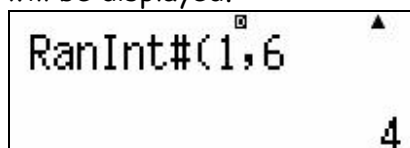
```
1+2×Ran#
              2.73
```

For example, the formula 1 + 2 × Ran# will generate random numbers between 1 and 3. Each press of [=] will generate another random value between 1 and 3.
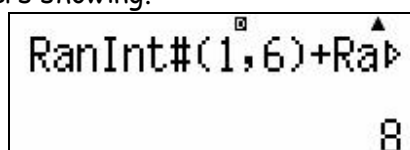
The RanInt function

To simulate the result of rolling a normal 6-sided die the formula RanInt#(1,6) is required. Enter this formula as [ALPHA] [·] [1] [SHIFT] [)] [6] [)] [=]. Each time you press [=] another die simulation will be displayed.

```
RanInt#(1,6
              4
```

The formula RanInt#(1,6) + RanInt#(1,6) simulates the results of rolling a pair of dice and adding the numbers showing.

```
RanInt#(1,6)+Ra▷
              8
```

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Using the memories

The calculator has an independent memory that can store the result of a calculation. In addition there are six pronumerals A, B, C, D, X and Y which may be assigned values.

The independent memory M

Before you start using the memory, check that there is nothing in the memory. In the following screen shot the small M in the top left hand corner of the screen indicates that a value is stored in the memory. The contents of the memory can be cleared by pressing ⓪ 🄢🄷🄸🄵🄣 🄡🄒🄛 (STO) 🄜🄉.

Store the result of a calculation by pressing 🄜🄉.

```
M                    ▣      Math ▲
12+M

                           27
```
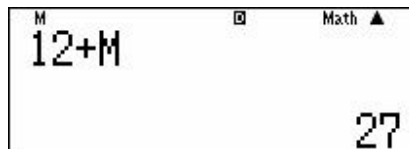
In the above screen 15 is stored in the M memory. The button sequence to add the memory to 12 is: ① ② 🄉 🄡🄒🄛 🄜🄉 🄐.

Caution! The calculator 'remembers' the values stored in the memories even after the machine has been turned off. If you place a value in the memory without first clearing the memory, the calculator will add the new value to the value already in the memory.

Storing values in A, B, C, D, X or Y

```
M                    ▣      Math ▲
3+5→A

                            8
```
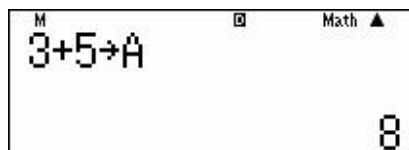
In the above screen the result of 3 + 5 is being stored in A. The button sequence is: ③ 🄉 ⑤ SHIFT 🄡🄒🄛 (STO) 🄪.

Using values stored in A, B, C, D, X or Y

```
M                    ▣      Math ▲
3²+A²

                           73
```
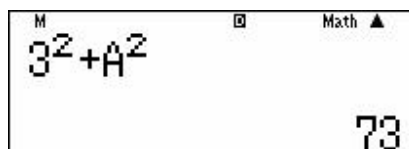
The button sequence for the above screen is:
③ x^2 🄉 🄡🄒🄛 🄪 x^2 🄐

16

Tips and hints!

Using brackets

It is not necessary to enter the final bracket.

```
sin(60
              0.8660254038
```

Scrolling through previous entries

```
cos(25
               0.906307787
```
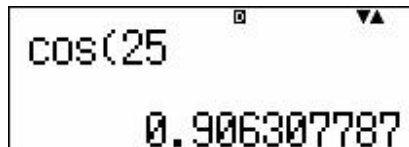
When there is a small up ⊕ or down ⊙ arrow displayed in the window you can review previous entries and answers by scrolling up or down using the top or bottom of the replay button.

Setting the calculator back to the factory settings

The second function on ⑨ allows you to clear memories and reset the calculator if required. When you press SHIFT⑨ the following screen will be displayed.

```
Clear?
1:Setup 2:Memory
3:All
```
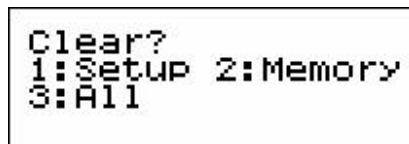
Press the number corresponding to your required action then follow the screen prompts.

Editing a calculation

Use the left or right side of the replay button to position the cursor. Pressing the ⓪⑤ key will delete the entry immediately to the left of the cursor. If you want to insert a digit or operation, use the round replay button to position the cursor then press the required button. An 'insert' function is available as the second function on ⓪⑤ should it be required.

Order of operations

This calculator 'knows' sophisticated order of operations. In addition to the usual order of operations this calculator 'knows' that in expressions like $8 \div 2\pi$ or $8 \div 2\sqrt{2}$ the correct order is $8 \div (2\pi)$ and $8 \div (2\sqrt{2})$. It is not necessary to include the brackets in the key strokes.

Trouble shooting

The calculator is using a comma in place of a decimal point

Solution: In 'display', 'comma' has been selected instead of 'dot'. In the calculations menu press SHIFT MODE (SET UP) then arrow down by pressing the bottom of the round replay button.

```
1:MthIO  2:LineIO
3:Deg    4:Rad
5:Gra    6:Fix
7:Sci    8:Norm
```
```
1:ab/c   2:d/c
3:STAT   4:Disp
5:◀CONT▶
```

Press ④ (for display).
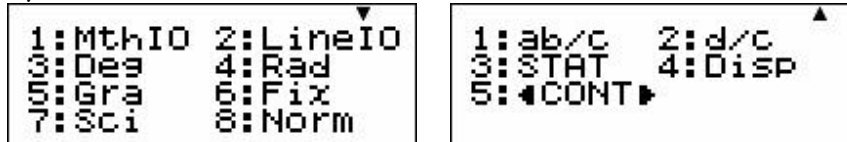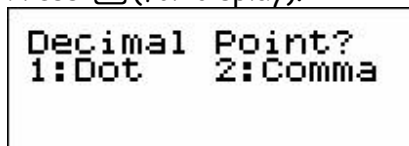
```
Decimal Point?
1:Dot    2:Comma
```
Then press ① for dot.

Answers to fractions calculations are improper fractions

There are several ways to deal with this issue. You can set the calculator to always display answers as a mixed numeral (see instructions below), or you can make use of ($a\frac{b}{c} \leftrightarrow \frac{d}{c}$), the second function of the S⇔D button to toggle between mixed numerals and improper fractions and decimals.

If you want to set the calculator to answer as a mixed numeral

Solution: In the calculations menu press SHIFT MODE (SET UP) then arrow down by pressing the bottom of the round replay button.

```
1:MthIO  2:LineIO
3:Deg    4:Rad
5:Gra    6:Fix
7:Sci    8:Norm
```
```
1:ab/c   2:d/c
3:STAT   4:Disp
5:◀CONT▶
```
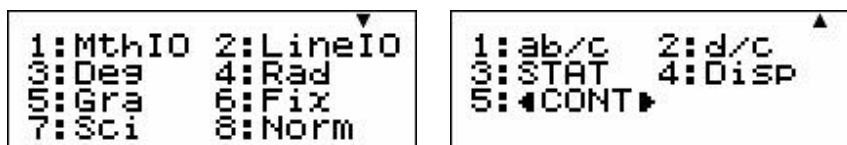
Press ① for mixed numeral or ② if you want to change to improper fractions.

The calculator is set to Maths mode but the fractions show the old way

You are working in the statistics menu rather than in calculations. Press MODE ①.

The calculator gives the wrong answer for calculations involving trigonometry.

Most likely the calculator is set to radians and the input is intended to be degrees. See the instructions on page 5 for changing from radians to degrees.

The calculator is recalling the wrong value for a value in the memory

You must clear the memory before placing a new value in the memory. The clear function is the second function on 9. Press SHIFT 9 then follow the instructions on the screen.

The calculator is frozen

In the middle of the back of the calculator there is a small hole. Press in the middle of the hole with a fine tipped biro.

In statistics the calculator is pasting the value of the mean in place of a score in the data list.

You haven't pressed AC to indicate that you have finished entering the scores. The calculator is treating the mean as a score.

Fractions and Decimals

Remember!

When you have a fraction or a decimal displayed on the screen pressing the [S⇔D] button will allow you to toggle between decimal and fractional representation. Pressing SHIFT [S⇔D] will toggle between an improper fraction and mixed numeral representation for expressions with a value greater than 1. Instructions for entering fractions in MathIO and LineIO are on pages 6 and 7.

Practice your skills with the following questions.

1. Express $1\frac{3}{4}$ as a decimal.

2. Express $2\frac{7}{8}$ as an improper fraction.

3. Change 0.135 to a fraction.

4. Write 2.65 as an improper fraction.

5. What is $\frac{11}{5}$ as a mixed numeral?

6. Enter 5% into your calculator by pressing [5] SHIFT [(]. Press [=] and [S⇔D] to express 5% as a decimal and as a fraction.

7. Express 36% as a fraction.

8. What is 8% as a decimal?

9. What number is equivalent to 125%?

10. Express 45% as a fraction.

11. Write 8.5% as a decimal.

12. What decimal is equivalent to $\frac{3}{8}$?

13. What improper fraction is equivalent to $4\frac{2}{5}$?

14. Express $\frac{8}{12}$ as a fraction in its simplest form. (Enter the fraction then press [=].)

15. Express $\frac{85}{25}$ as a mixed numeral expressed in simplest form.

Answers

1 1.75   **2** $\frac{23}{8}$ **3** $\frac{27}{200}$ **4** $\frac{53}{20}$ **5** $2\frac{1}{5}$ **6** 0.05, $\frac{1}{20}$ **7** $\frac{9}{25}$ **8** 0.08   **9** 1.25

10 $\frac{9}{20}$ **11** 0.085   **12** 0.375   **13** $\frac{22}{5}$ **14** $\frac{2}{3}$ **15** $\frac{17}{5}$

Percentages

1 The screen shot shows the calculator converting 25% to a fraction.
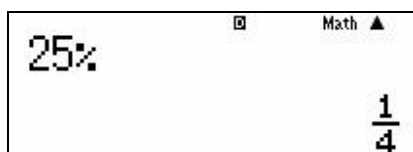
Enter 25% by pressing ② ⑤ SHIFT 🄀 followed by ▣ to check the value of 25% as a fraction.

2 Express each percentage as a fraction.

A 50%   **B** 75%   **C** 40%   **D** 5%   **E** 100%

F 200%   **G** $\frac{1}{2}$%   **H** 1.5%   **I** $\frac{1}{4}$%   **J** 35%

3 Express each percentage as a decimal.
Hint! Express the percentage as a fraction then press the ⓢ⇔ⓓ button.

A 45%   **B** 79%   **C** 5%   **D** 7.5%   **E** $2\frac{1}{2}$%

F 245%   **G** 1000%   **H** 1%   **I** 120.5%   **J** $11\frac{1}{2}$%

4 The screen shot shows the solution to the problem 'Increase 40 by 10%'.
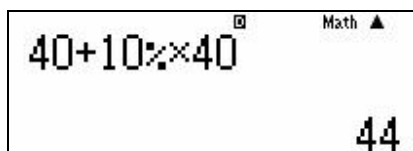
Check the calculation by pressing ④ ⓪ ＋ ① ⓪ SHIFT 🄀 ✕ ④ ⓪ ▣.

Determine the following amounts.
A Increase 60 by 10%.
B Increase 75 by 25%.
C Decrease 80 by 20%. (Hint! Remember decrease means make smaller.)
D Decrease $120 by 30%.
E Increase $90 by 25% then decrease the result by 25%.

5 The local sports store is having a '15% off sale'. Gillian is going to buy a pair of running shoes that normally cost $165. How much will the running shoes cost in the '15% off sale'?

Answers

2A $\frac{1}{2}$ **B** $\frac{3}{4}$ **C** $\frac{2}{5}$ **D** $\frac{1}{20}$ **E** 1   **F** 2   **G** $\frac{1}{200}$ **H** $\frac{3}{200}$ **I** $\frac{1}{400}$ **J** $\frac{7}{20}$
3A 0.45 **B** 0.79 **C** 0.05 **D** 0.075 **E** 0.025 **F** 2.45 **G** 10 **H** 0.01 **I** 1.205 **J** 0.115
4A 66 **B** 93.75 **C** 64 **D** $84 **E** 84.375
5 $140.25

Working with fractions

Practise the calculator fractions skills outlined on pages 6 and 7 with the following questions that involve fractions. Remember to use the round replay button to position the cursor correctly when you are using MathIO.

1. Evaluate $\frac{1}{2}+\frac{3}{4}$ and express your answer as a mixed numeral, improper fraction and a decimal.

2. Express $\frac{7}{8}\times\frac{2}{5}$ as a fraction.

3. Write the value of $1\frac{1}{3}-\frac{4}{5}$ as a fraction.

4. Evaluate $\frac{9}{10}\times1\frac{3}{5}$ and express your answer as an improper fraction.

5. Write the answer to $1\frac{3}{8}\times2\frac{1}{4}$ as a mixed numeral.

6. Find the value of $3\frac{1}{2}\div2\frac{3}{5}$ and express the value as an improper fraction.

7. Calculate $3\frac{7}{10}+5\frac{3}{5}$. Write your answer as a mixed numeral.

8. Find the value of $(\frac{3}{5})^2$. Write your answer as a fraction and as a decimal.

9. Calculate the value of $\sqrt{1\frac{9}{16}}$ and express your answer as an improper fraction.

10. Evaluate $2\frac{3}{4}+\frac{1}{2}\times1\frac{1}{2}$. Express your answer as a mixed numeral.

11. Find a decimal value for $1\frac{4}{5}+5\frac{2}{5}\div\frac{4}{5}$.

12. The ⌧ button produces the reciprocal of a fraction. Enter $\frac{2}{5}$ ⌧ and record the reciprocal of $\frac{2}{5}$ as an improper fraction and a mixed numeral.

13. What is the reciprocal of $\frac{5}{9}$? Express your answer as a mixed numeral.

14. Write the reciprocal of $3\frac{1}{2}$ as a fraction.

15. What is the value of $\frac{3}{5}$ multiplied by the reciprocal of $\frac{3}{5}$?

Answers

1 $1\frac{1}{4}$, $\frac{5}{4}$, 1.25 **2** $\frac{7}{20}$ **3** $\frac{8}{15}$ **4** $\frac{36}{25}$ **5** $3\frac{3}{32}$ **6** $\frac{35}{26}$ **7** $9\frac{3}{10}$ **8** $\frac{9}{25}$, 0.36 **9** $\frac{5}{4}$
10 $3\frac{1}{2}$ **11** 8.55 **12** $\frac{5}{2}$, $2\frac{1}{2}$ **13** $1\frac{4}{5}$ **14** $\frac{2}{7}$ **15** 1

Fix, scientific notation and norm

Remember!

When you want to cancel fix or scientific notation choose Norm2. Refer to page 5 for fix and scientific notation procedures.

1. Express 65 123 in scientific notation with 2 significant figures.
2. Express 6.8×10^3 without using scientific notation. (Hint! Press 6.8 ⊠ ×10ˣ 3 then set the calculator to Norm2.)
3. Express 3.25×10^6 without using scientific notation.
4. Write 4.6349 correct to 2 decimal places.
5. Determine the value of 16.8731 correct to 1 decimal place.
6. Find the value of $\sqrt{175}$ correct to 2 decimal places.
7. Calculate the value of $8.61 \times 10^2 \times 9.356 \times 10^3$ in scientific notation with two significant figures.
8. What is the value of 8.3×2.5? Express your answer as a decimal.
9. Find the value of $(11.75)^2$ correct to two decimal places.
10. What is the value of $4.1 \times 10^5 \div (8.75 \times 10^4)$ correct to the nearest whole number?
11. The calculation $(1.07)^3 \times \$1260$ gives the value of an investment in 3 years time. Calculate the value of the investment in 3 years time correct to the nearest cent.
12. Calculate the value of $2\pi rh$ when $r = 17.6$ and $h = 11.8$. Express your answer correct to 1 decimal place.
13. The screen capture shows a calculation.
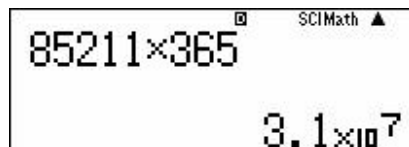
    A How do you know the calculator is set in scientific notation, not Norm1 or 2?
    B How many significant figures is the calculator set to display?
    C Express the answer without any rounding or scientific notation.

Answers

1 6.5×10^4 **2** 6800 **3** 3 250 000 **4** 4.63 **5** 16.9 **6** 13.23 **7** 8.1×10^6
8 20.75 **9** 138.06 **10** 5 **11** $1543.55 **12** 1304.9
13 A SCI is at the top of the screen **B** 2 **C** 31 102 015

Roots and exponents

Button procedures for roots and exponents are on pages 7 to 9. Remember that you can use the [S⇔D] button to toggle between fractions and decimals if you want your answer in a different form.

1. Use the [x^2] button to find the value of the following squares.

   A 5^2 **B** 11^2 **C** 2.6^2 **D** 4.3^2

2. Use the [x^3] button to calculate the value of the following cubes.

   A 2^3 **B** 6^3 **C** 1.2^3 **D** 4.1^3

3. Use the [$x^\blacksquare$] button to calculate the following quantities.

   A 2^7 **B** $16^{1.5}$ **C** $16^{-0.5}$ **D** $8^{\frac{2}{3}}$

   E $\left(\frac{1}{2}\right)^{-5}$ **F** $\left(\frac{27}{8}\right)^{\frac{2}{3}}$ **G** $\left(1\frac{11}{25}\right)^{-\frac{1}{2}}$ **H** $16^{-\frac{1}{2}} \times 2^3$

4. Use the [$\sqrt{\blacksquare}$] button to find the following roots.

   A $\sqrt{2809}$ **B** $\sqrt{23104}$ **C** $\sqrt{48^2 + 55^2}$ **D** $\sqrt{65^2 - 56^2}$

   E $\sqrt{6^2 - 4 \times 1 \times 8}$ **F** $\sqrt{43^2 - 4 \times 6 \times 55}$

5. Use the SHIFT then [$x^\blacksquare$] buttons to find the value of the following roots. Express each answer correct to one decimal place.

   A $\sqrt[4]{700}$ **B** $\sqrt[5]{620}$ **C** $\sqrt[8]{11}$ **D** $\sqrt[4]{3^2 + 5^3}$

6. Express the following values as whole numbers or mixed numerals.

   A $\left(1\frac{1}{2}\right)^5$ **B** $\sqrt{2\frac{7}{9}}$ **C** $\left(\frac{1}{5}\right)^{-2}$ **D** $\left(\frac{4}{9}\right)^{-\frac{3}{2}}$

Answers

1A 25   **B** 121   **C** 6.76   **D** 18.49   **2A** 8   **B** 216   **C** 1.728   **D** 68.921
3A 128   **B** 64   **C** $\frac{1}{4}$ **D** 4   **E** 32   **F** $\frac{9}{4}$ **G** $\frac{5}{6}$ **H** 2
4A 53   **B** 152   **C** 73   **D** 33   **E** 2   **F** 23   **5A** 5.1   **B** 3.6   **C** 1.3   **D** 3.4
6A $7\frac{19}{32}$ **B** $1\frac{2}{3}$ **C** 25   **D** $3\frac{3}{8}$

Trigonometry

The instructions for working with trigonometry are on pages 10 and 11.

Check your calculator settings!

The statement $\sin 30^0 = 0.5$ is correct. Explain why both of the following calculator screens are displaying the wrong value for $\sin 30^0$.
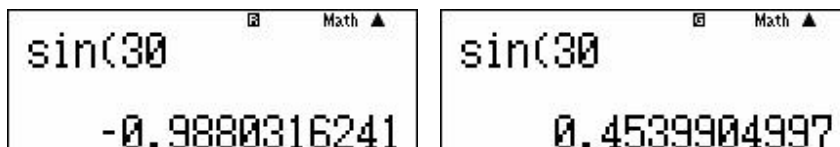
Set your calculator to degrees before you start the following practice questions.

1 Find the value of the following expressions correct to 2 decimal places.
  A $43.6 \sin 52^0$ **B** $28.9 \tan 38^0$ **C** $11 \cos 61^0$

2 Determine the value of θ correct to the nearest degree.
  A $\cos \theta = 0.743$ **B** $\tan \theta = 1.628$ **C** $\sin \theta = 0.463$
  D $\tan \theta = \frac{5}{4}$ **E** $\cos \theta = \frac{2}{5}$ **F** $\sin \theta = \frac{16.3}{21.5}$

3 Use the [•••] button twice each time to enter the degrees and minutes in the following expressions. Express each answer correct to 2 decimal places.
  A $8 \sin 41^0 28'$ **B** $12.3 \cos 62^0 50'$ **C** $7.4 \tan 42^0 13'$

4 Enter each angle, press [=] then SHIFT followed by [•••] to express each of the following angles in degrees and minutes and seconds.
  A 73.65^0 **B** 44.78^0 **C** 25.64^0

5 Determine the value of α correct to the nearest minute. Remember that there are 30 seconds to the minute.
  A $\tan \alpha = 1.26$ **B** $\sin \alpha = 0.634$ **C** $\cos \alpha = 0.25$

6 Determine the value of $\dfrac{12 \sin 36^0 25'}{5 \sin 28^0 32'}$. Express your answer to 2 decimal places.

Answers

The first screen is set in radians and the second in gradients. Change the calculator to work in degrees by pressing SHIFT [MODE] [3].

1A 34.36 **B** 22.58 **C** 5.33   **2A** 42^0 **B** 58^0 **C** 28^0 **D** 51^0 **E** 66^0 **F** 49^0

3A 5.30 **B** 5.62 **C** 6.71   **4A** $73^0 39' 0''$ **B** $44^0 46' 48''$ **C** $25^0 38' 24''$

5A $51^0 34'$ **B** $39^0 21'$ **C** $75^0 31'$ **6** 2.98

Statistics

The button pressing sequence for statistics is on pages 12 to 15.

Remember!

- When you have finished entering the data you must press $\boxed{\text{AC}}$ to tell the calculator that you have completed entering the scores.
- When you press SHIFT $\boxed{1}$ $\boxed{4}$ then $\boxed{2}$ to bring up the value of the mean you must press $\boxed{=}$ to display the value. This is particularly important when you proceed to find the second piece of information, e.g. the standard deviation.

Practise your statistics skills with the following questions.

1   Set your calculator to statistics and turn the frequency list off.
    A Enter the scores 16, 19, 5, 11, 15, 12 and 9.
    B Determine the value of the mean, ($\bar{x}$) to 2 decimal places.
    C What is the value of the standard deviation (σ_n) to 3 decimal places?
    D Determine the sample standard deviation (σ_{n-1}) correct to 3 decimal places.

2   Clear the data in the statistics list. The easiest way to clear the data is to turn the calculator off. Alternatively, set the calculator to comp then back to statistics.

3   Set the calculator to statistics with the frequency on.
    A Enter the data in the table into the calculator.

Scores	Frequency
5	4
6	9
7	15
8	11
9	7
10	4

    B Determine the size of n, the number of scores.
    C What is the value of the mean?
    D Determine the size of the standard deviation correct to 3 decimal places.

4   Determine the mean and standard deviation of the scores in the following table.

Scores	10	11	12	13	14	15	16
Frequencies	15	12	5	8	10	13	6

Answers

1B $\bar{x} = 12.43$, $\sigma_n = 4.338$, $\sigma_{n-1} = 4.685$ **3B** $n = 50$ **C** $\bar{x} = 7.4$ **D** $\sigma_n = 1.356$

4 $\bar{x} = 12.7$, $\sigma_n = 2.079$

Using the memories

Remember!
You must clear the memory before you place anything in the memory. If you forget to clear the memory the calculator will add the new value to the value that is already in the memory. The instructions for clearing the memory are on page 16.

1 In which of the following calculators is a number stored in the memory?

or
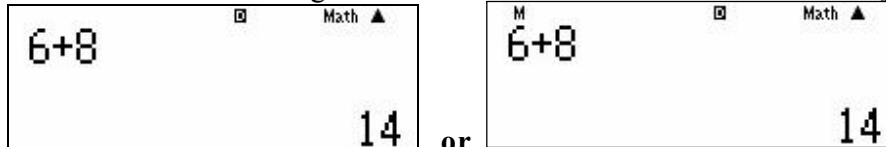
2 Clear the memory on your calculator and place the value of π in the memory. Use the RCL M+ = buttons to determine the value of the following expressions. Express each answer correct to 2 decimal places.

   A $2 + \pi$ **B** 2π **C** $12 - \pi$ **D** $\pi \div 2$ **E** $2 \times \pi \times 4.3^2$

3 Store the result of the calculation $3 + 8.1$ in the memory, then determine the value of each expression.

   A $(3 + 8.1) \times 4.5$ **B** $12.7 + 3 + 8.1$ **C** $(3 + 8.1) \div 4.3$

   Hint! If you are not getting the answers at the bottom of the page, you may not have cleared the memory properly before you started.

4 In Australia a 10% GST is added to prices to determine the final selling price. Increasing an amount by 10% is the same as multiplying the amount by 1.1. Place 1.1 in the calculator's memory then determine the final price of each item.

   A $32 book   **B** $3.20 ice cream   **C** $20 hair cut
   D $260 camera   **D** $33 000 car

5 If you want to determine the amount of GST included in a price, divide the price by 11. Use the calculator memory to determine the amount of GST in each price.

   A $132 pair of jeans   **B** $38.50 movie ticket
   C $5.72 bus ticket   **D** $11.55 take-away lunch

Answers
1 The right hand screen has a value stored in the memory.
2 **A** 5.14   **B** 6.28   **C** 8.86   **D** 1.57   **E** 116.18
3 **A** 49.95   **B** 23.8   **C** 2.85 to 2 decimal places
4 **A** $35.20   **B** $3.52   **C** $22   **D** $286   **E** $36 300
5 **A** $12   **B** $3.50   **C** 52c   **D** $1.05

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Degrees ⇔ Radians

Remember!

The small c in the expression 1.4^c means radians. When you want to change from degrees to radians, or the reverse, you must have the calculator set on the measure you are changing <u>into</u>. The button pressing sequence for degrees ⇔ radians and changing degrees into degrees and minutes is on page 11.

Note! The only times when the degrees or radians setting is relevant is when you are converting between degrees and radians or when you are going to press one of the [sin] [cos] or [tan] buttons.

1 Express $\frac{\pi}{4}$ radians in degrees.

2 Convert 30^0 into radians, correct to 3 decimal places.

3 Express $\frac{\pi}{5}$ radians in degrees.

4 Convert $55^0\ 30'$ into radians. Express your answer correct to 3 decimal places.

5 Express 1.8^c in degrees, correct to the nearest minute.

6 Determine the following values correct to 3 decimal places.
   A $\tan 1.6^c$ **B** $\cos 1.2^c$ **C** $\sin 54^0\ 28'$

7 Determine the value of $\frac{1}{2}r^2\theta$ when $r = 6.4$ and $\theta = 1.9^c$.

8 Evaluate $\frac{1}{2}r^2\left(\theta - \sin\theta\right)$ when r = 11.7 and $\theta = 0.8^c$. Express your answer correct to 2 decimal places.

9 Solve the equations for θ, $0 \le \theta \le \frac{\pi}{2}$. Express each answer correct to 3 decimal places.
   A $\sin\theta = 0.4$ **B** $\cos\theta = 0.128$ **C** $\tan\theta = 1.7$

10 Determine the value of θ, $0 < \theta < \pi$ for $\cos\theta = \frac{5^2+6.2^2-10^2}{2\times5\times6.2}$. Express your answer correct to 3 decimal places.

11 Calculate the value of α, $0 < \alpha < \frac{\pi}{2}$, in the equation $\sin\alpha = \frac{9\sin 0.7^c}{10}$. Express your answer correct to 4 decimal places.

12 Determine the positive solution for p in the equation
   $p^2 = 4.8^2 + 7.3^2 - 2\times4.8\times7.3\times\cos 1.9^c$. Answer correct to 1 decimal place.

Answers

1 45^0 **2** 0.524^c **3** 36^0 **4** 0.969^c **5** $103^0\ 8'$ **6A** -34.233 **B** 0.362 **C** 0.814
7 38.912 **8** 5.66 **9A** 0.412^c **B** 1.442^c **C** 1.039^c **10** 2.20^c **11** 0.6185^c **12** 9.9

Logs, natural logs and *e*

The calculator uses [log] for log base 10 and [ln] for log base *e*. You don't have to remember which button is which. All you need to do is look at the second function above each button. The [log] button has $(10^{\blacksquare})$ above it reminding you that the [log] button is base 10. Similarly the [ln] button has $(e^{\blacksquare})$ above it. [ln] is base *e*.

1 Use your calculator to evaluate each expression correct to 3 decimal places.
   A $\log_{10} 105$ **B** $\log_e 8$ **C** $\log_{10} 0.6$

   D $\log_e 0.5$ **E** $\log_{10}(4.3 \times 2.5)$ **F** $4\log_e 209$

2 **A** Enter $\log_e(-1)$ into your calculator.

   B Explain why your calculator displays the message "Math ERROR".

3 Your calculator has two *e* buttons. You can find the value of *e* as the alpha function on [×10ˣ]. The value of e^x can be determined by using the second function on [ln].

   A Determine the value of *e* using [ALPHA] [×10ˣ] [=]. Answer to 4 decimal places.

   B Find the value of e^3 to 2 decimal places by pressing SHIFT [ln] [3].

1. Determine the following values correct to 2 decimal places.
   A $e^{2.5}$ **B** e^{-1} **C** e

4 Calculate the values of the following expressions.
   A $\log_e e^2$ **B** $\log_e e^3$ **C** $\log_e e$

   D $\log_e e^{-1}$ **F** $\log_{10} 100$ **G** $\log_{10} 10^{-1}$

5 What is the value of $\log_e e^n$? (You'll have to use your brain for this one!)

6 Evaluate $800e^{12k}$ when $k = 0.4$. Express your answer to the nearest hundred.

7 Determine the value of $950e^{-10k}$ when $k = 1.4$. Express your answer in scientific notation with 3 significant figures.

8 What is the value of πe? Express your answer to 2 decimal places.

Answers

1A 2.021 **B** 2.079 **C** −0.222 **D** −0.693 **E** 1.031 **F** 21.369

2 $\log x$ only exists for $x > 0$. **3A** 2.7183 **B** 20.09   **4A** 12.18 **B** 0.37 **C** 2.72

5A 2   **B** 3 **C** 1   **D** −1 **E** 2 **F** −1   **6** *n* **7** 97 200   **8** 7.90×10^{-4} **9** 8.54

Gallipoli
Australia and New Zealand joined the First World War[1]

In 1915 soldiers from Australia and New Zealand joined allies from Britain, France and India to fight against soldiers from Turkey in the Gallipoli Campaign. As you work through this set of questions you will learn about some of the tragedy of war and of Gallipoli in particular.

1. The youngest ANZAC soldier to die in the Gallipoli Campaign was James Martin. He was a 14-year-old Australian. In which of the school years, Year 7, Year 9 or Year 11, would a 14-year-old boy be included today?

2. Major Frank Chapman from New Zealand was the oldest ANZAC to die in Gallipoli. He was 57 years old. What was the range in ages of ANZAC soldiers who died in the Gallipoli Campaign?

3. This table shows a random sample of the ages of 520 ANZAC soldiers who died in Gallipoli.

Ages (class)	Class centres	Frequency
16 - 20	18	78
21 - 25	23	226
26 - 30	28	110
31 - 35	33	58
36 - 40	38	36
41 - 45	43	9
46 - 50	48	3

Use the information in the table to answer these questions.

A   What is the modal class?

B   In this context, what does the mode represent?

C   What fraction of the soldiers in the sample were 25 years old or less when they were killed? Use your calculator to express this fraction in its simplest form.

D   Set your calculator to statistics and enter the class centres in the score column and the frequencies in the frequency column. Remember to press ⊟ after you enter each value. If you want to change a value, highlight the value and type over it. When you've finished entering all the values press [AC]. Then press SHIFT [1] (STAT) and [4] (Var). Press [2] ⊟ to find the mean age of the sample of soldiers killed in the Gallipoli Campaign.

---

[1] The random sample information used in this activity was obtained from information on the Australian War Memorial, Canberra website.

E   In 1915 the average age of Australian and New Zealand soldiers was 28 years.

       (i)   How many years younger than 28 was the average age of the sample of ANZAC soldiers killed in Gallipoli?

       (ii)   Calculate this age difference as a percentage of 28.

F   No one is sure exactly how many men died in action or as a result of wounds in Gallipoli. The number is somewhere between 8160 and 8710.

       (i)   Assuming the number is 8710, use the sample information to estimate the number of ANZAC soldiers killed in the Gallipoli Campaign who were less than 21 years old.

       (ii)   How many maths classes with 25 students in each class could have been made from the ANZAC soldiers who were less than 21 years old when they were killed in the Gallipoli Campaign?

4.   The first ANZAC Division contained 30 000 men. Of these men, 631 were officers and 29 369 were enlisted men.

A   Of the 631 officers only about one-sixth had previous war experience. How many of the officers had <u>no</u> previous war experience?

B   Calculate the percentage of the first Division who were officers.

C   In the random sample of 520 ANZAC soldiers killed in the Gallipoli Campaign only 1 man was an officer, the remaining 519 men were enlisted. What percentage of the sample killed in Gallipoli was an officer?

D   One T.V. commentator said: "If you are going to fight in a war, make sure you are an officer. Officers are less likely to be killed."

      Use your answer to parts (B) and (C) to determine whether the T.V. commentator's statement is correct. Give a reason for your opinion.

Want to know more?

Log onto these sites to find out more information about the ANZACs at war

http://www.awm.gov.au/

http://www.awm.gov.au/database/collection.asp

Waiting time investigation

On average, how long do customers wait in your school canteen queue before they have completed their purchases? In this activity you will be investigating this question and evaluating the results.

Equipment required
- A watch that measures time in minutes and seconds
- Pen and paper for recording results
- A Casio *fx*-82AU PLUS calculator

What you have to do
- In groups of 3 assign each person one of the roles of timer, recorder or customer selector.
- Arrange for different groups to measure customer-waiting times at the beginning, middle and end of buying times.
- To make sure your results are valid it is important to choose a random sample of customers to time. The 'customer selector' will use the calculator's random number generator to choose customers. Set the calculator to Line10 and fix the display to show 2 decimal places. When you press SHIFT ⦁ ▤ the calculator will show a decimal number. If the random number is less than 0.50 select the next customer that joins the line to time. Each time you press ▤ another random number will be displayed.
- The 'timer' measures the time from when the selected customer joins the queue until they move away from the counter.
- Record the time for at least 10 randomly selected customers.

Calculating the mean (average) time
- Set the calculator to statistics by pressing MODE then ② (for stats) then ① (for 1-VAR).
- Use the ⦿ button to enter the waiting times in minutes and seconds. e.g. enter 2 minutes and 35 seconds by pressing ② ⦿ ③ ⑤ ⦿ and the calculator will display the amount automatically as 2.5833 minutes. After you have entered all the times press AC. Then press SHIFT ① (stats) ④ (Var). The screen options show that pressing ② will give the mean. Press ② then ▤ to find the mean of the times. The calculator will show the time as a decimal. Press SHIFT ⦿ to show the time in minutes and seconds.

Evaluating your results
- Compare the results from different groups. Are they the same? If they are different suggest a reason for the difference.
- Use the information to determine whether customers have to wait too long. If the times are too long, can you suggest a way to shorten the time?

Who is interested in your results?
Write a report of your investigation and your findings. Give the report to someone who can implement any suggestions you can make.

Playing dice simulation

Simulation 1

When you roll a pair of normal, 6-sided dice together and add the numbers showing, what is the most likely total?

What you have to do

- Enter the formula RanInt#(1,6) + RanInt#(1,6) into your calculator. Each time you press ▣ the calculator will simulate another roll of the dice.
- Record the number displayed by your calculator each time you press ▣ in the table. Simulate the dice rolls at least 40 times.

Total of the dice	Tally	Frequency
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Discussion questions

- What is the most common total when the numbers on a pair of dice are added?
- Why does this number occur more than other numbers?
- What are the two rarest totals?

Simulation 2

Andrew and Imran are rolling a pair of normal, 6-sided dice. Andrew thinks that a sum of 7 will occur twice before a sum of 6 and a sum of 8 happens. Imran doesn't agree. He thinks that a sum of 6 and a sum of 8 before two sums of 7.
Your task is to determine who is right!

What you have to do

Enter the formula RanInt#(1,6) + RanInt#(1,6) into your calculator. When you press ▣ ignore any values that are not 6, 7 or 8. Record whether two sums of 7 or a sum of 6 and a sum of 8 happens first. Carry out at least 20 simulations and show your results in the table.

Two sums of 7		
A sum of 6 and a sum of 8 (or a sum of 8 and a sum of 6)		

Which event occurs first most often; two sums of 7 or a sum of 6 and a sum of 8? Why?

Subtracting dice Bingo

The game rules

- The values called in this game of bingo will be determined by subtracting the numbers showing on a pair of normal 6-sided dice. The subtraction will always be the bigger value subtract the smaller value. There will be no negative values.
- Players choose 9 numbers. They can be all the same, mostly the same or mostly different. However, if a player chooses to have all nine numbers the same, that number must be called 9 times for the player to win. Players can only cross out one of their numbers each time a number is called.
- The first player to have all their numbers crossed out is the winner.

Your challenge is to determine the best set of 9 numbers to use in this game.

What you have to do

Enter the formula "the absolute value of [RanInt#(1,6) – RanInt#(1,6)]" into your calculator by pressing the following sequence of buttons:

[Abs] [ALPHA] [.] [1] SHIFT [)] [6] [)] [−] [ALPHA] [.] [1] SHIFT [)] [6] [)] [=]

Each time you press [=] another simulation value will be displayed.
Simulate the roll of the dice at least 50 times and record your results in the table.

Number rolled	Tally	Frequency
0		
1		
2		
3		
4		
5		

What set of 9 numbers do you think are the best set for winning this game?

Write a paragraph to explain the reason for your choice.

In your group, play the game with a real pair of dice. Which group member's set of numbers wins the most frequently?

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