USING A CASIO SCIENTIFIC CALCULATOR
IN THE TECHNICAL MATHS CLASSROOM

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Adequate knowledge of calculator skills makes the teaching of Technical Maths easier and enables the educator to assist their learners more efficiently. This workshop will guide you through the calculator functions: applicable to the subject and unique to the CASIO FX-991ZA PLUS scientific calculator.

Motivation:
As of 2015 Technical Maths has been introduced as a FET subject for learners at Technical schools, as an alternative and value adding substitute to Maths Literacy.

The aim of Technical Maths is to apply the Science of Maths to the Technical field where the emphasis is on APPLICATION and not on abstract ideas. These learners are encouraged to develop fluency in computation skills **with the usage of calculators,** as stated by the current Technical Maths CAPS document.

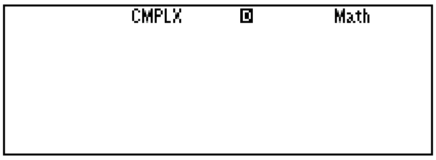
This workshop serves to increase educators understanding of the CASIO scientific calculator. In turn, it will foster self-confidence and a positive attitude towards many aspects of the subject, enhancing both the educators' and learners' understanding.

FX-82ZA PLUS vs. FX-991ZA PLUS

CASIO FX-82ZA PLUS		CASIO FX-991ZA PLUS	
1: COMP	2: STAT	1: COMP	2: CMPLX
3: TABLE		3: STAT	4: BASE-N
		5: EQN	6: MATRIX
		7: TABLE	8: VECTOR

NUMBER SYSTEMS

Complex Number Calculations

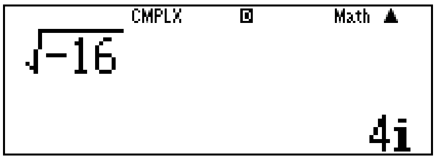


In the **Real Number System**, we can't find the square root of a negative number.

We call numbers such as $\sqrt{-3}$ or $\sqrt{-16}$ **imaginary numbers**.
Both of these numbers $\sqrt{-3}$ and $\sqrt{-16}$ exist in the **Complex Number System** using ***i***.

Express $\sqrt{-16}$ in terms of i:

$\sqrt{-16} = \sqrt{-1}.\sqrt{16} = i.4 = 4.i$

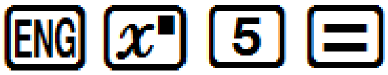


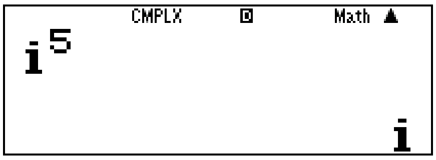
Express the following roots of negative numbers in terms of i:

a) $\sqrt{-5}$ $\boldsymbol{\sqrt{5}i}$ b) $\sqrt{-18}$ $\boldsymbol{3\sqrt{2}i}$ c) $-\sqrt{-11}$ $\boldsymbol{-\sqrt{11}i}$ d) $-\sqrt{-50}$ $\boldsymbol{-5\sqrt{2}i}$

We define the number ***i*** such that $i = \sqrt{-1}$ and $i^2 = -1$

Simplify i^5





Simplify:

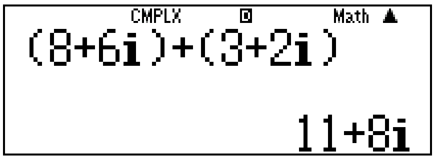
a) i^4 **1** b) i^{99} **- *i*** c) i^{100} **1** d) i^3 **- *i***

Complex numbers are numbers that consist of real numbers & imaginary numbers.
They are in the form of ***a* + *bi***, where ***a*** represents a **real number** & ***b*** represents **imaginary numbers** (Note that both *a* & *b* can be 0)
Examples of complex numbers are 2 + 3*i*, −4 + *i*, etc.

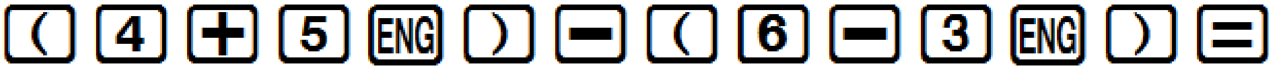
A. Adding & Subtracting Complex Numbers
Complex numbers obey the commutative, associative & distributive laws.
Thus we can add & subtract them as we do binomials.
When adding & subtracting complex numbers, we add (or subtract) the real number parts & then add (or subtract) the imaginary number parts.

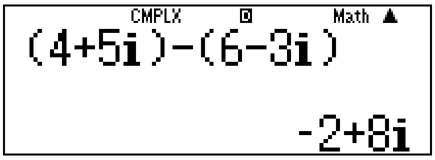
Simplify:

1) $(8 + 6i) + (3 + 2i)$



2) $(4 + 5i) – (6 – 3i)$





Simplify:

a) $(5 - 6i) + (3 + 2i)$ **8-4*i*** b) $(4 - 12i) - (9 + 6\,i)$ **-5-18*i***

B. Multiplying Complex Numbers

The property $\sqrt{a}\sqrt{b} = \sqrt{ab}$ **does not** hold in general for complex numbers. However, it does hold when $a = -1$ and b is non-negative.

This means that $\sqrt{-1}\sqrt{4} = \sqrt{-1}.2 = 2\sqrt{-1} = 2i$,

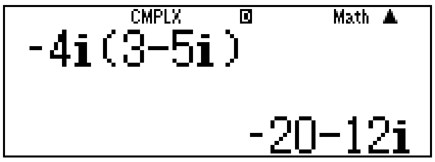
BUT $\sqrt{-1}\sqrt{-4} \neq \sqrt{+4}$

To multiply square roots of negative real numbers, we first express them in terms of *i* and then multiply.

Simplify:

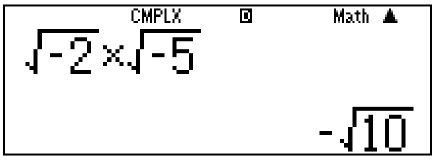
1) $-4i\,(3 – 5i)$

$= -4i\,.\,3 + (-4i)(-5i) = -\,12i + 20i^2 = -12i + 20(-1) = -20 - 12i$



2) $\sqrt{-2}.\sqrt{-5}$

$= \sqrt{-1}\sqrt{2}.\sqrt{-1}\sqrt{5} = i.\sqrt{2}.i.\sqrt{5} = i^2.\sqrt{10} = -1\sqrt{10}$



Simplify:

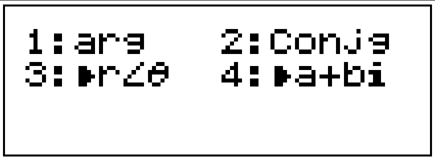
a) $-3\,i\,.\,8\,i$	**24**	b) $(1+2i)(1+3i)$	**-5+5*i***	c) $\sqrt{-16}.\sqrt{-25}$	**-20**

C. Dividing Complex Numbers

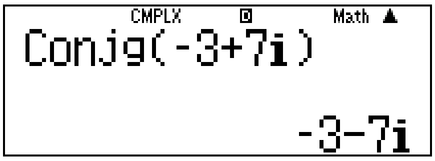
Often, in order to divide complex numbers, we use **conjugates**.

The **conjugate** of *a* + *bi* is *a* – *bi*,

& the **conjugate** of *a* – *bi* is *a* + *bi*.



Find the conjugate of $-3 + 7i$



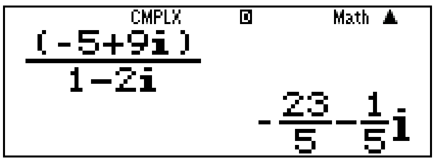
Find the conjugates of:

a) 14 – 5*i*	**14+5*i***	b) 4*i*	**-4*i***

Simplify: $\frac{-5+9i}{1-2i}$

$= \frac{-5+9i}{1-2i} \times \frac{1+2i}{1+2i}$

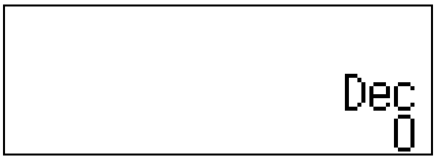
multiply the fraction by 1 i.e. multiply both the numerator and the denominator by the conjugate of the denominator



Simplify:

a) $\frac{-4+6i}{2}$ **$-2+3i$** b) $\frac{7+3i}{5i}$ **$\frac{3}{5}-\frac{7}{5}i$**

Binary Calculations



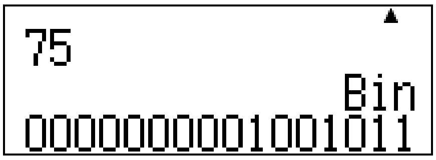
Binary Number System

In mathematics & digital electronics, a **binary** number is a number expressed in the base-2 numeral system which represents numeric values using two different symbols: typically **0 (zero) and 1 (one)**

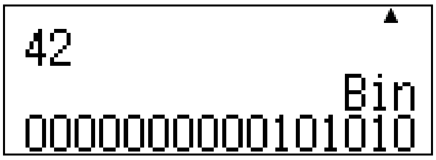
A. Conversion from Decimal to Binary

To express a decimal number in binary form we decompose the decimal number into the sum of powers of base 2.

Convert the decimal number 75 to binary



Convert the decimal number 42 to binary



Convert the following decimal numbers to binary:

a) 19 **10011**

b) 36 **100100**

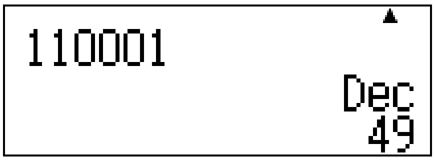
c) 56 **111000**

B. Conversion from Binary to Decimal

A binary number can be converted to a decimal number by calculating the sum of the products of each digit (0 or 1) & the actual place value of the position of the digit.

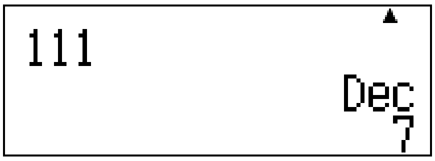
Convert the binary number 110001 to decimal

[1] [1] [0] [0] [0] [1] [=] [x^2]



Convert the binary number 111 to decimal

[log] [1] [1] [1] [=] [x^2]



Convert the following binary numbers to decimal:

a) 10	**2**
b) 10101	**21**
c) 11110	**30**

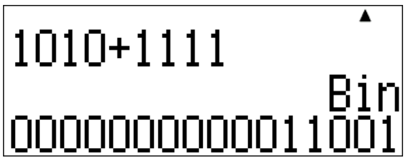
C. Adding & Subtracting Binary Numbers

The arithmetic of binary numbers is similar to that of decimals.

We can follow the same procedures, as long as we remember that our base is 2 & not 10.

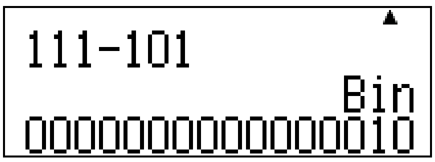
Add the following binary numbers: 1010 + 1111

[log] [1] [0] [1] [0] [+] [1] [1] [1] [1] [=]



Subtract the following binary numbers: 111 - 101

[1] [1] [1] [−] [1] [0] [1] [=]

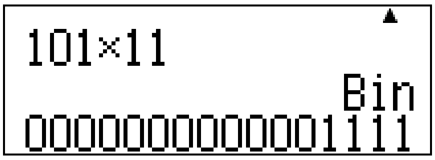


Simplify:

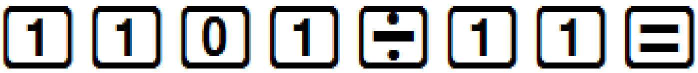
a) 101 + 100	**1001**
b) 101 – 11	**10**
c) 11111 + 11111	**111110**
d) 1101 – 11	**1010**

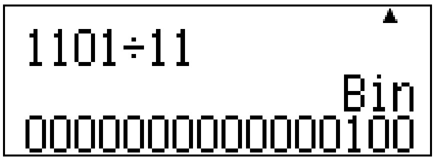
D. Multiplying & Dividing Binary Numbers

Multiply the following binary numbers: 101 × 11



Divide the following binary numbers: 1101 ÷ 11





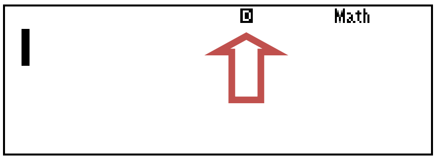
Simplify:

a) 1101 × 11	**100111**
b) 111101 ÷ 10	**11110**
c) 110011 × 11	**10011001**
d) 11011 ÷ 10	**1101**

*** NOTE * The calculator cannot compute fractions in BASE-N MODE**

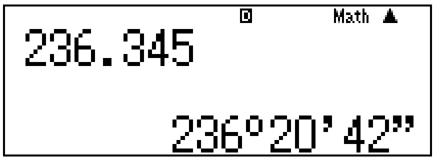
CIRCLES, ANGLES & ANGULAR MOVEMENT

Angles



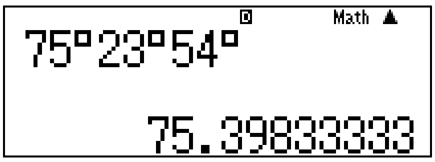
A. Converting from Decimal Degree notation to Degree-Minute-Second (D-M-S) notation

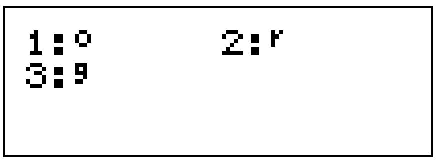
Express 236,345° in D-M-S notation:



B. Converting from D-M-S notation to Decimal Degree notation

Express 75°23'54" in decimal degree notation:

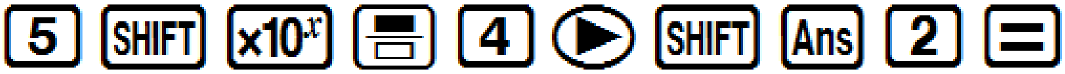


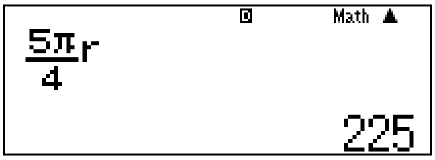


C. Converting from Radians to Degrees

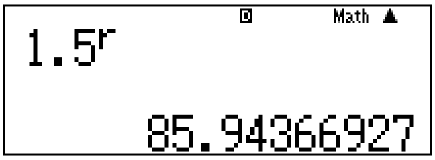
Calculate the degree measure of:

1) $\frac{5\pi}{4}$

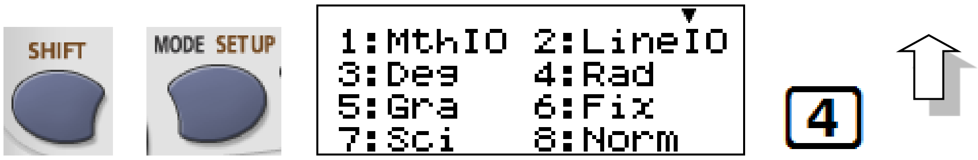


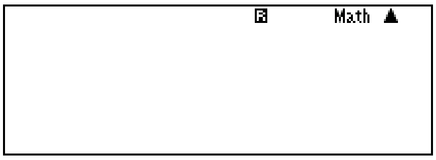


2) 1,5 rad

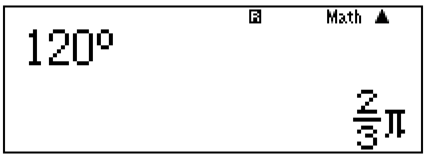


D. Converting from Degrees to Radians





Convert 120° to radians



Convert to:

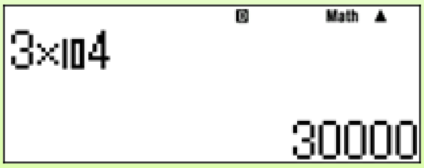
D-M-S notation	a) 47,7°	**47°42'0''**
Decimal Degree notation	b) 23°12'	**23,2°**
Decimal Degree notation	c) $\frac{\pi}{7}$	**25,71428571°**
Decimal Degree notation	d) 2 rad	**114,591559°**
Radians	e) 71,72°	**1,25175014 rad**

SCIENTIFIC NOTATION

✓**CONVERTING FROM SCIENTIFIC NOTATION TO A WHOLE NUMBER OR DECIMAL**

Convert 3×10^4 to a rational number: 

[3] [x10^x] [4] [=]



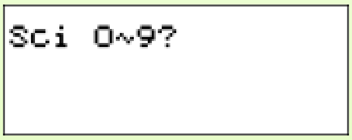
✓**CONVERTING TO SCIENTIFIC NOTATION**

Convert 148 501 000 to scientific notation with **three** significant digits:

[1] [4] [8] [5] [0] [1] [0] [0] [0] [=]

To enter **SCIENTIFIC NOTATION:** [SHIFT] [MODE]

[7]



[3]

Select the number of **significant digits**

✓**ENGINEERING KEY**

Transforms a displayed value to engineering notation

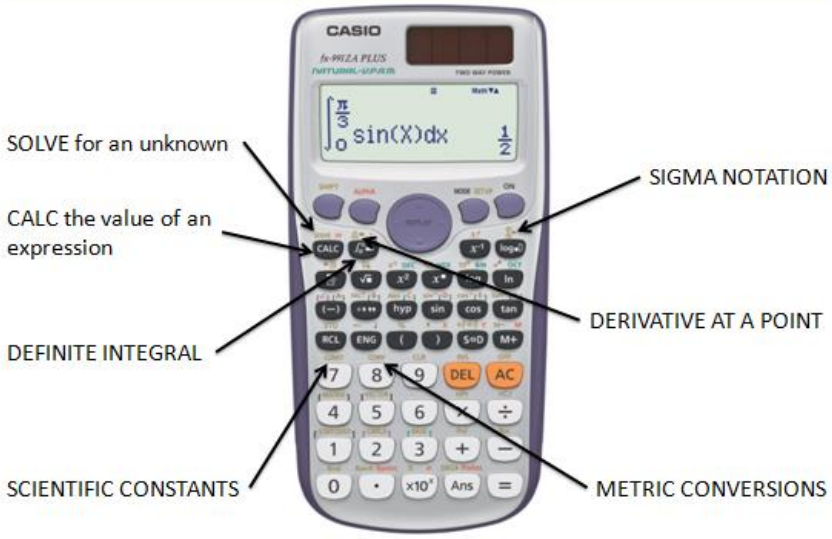
[SHIFT] [ENG]

shifts the decimal point to the left

[ENG]

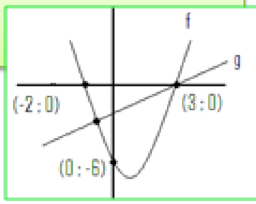
shifts the decimal point to the right

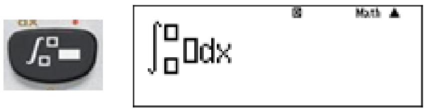
MODE 1 : COMP (Computational)

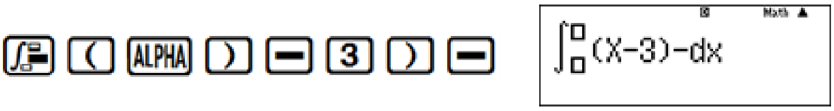


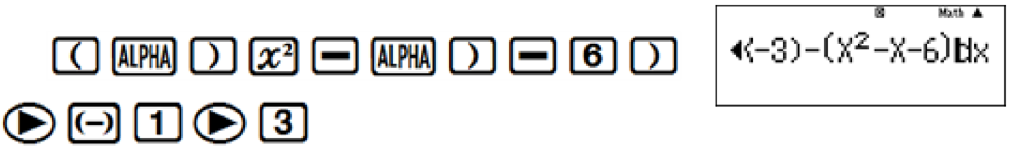
MODE 1 : COMP (Integration)

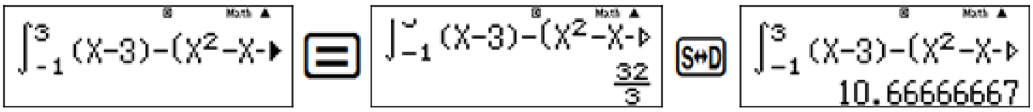
Find the area of the region bounded by the graphs $f(x) = x^2 - x - 6$ and $g(x) = x - 3$





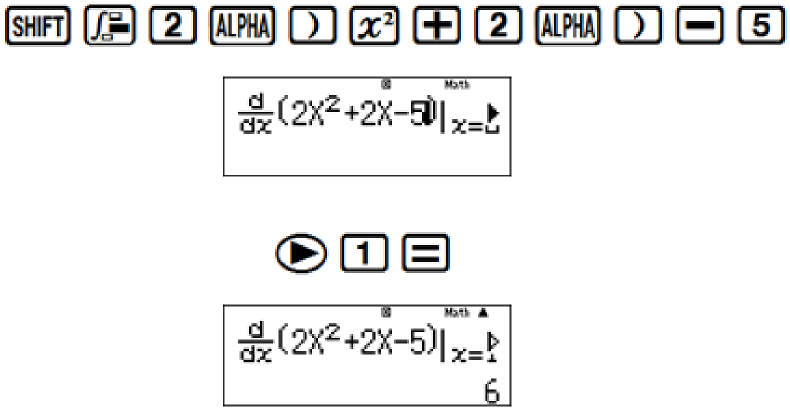


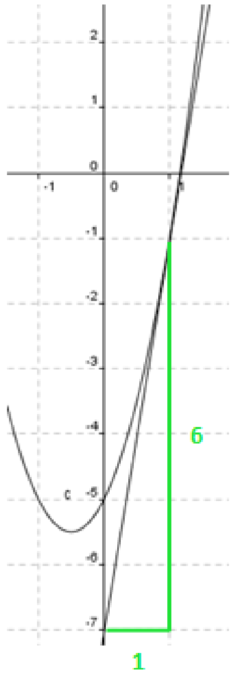




MODE 1 : COMP (Differentiation)

Find the gradient of the graph $y = 2x^2 + 2x - 5$, at $x = 1$





CASIO means TECHNOLOGY

REFERENCES:

RADMASTE Centre and ETDP SETA – NUMBER AND FINANCIAL MATHEMATICS FOR FET LECTURERS, BOOK 1 – NUMBER AND COMPLEX NUMBERS (2013) University of the Witwatersrand, SA.

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