CASIO®

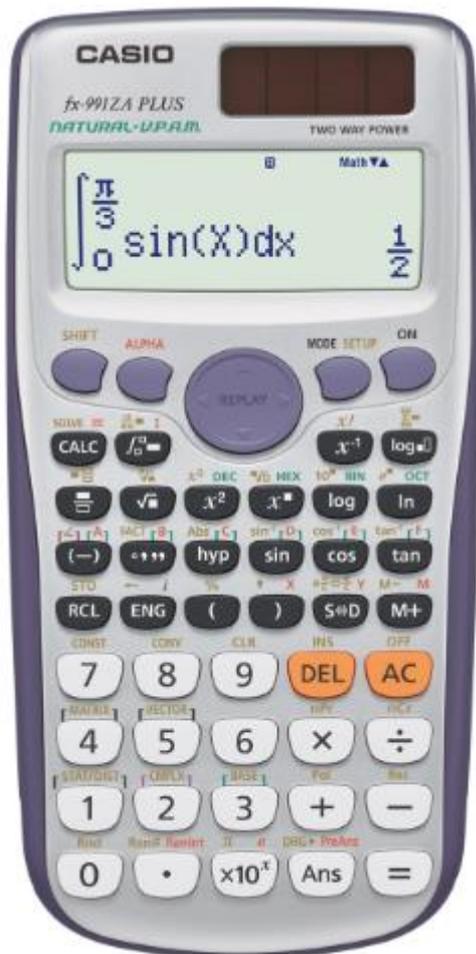## FX 991 ZA- PLUS CALCULATOR WORKSHEET

MODES:

```
        ▼
1:COMP    2:CMPLX
3:STAT    4:BASE-N
5:EQN     6:MATRIX
7:TABLE   8:VECTOR
```

Before we start always remember to clear the memory of our calculator!

[SHIFT] [9]

Choose Option 3: All

Reset All? Press [=] Press [AC]

Be sure to put the calculator into NORMAL, as currently all answers will appear in scientific notation.
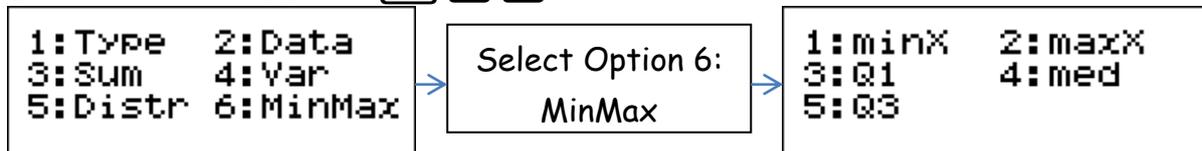
[SHIFT] [MODE]

Choose Option 8: NORM

Choose Option 2: (Option 1 will leave answers as is in scientific notation)

You are now ready to use the Calculator effectively and correctly! ☺

- In stats mode you are now able to calculate the Q1, median and Q3.

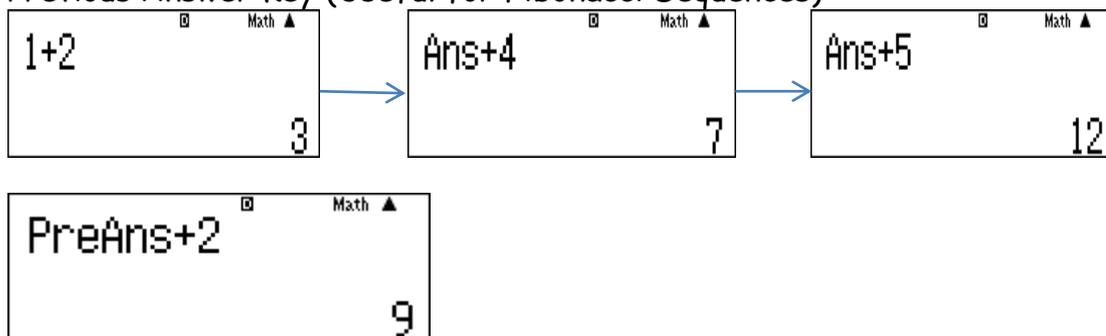Enter into Stats Mode: [MODE] [3] [1]

```
1:Type   2:Data
3:Sum    4:Var
5:Distr  6:MinMax
```
→
Select Option 6:
MinMax
→
```
1:minX   2:maxX
3:Q1     4:med
5:Q3
```

- Dual Table Function (as in the FX82 ZA- Plus) allowing learners to calculate the F(x) and the G(x) simultaneously.

```
      X      F(X)   G(X)
 1                     6
 2            3        9
 3            5       12
 4            7
                      0
```
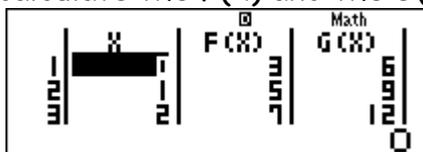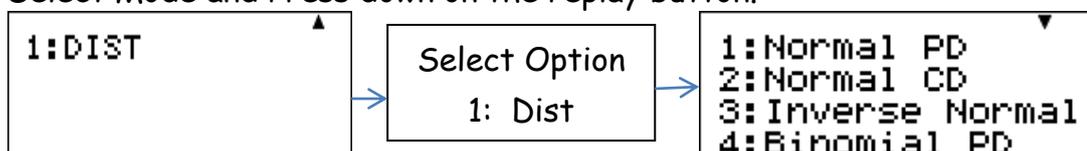
- Previous Answer Key (Useful for Fibonacci Sequences)

```
1+2                Math ▲


              3
```
→
```
Ans+4              Math ▲


              7
```
→
```
Ans+5              Math ▲


             12
```

```
PreAns+2           Math ▲


              9
```

- Distribution Mode
  Select Mode and Press down on the replay button.

```
1:DIST             ▲


```
→
Select Option
1: Dist
→
```
1:Normal PD        ▼
2:Normal CD
3:Inverse Normal
4:Binomial PD
```

ROUNDING OFF:

Press [SHIFT] [MODE]
Choose Option 6: Fix

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

Fix 0~9?

Select the number of Decimal Places you want to fix it to. Eg 2
Note the word FIX on the top of your screen.
All answers will now be rounded off to 2 decimal places.
BUT
Do Not Fix the calculator for Financial Maths or Trig as it will carry the rounded answers down automatically.
This must be undone, as it does not automatically go away.
Go back to NORMAL

PRIME FACTORISING:

You are now able to find the Prime Factors of any number when using the FX991 ZA- Plus.

Eg1: Find the prime factors of 36.
[3] [6] [=] [SHIFT] [°,,,]

```
36                    Math ▲

              2² × 3²
```

USING THE CALC FUNCTION:

The CALC function can be used for direct substitution/ finding the value of expressions.

Eg 1: Calculate the following: $3A^2+4B$, if A=6 and B=2.
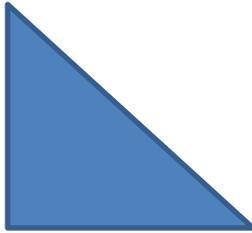　　　　Enter the expression given $3A^2+4B$
　　　　Press the CALC button
　　　　Enter the value for A? 6 and Press Equals =
　　　　Enter the value for B? 2 and Press Equals =
　　　　The solution is given automatically

Eg 2:

Calculate the hypotenuse of the triangle given that A=5 (Base) and B=12 (Height)

Use the formula

$$C = \sqrt{A^2 + B^2}$$

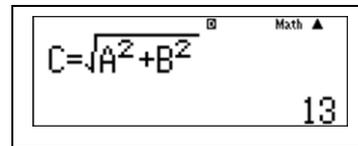Enter the formula $C = \sqrt{A^2 + B^2}$ (Follow the key sequences allocated)

[ALPHA] [hyp] [ALPHA] [CALC] [√▪] [ALPHA] [(−)] [x²] [+] [ALPHA] [∘,,,] [x²]

Do not press Equals but instead Press [CALC]

Enter the value A? [5] [=]

Enter the value B? [1] [2] [=]

The solution for C is now given.

Therefore the hypotenuse has been calculated.
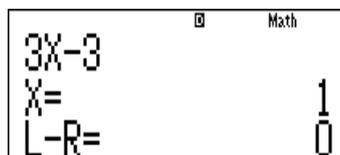

USING THE SOLVE FUNCTION:

The SOLVE function is used to solve unknowns in equations.

Eg 1: Solve the following equation $Y = 3X - 3$ if Y=0.
       Enter the Equation [3] [ALPHA] [)] [−] [3]

You are now SOLVING so Press [SHIFT] [CALC]

Solve for X? Press Equals

This is the original Equation.

This is the Solution for B (height)
This is the Left side minus right side equal to zero.

Eg 2: Solve the following equation $96 = 3x^{\frac{5}{4}}$

Enter the Equation [9] [6] [ALPHA] [CALC] [3] [ALPHA] [ )] [x■] [5] [▦] [4]

You are Solving again so [SHIFT] [CALC]
Solving for X? Press Equals

```
 ▯        Math
96=3X⁴
X=            16
L-R=           0
```

Eg 3: Using the SOLVE function to change the subject of the formula.

A cone has a volume given by the formula $V = \dfrac{1}{3}\pi r^2 h$.

Calculate the height of the cone if the volume is 30cm^3 and the radius is 2.3cm.

To enter this into the calculator substitute using the letters A-F, X, Y and M.

$$X = \frac{1}{3}\pi A^2 B$$

You are required to calculate the height (B) so therefore we place a comma at the end of the equation/ formula followed by the letter you are solving.

Once the equation has been entered it will appear as follows:

```
 ▯          Math
X=⅓πA²B,B█

```

Press [SHIFT] [CALC]

X? [3] [0] [=]

A? [2] [•] [3] [=]

Solve for B, Press Equals =

```
 ▯          Math
X=⅓πA²B,B
B=   5.415480105
L-R=          0
```

→ This is the original Equation.

→ This is the Solution for B (height)
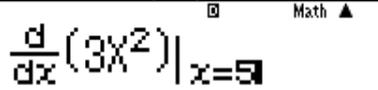→ This is the Left side minus right side equal to zero.

NB: The calculator should only be used to check the answers for differentiation as often first principles must be used to get to the final answer.

Eg 1: Find the gradient of the function $Y = 3x^2$ when X=5.
Press [SHIFT] [⌐]
In the brackets enter $3x^2$
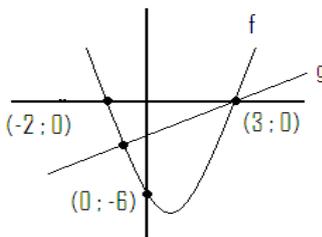Use the replay button to the right and enter the value of X as 5.

$$\frac{d}{dx}(3X^2)\Big|_{x=5}$$

Press [=] The gradient of this function is 30

INTEGRATION:

Find the area of the region bound by the graphs f(x) = x^2 – x – 6 and g(x) = x – 3

Step 1: Sketch graphs f(x) = x^2 – x – 6 and g(x) = x – 3

Step 2: Solve for the intersection of the two graphs

Using EQN Mode: Select Option 3: Quadratic equation
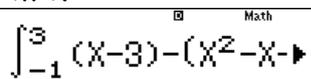
x^2 – x – 6 = x – 3, x^2 –2x – 3 = 0,

x_1 = 3 or x_2 = -1

Hence our interval is [-1 : 3]

Step 3: Set up the integral in COMP Mode and Select the Integration button [⌐]

Enter in the body of the integral first. Use the replay button to the right. Then enter the bottom limit first. Now replay right and you can enter the top limit.

$$\int_{-1}^{3} (X-3)-(X^2-X-\blacktriangleright$$
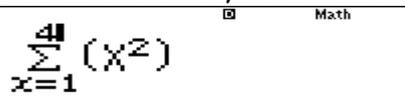
SIGMA NOTATION:

Eg 1: Write the following in Sigma Notation and calculate $1^2+2^2+3^2+4^2$.
Press [SHIFT] [log∎□]
Enter the start, end and sum of amounts in the relevant positions.

$$\sum_{x=1}^{4} (X^2)$$

Press [=]

EQUATIONS:

Enter into Equations Mode. MODE 5

1: aₙX+bₙY=cₙ ——————→ Simultaneous Linear with 2 Unknown
2: aₙX+bₙY+cₙZ=dₙ ——→ Simultaneous Linear with 3 Unknown
3: aX²+bX+c=0 ————→ Quadratic Equation
4: aX³+bX²+cX+d=0 —→ Cubic Equation

Eg 1: Simultaneous Linear Equation with 2 unknown
        Calculate the following simultaneous equation: 2x-3y=3 and 4x-2y=10
        Select Option 1 from the Equations Menu
        Enter in only the numerical values (remember the signs too) and press
        equals after each value.
        NB: The values must be in the sequence x+y=c.

$$\frac{1}{2}\begin{bmatrix} a & b & c \\ 2 & -3 & 3 \\ 4 & -2 & \blacksquare \end{bmatrix}$$

                                        10 Press =

$X=$ 3 Press =

$Y=$ 1

Therefore X= 3 and Y= 1.

Eg 2: Quadratic Equation
        NB: Always put the quadratic equation into standard format $ax^2+bx+c=0$
        Enter into Equations Mode and Select Option 3 from Equations Menu.

        Calculate the X values if X^2-X-12
        Enter the numerical values and Press Equals after each value is entered.

$$\begin{bmatrix} a & b & c \\ & -1 & \blacksquare \end{bmatrix}$$

                                        -12 Press ▤

$X_1=$ 4 Press ▤

$X_2=$ -3

        These are the X- values of the Equation. Should you require the roots,
   everything must be brought to one side, therefore (X-4)(X+3)=0.
        With the FX 991 ZA- Plus you are able to continue further and calculate
        the X and Y Minimum values. (Turning Points of the Parabola).

X-Value Minimum= $\frac{1}{2}$ Press ▤

Y-Value Minimum= $-\frac{49}{4}$

Eg 3: Cubic Equation
Enter into Equations Mode and Select Option 4 from the Equations Menu.

Calculate the roots of the equation $x^3-6x^2+11x-6=0$.
Enter the numerical values and Press Equals after each value is entered.

-6 Press ▣

1 ▣   3 ▣   2
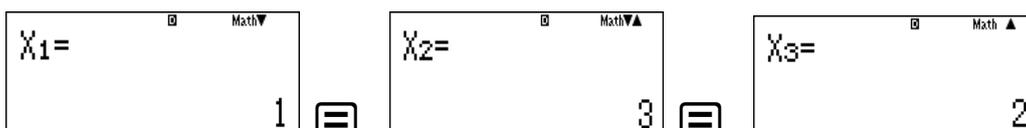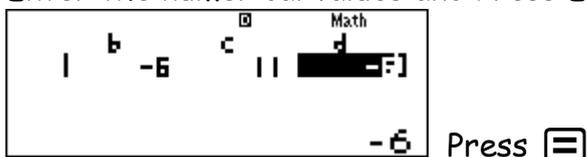
The roots of this equation are therefore (x-1)(x-3)(x-2)=0.

The following 2 examples are only able to be conducted on the FX 991 ZA- Plus.
If attempted on the FX 991 ES- Plus a Math Error will appear.
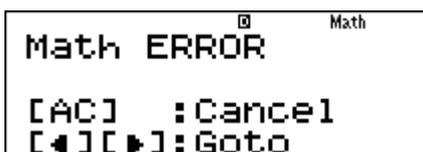
Eg 4: No Solution
When the solution to an equation is not equal for example, 3=5

Solve the following equation $3x+12=3x+10$
Equations Mode, Select Option 1.
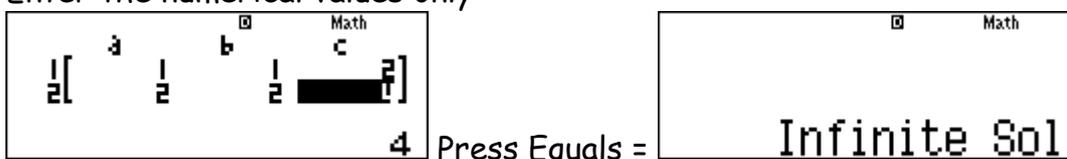Enter the numerical values only.

3 Press ▣   No-Solution

Eg 5: Infinite Solution
This occurs when 2 graphs or equations are the same.
Solve the following simultaneously $x+y=2$ and $2x+2y=4$

Equations Mode, Select Option 1.
Enter the numerical values only
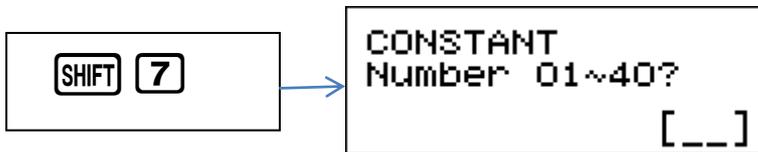

4 Press Equals =   Infinite Sol

> SCIENTIFIC CONSTANTS and METRIC CONVERSIONS

To use this feature you must be in COMP Mode.
Select Mode Option 1: COMP

Look at the inside cover of the calculator, you will notice Scientific Constants from 01- 40 and also Metric Conversions 01- 40
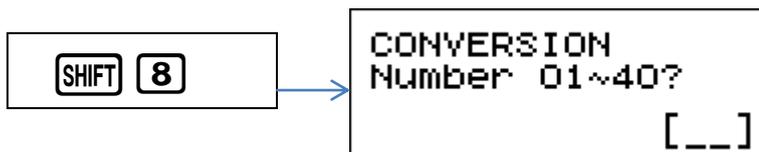
Eg 1: Scientific Constants

[SHIFT] [7] →
```
CONSTANT
Number 01~40?
              [__]
```

Look at the inside cover of the calculator and choose the constant you are needing to calculate.

Let us use G- Newton's Constant of Gravitation (39)

```
G                    ▣    Math
```
Press [=]
```
G                    ▣    Math ▲

           6.67384×10⁻¹¹
```

Eg 2: Metric Conversions

[SHIFT] [8] →
```
CONVERSION
Number 01~40?
              [__]
```

Look at the inside cover of the calculator and choose the conversion you are needing to do.

Let us convert 120km/h into m/s (19)

```
120km/h▶m/s        ▣    Math ▲
```
Press [=]
```
120km/h▶m/s        ▣    Math ▲

           33.33333333
```

COMPLEX NUMBERS:

Enter into Complex Mode. Press Mode and select Option 2: CMPLX

You are now able to find the roots of negative numbers. All answers will be given in complex number format.

Eg 1: $\sqrt{-5} = \sqrt{5}\,i$

Eg 2: $i^3 = -i$

Eg 3: $i^{100} = 1$ (Enter as the question asks into the FX991 ZA- Plus)
　　　　BUT on the FX991 ES- Plus put it into its simplest form $(i^2)^{50} =$

Complex numbers are a combination of real and imaginary numbers. These can be expressed as $a+bi$. $a-real$ and $bi-imaginary$. For example: $7+3i$

You are able to Add or Subtract Complex Numbers

Eg 4: $(8+6i)+(3+2i) = 11+8i$

You are also able to Multiply Square Roots of Negative Real Numbers
NB: Use the replay button for direction and to move the cursor out of the square root sign.

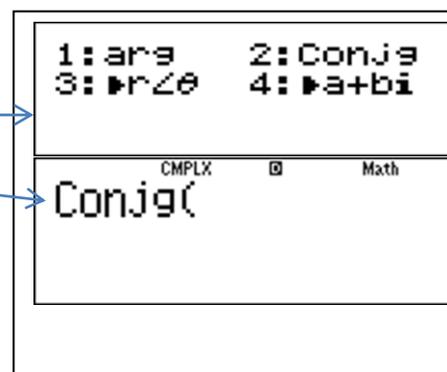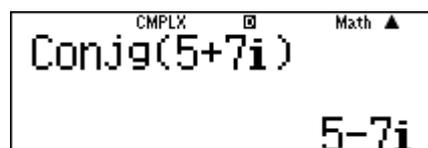Eg 5: $\sqrt{-2} \times \sqrt{-5} = -\sqrt{10}$

Conjugates

$a+bi \rightarrow a-bi$ OR $a-bi \rightarrow a+bi$

Eg 6: Find the conjugate of $5+7i$
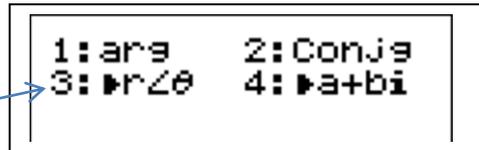
Select the following key Sequence:
[SHIFT] [2]　　　This Screen will appear:
Select Option [2]

Finding the Modulus and Polar Form of Complex Numbers

Eg 7: Enter the question
Select Shift 2 again
Now choose Option 3

```
1:arg     2:Conjg
3:▶r∠θ    4:▶a+bi
```

```
      CMPLX    ▣      Math
4+3i▶r∠θ
```

Press Equals =

```
      CMPLX    ▣      Math ▲
4+3i▶r∠θ

          5∠36.86989765
```

Modulus/
Absolute Value

Polar Co- Ordinates