

Use the **ON** key to turn the calculator on, and press **SHIFT AC** (OFF) to power the unit down.

The **MODE** key allows you to choose between the 11 different modes on the calculator. **SHIFT MODE** (SETUP) allows you to make changes to the calculator settings.

To enter a fraction, press **□** and enter your numerator and denominator. The **S/D** key toggles your calculation results between Standard and Decimal forms.

Press **(-)** to input a negative value or variable.

Press **AC** to clear out anything typed or the entire screen.

The following explains the meaning of each mode on the fx-115ES Plus 2nd Edition:



MENU NAME	DESCRIPTION
COMP	This mode performs general calculations.
CMPLX	This mode performs complex number calculations.
STAT	This mode performs statistical and regression calculations.
BASE-N	This mode performs calculations involving specific number systems (binary, octal, decimal, & hexadecimal).
EQN	This mode solves equations.
MATRIX	This mode performs matrix calculations.
TABLE	This mode generates a numerical table based on one or two functions.
VECTOR	This mode performs vector calculations.
INEQ	This mode solves inequalities.
VERIF	This mode verifies a calculation.
DIST	This mode performs distribution calculations.

COMP MODE

To calculate and solve basic expressions, press **MODE** **1** to enter COMP mode.

To make any changes to the calculator settings, press **SHIFT** **MODE** (SETUP).

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

1: ab/c	2: d/c
3: CMPLX	4: STAT
5: TABLE	6: Rdec
7: Disp	8: CONT

Inputting a Fraction & Converting to Decimal Form:

1. To solve $\frac{7}{8} + 2\frac{3}{11}$, press

7 **8** **+** **2** **3** **11** **=**

Math ▲
 $\frac{7}{8} + 2\frac{3}{11}$
 $\frac{277}{88}$

2. To view the solution as a decimal, press **S \rightarrow D**.

*Note: press **S \rightarrow D** again to see the entire decimal answer. Pressing once more will display the fraction solution again.*

Math ▲
 $\frac{7}{8} + 2\frac{3}{11}$
3.14772

Math ▲
 $\frac{7}{8} + 2\frac{3}{11}$
3.147727273

To Find the Remainder of a Division Problem:

1. To find the remainder of 7 divided by 5, press

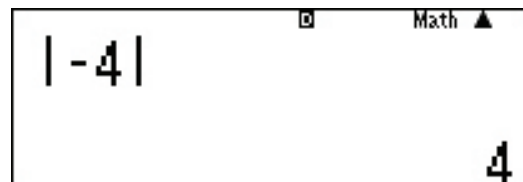
7 **ALPHA** **5** **=**

Math ▲
7÷R5
1,R=2

Absolute Value:

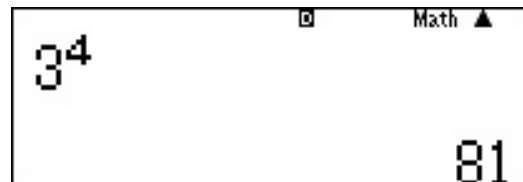
- To find the absolute value of -4, press

SHIFT **hyp** **(-)** **4** **=**.



Exponents:

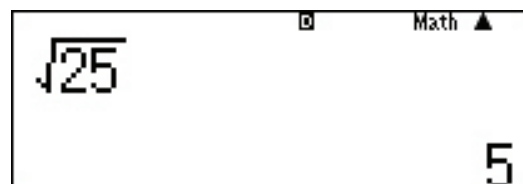
- To evaluate 3^4 , press **3** **x^y** **4** **=**.



Roots:

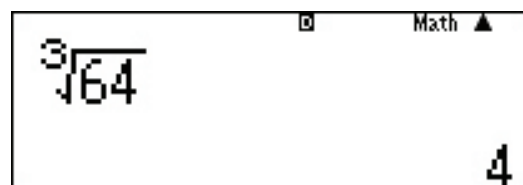
- To calculate the square root of 25, press

$\sqrt{\square}$ **2** **5** **=**.



- To calculate the cube root of 64, press

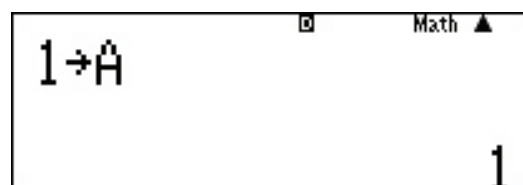
SHIFT **x^y** **3** **\blacktriangleright** **6** **4** **=**.



Storing Variables:

To store a value for any variable, press **SHIFT** **RCL** followed by a variable, A – F. In this example, we will store a value of 1 for the variable A.

- Press **1** **SHIFT** **RCL** **(A)**.



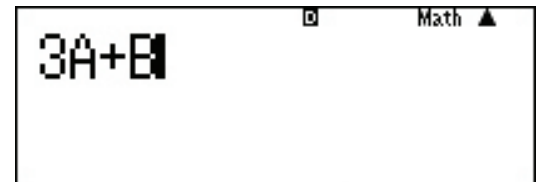
*Note: When you store the value for the variable, you do not need to press the **ALPHA** key prior to pressing the variable key.*

Calculating Expressions:

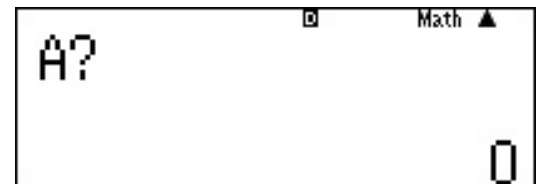
The **CALC** key allows you to enter an expression with variables, assign values for each variable and then automatically calculate the expression, without having to store values for the variable first.

1. Enter the expression, $3A + B$, by pressing

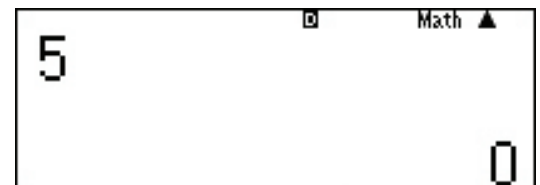
3 **ALPHA** **(←)** **+** **ALPHA** **(→)**.



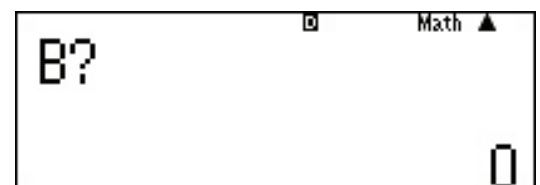
2. Press **CALC**.



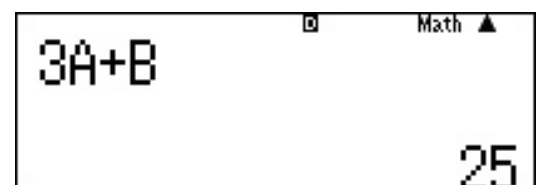
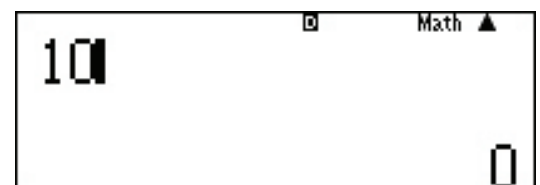
3. Enter 5 for **A** by pressing **5** **=**.



4. Enter 10 for **B** by pressing **1** **0** **=**.



5. The values of A and B can be used to solve additional expressions, without using **CALC**.



Solving Equations (SOLVE):

SOLVE uses Newton's method to approximate the solution of equations. SOLVE can only be used in COMP mode.

Solve $y = ax^2 + b$ for x , when $y = 0$, $a = 1$, and $b = -2$.

- Enter the equation by pressing ALPHA S+D (Y) ALPHA CALC (=) ALPHA (-) (A) ALPHA) (X) x^2 $+$ ALPHA 0.999 (B).
- Press SHIFT CALC (SOLVE) to enter the SOLVE feature.
- Enter the value for y by pressing 0 = .
- Enter the value for a by pressing 1 = .
- Enter the value of b by pressing (-) 2 = .
- Enter an initial value for x , for this example, we will enter 1, by pressing 1 = .
- To exit SOLVE, press AC .

Y=AX²+B

Y?

A?

B?

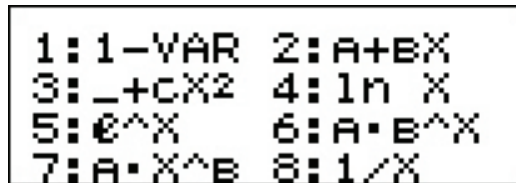
Solve for X

Y=AX²+B
X= 1.414213562
L-R= 0

STAT MODE

To start a statistical calculation, press **MODE** **3** to enter STAT mode and use the screen that appears to select the type of calculation you want to perform.

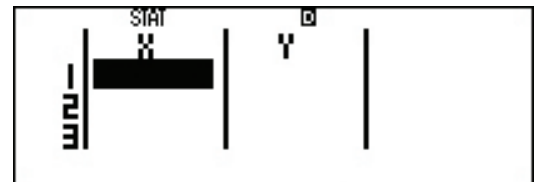
Note: When you want to change the calculation type after entering STAT mode, press **SHIFT** **1** (STAT/DIST) **1** (Type) to display the calculation type selection screen.



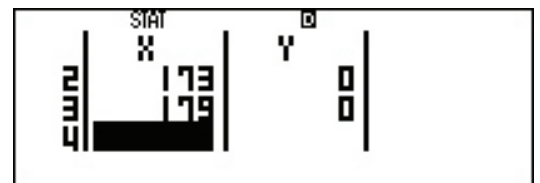
Input the following data and find the linear regression.
(170, 66) (173, 68) (179, 75)

Entering Data:

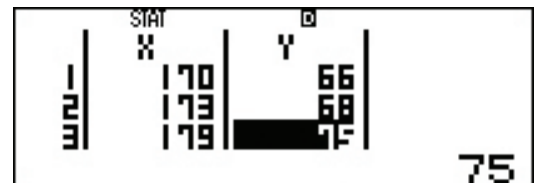
1. To enter the data points above, press **MODE** **3** **2** (A+BX).



2. Enter the x-values first, pressing **□** after each value.
1 7 0 □ 1 7 3 □ 1 7 9 □



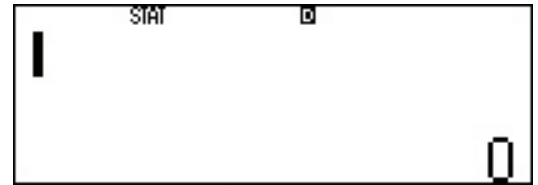
3. Use the arrows to move to the top of the y-column and enter the y-values, pressing **□** after each value.
6 6 □ 6 8 □ 7 5 □



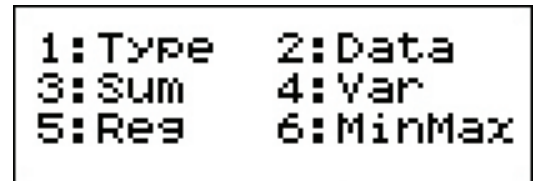
STAT MODE

Finding a Regression:

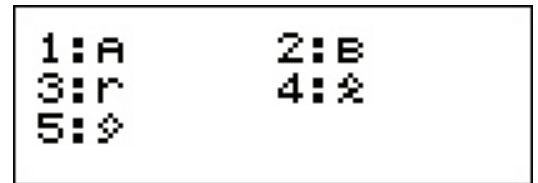
1. To find the regression equation, press **AC** to clear the screen.



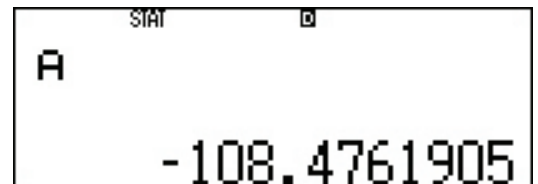
2. Press **SHIFT** **1** to display the Statistics Menu.



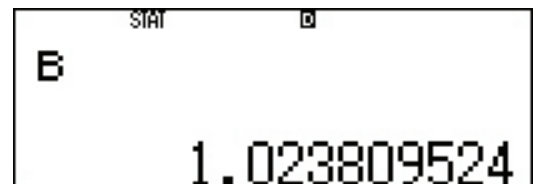
3. Press **5** (Reg) to find the coefficients for the linear regression equation.



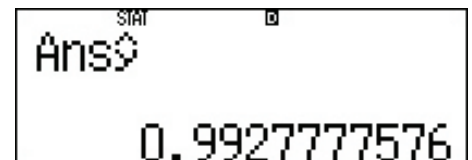
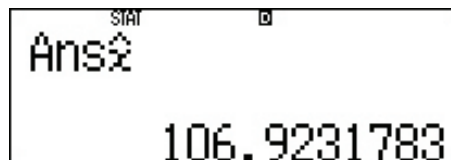
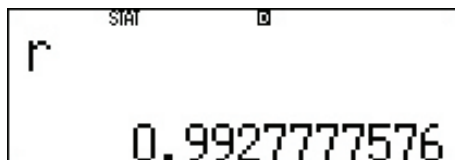
4. Press **1** (A) **ENTER** to find the value of **A**.



5. To find the value of **B**, repeat the process.
Press **SHIFT** **1** **5** **2** (B) **ENTER**.



6. The values of the correlation coefficient (r), the estimated value of X (\hat{x}), and the estimated value of Y (\hat{y}) can also be found.

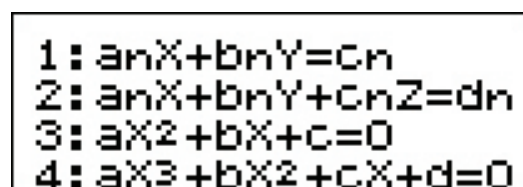


EQN MODE

Equation Mode can be used to solve simultaneous linear equations with two or three unknowns, quadratic equations, or cubic equations. Press **MODE** **5** to enter EQN mode and press the corresponding number for the desired equation type.

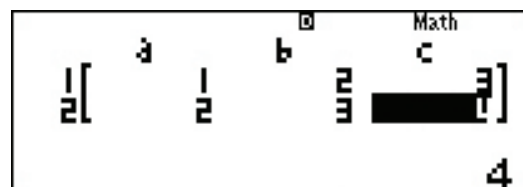
Example 1:
$$\begin{cases} x + 2y = 3 \\ 2x + 3y = 4 \end{cases}$$

1. Press **1** to select a simultaneous linear equation with two unknowns.



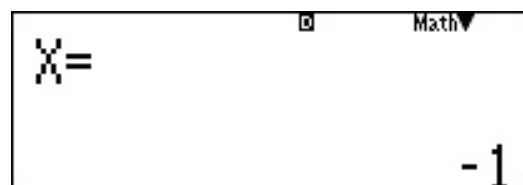
1: aX+bY=Cn
2: aX+bY+cZ=dn
3: aX²+bX+c=0
4: aX³+bX²+cX+d=0

2. Enter the coefficients for each term in each equation by pressing **1** **=** **2** **=** **3** **=** **2** **=** **3** **=** **4** **=**.



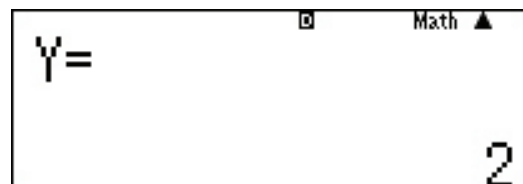
1/a [a b c]
2/a [2 3]

3. Press **=** to solve for the variables.



X = -1

4. Press **▼** to see the solution for y.



Y = 2

5. To solve additional simultaneous equations with two unknowns, press **AC** **AC**.

Example 2: Solve $2x^2 - 3x - 6 = 0$.

1. To choose a different type of equation to solve, press **MODE** **5** to return to the initial Equation screen.

2. Press **3** to select a quadratic equation.

3. Enter the coefficients of each term and the constant by pressing **2** **=** **(←)** **3** **=** **(←)** **6** **=**.

4. Press **=** to solve for the roots and the minimum.

5. Press **▼** to see the additional information

```

1: aX+bY=Cn
2: aX+bY+CnZ=dn
3: aX2+bX+c=0
4: aX3+bX2+cX+d=0
    
```

```

      a      b      c
[  2      -3      -6 ]
    
```

```

X1=
      3+√57
      4
    
```

```

X2=
      3-√57
      4
    
```

```

X-Value Minimum=
      3
      4
    
```

```

Y-Value Minimum=
      -57
      8
    
```

TABLE MODE

TABLE generates a number table based on one or two functions, entered as $f(x)$ and/or $g(x)$. Press **MODE** **7** to enter TABLE mode.

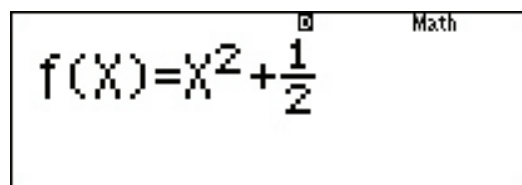
*Note: Be sure to input the x variable (**ALPHA** **X**) when generating a number table. All other variables will be handled as constants.*

$$f(x) = x^2 + \frac{1}{2}$$

$$g(x) = x^2 - \frac{1}{2} \text{ for the domain } -1 \leq x \leq 1, \text{ by step of } 0.5$$

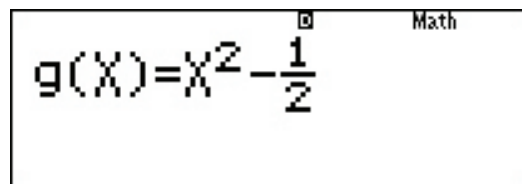
1. Enter the first function by pressing

ALPHA **X** **x²** **+** **1** **÷** **2** **=**.



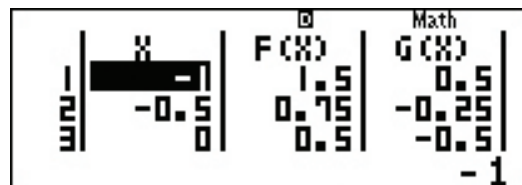
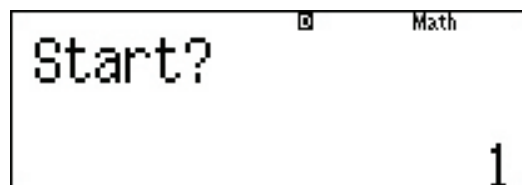
2. Enter the second function by pressing

ALPHA **X** **x²** **-** **1** **÷** **2** **=**.



3. Enter the Start, End, and Step values by pressing

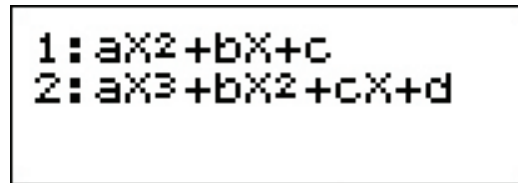
← **1** **=** **1** **=** **0.5** **=**.



X	F(X)	G(X)
1	1.5	0.5
0.5	0.75	-0.25
-0.5	0.5	-0.5
0		-1

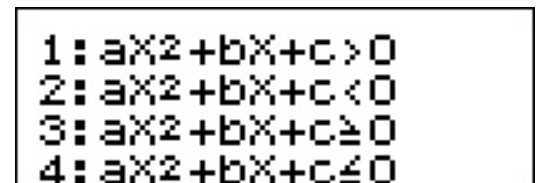
INEQ MODE

INEQ Mode allows you to solve a quadratic inequality or a cubic inequality. Press **MODE** \blacktriangledown **1** to enter INEQ Mode and select quadratic or cubic.

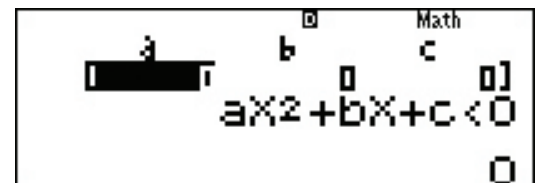


Solve $x^2 + 2x - 3 < 0$:

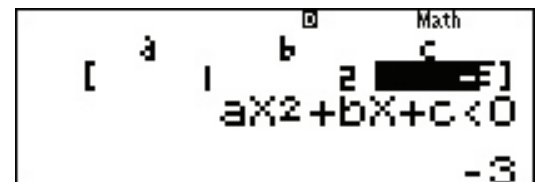
1. Press **1** to select a quadratic inequality.



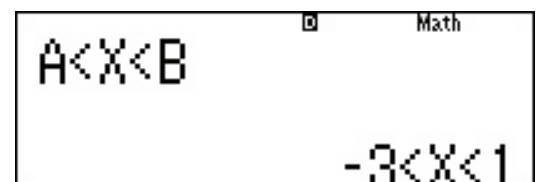
2. Press **2** to select the less than inequality.



3. Enter the coefficients of each term and the constant by pressing **1** **=** **2** **=** **(←)** **3** **=**.



4. Press **=** to display the solution set.

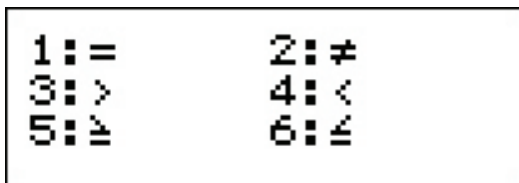


VERIF MODE

VERIF Mode allows you to verify whether an input equality or inequality is true or false. Press **MODE** \blacktriangledown **2** to enter VERIFY Mode.



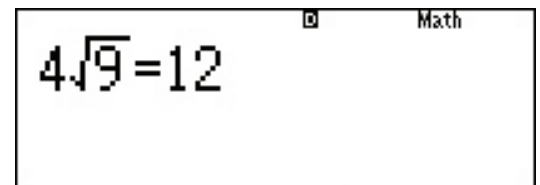
Note: Pressing **SHIFT** **6** will bring up a menu of equality or inequality symbols to use.



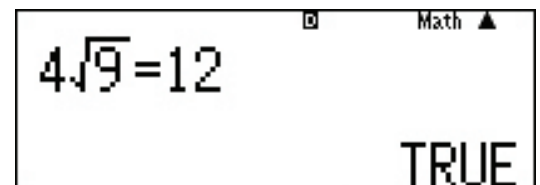
Verify whether $4\sqrt{9} = 12$ is true or false:

1. Enter the equation by pressing

4 $\sqrt{\square}$ **9** \blacktriangleright **SHIFT** **6** **1** **1** **2**.



2. Press **☰** to see if the statement is true or false.



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