

# Persona Equation 4D (Universal Windows Platform application)

## Operation manual Ver. 1.1 (2020/ 3/10)

**At the beginning:** This application's characteristics are: number change by "direct touch to number" and automatic calculation of result. No explanation is necessary for basic calculations, I think. This manual includes only the minimum functional description. Word "Touch" in this manual is assuming touchscreen. If you use different point device like mouse, please replace it with the corresponding operation.

**Attention:** Please check by yourself carefully any value, if you use it to practical purpose.

I make no warranty and can't respond to claims of any kind of damage.

I have developed and checked this application with Surface Pro, its keyboard, and attached mouse. I follow rule of Universal Windows Platform, and I have corresponded and checked different screen resolution, so I believe it works on any models without a problem, but I can't guarantee. If you encounter this application's trouble, I wish you to inform me it with as much as possible detailed information like equipment specs, etc.

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## Attached calculations in this Application

This application is specialized to equation solver. It has 8 sheets.

By scrolling right or left (Touch dark color behind and move right or left), you can switch to another sheet.

1. 2/3/4-VLE simultaneous equation coefficient 4sheets

a1: 🔒 -1.	a2: 🔒 2.	a3: 🔒 3.	a4: 🔒 1.
b1: 🔒 2.	b2: 🔒 2.	b3: 🔒 -2.	b4: 🔒 1.
c1: 🔒 3.	c2: 🔒 -3.	c3: 🔒 1.	c4: 🔒 1.
d1: 🔒 4.	d2: 🔒 -1.	d3: 🔒 -4.	d4: 🔒 1.
e1: 🔒 5.	e2: 🔒 -3.	e3: 🔒 -9.	e4: 🔒 -2.
$a1 \cdot x + b1 \cdot y + c1 \cdot z + d1 \cdot w = e1$	$a2 \cdot x + b2 \cdot y + c2 \cdot z + d2 \cdot w = e2$	$a3 \cdot x + b3 \cdot y + c3 \cdot z + d3 \cdot w = e3$	$a4 \cdot x + b4 \cdot y + c4 \cdot z + d4 \cdot w = e4$

2. 2/3/4-VLE simultaneous equation solution

x: 🔒 -4.
y: 🔒 3.
z: 🔒 1.
w: 🔒 -2.

By scrolling up or down (Touch dark color behind and move up or down), you can switch 2/3/4-VLE on the sheet.

a1: 🔒 -1.	a2: 🔒 2.
b1: 🔒 2.	b2: 🔒 -3.
c1: 🔒 30.	c2: 🔒 21.
$a1 \cdot x + b1 \cdot y = c1$	$a2 \cdot x + b2 \cdot y = c2$

a1: 🔒 -1.	a2: 🔒 2.	a3: 🔒 1.
b1: 🔒 2.	b2: 🔒 3.	b3: 🔒 1.
c1: 🔒 3.	c2: 🔒 4.	c3: 🔒 1.
d1: 🔒 24.	d2: 🔒 32.	d3: 🔒 18.
$a1 \cdot x + b1 \cdot y + c1 \cdot z = d1$	$a2 \cdot x + b2 \cdot y + c2 \cdot z = d2$	$a3 \cdot x + b3 \cdot y + c3 \cdot z = d3$

x: 🔒 132.	z: 🔒 -5.
y: 🔒 81.	y: 🔒 50.
	z: 🔒 -27.

### 3. N-degree equation coefficient

a:	1.
b:	3.
Solution	-3.
$a \cdot x + b = 0$	

a:	1.
b:	2.
c:	-3.
$a \cdot x^2 + b \cdot x + c = 0$	

By scrolling up or down (Touch dark color behind and move up or down), you can switch linear/quadratic/cubic/biquadratic on the sheet.

Thin color squares are either number input field or calculation result field. You can switch these by touch. (P.8)

a:	1.
b:	-3.
c:	-6.
d:	8.
$a \cdot x^3 + b \cdot x^2 + c \cdot x + d = 0$	

a:	1.
b:	-6.
c:	1.
d:	24.
e:	-20.
$a \cdot x^4 + b \cdot x^3 + c \cdot x^2 + d \cdot x + e = 0$	

### 4. N-degree equation solution and slope

Solution1	-3.
Solution2	1.
X-coordinate	1.
Slope $\Delta y/\Delta x$	4.

Solution1	-2.
Solution2	1.
Solution3	4.
X-coordinate	1.
Slope $\Delta y/\Delta x$	-9.

Solution1	-2.
Solution2	1.
Solution3	2.
Solution4	5.
X-coordinate	3.
Slope $\Delta y/\Delta x$	-24.

### 5. Coordinate (pole or any X entry)

Point A x-coordinate	-1.
Point A y-coordinate	-4.
Point B x-coordinate	1.
Point B y-coordinate	0.
Point C x-coordinate	0,000,000,000.
Point C y-coordinate	0,000,000,000.

Point A x-coordinate	$1 - \sqrt{3}$
Point A y-coordinate	$6\sqrt{3}$
Point B x-coordinate	$1 + \sqrt{3}$
Point B y-coordinate	$-6\sqrt{3}$
Point C x-coordinate	1.
Point C y-coordinate	0.

Point A x-coordinate	-1.
Point A y-coordinate	-36.
Point B x-coordinate	$1 \frac{1}{2}$
Point B y-coordinate	$3 \frac{1}{16}$
Point C x-coordinate	4.
Point C y-coordinate	-36.

Depending on window size, following items are switched. Display length 10-digits or 14-digits, 1 sheet or 2 sheets pair, and vertical or horizontal.

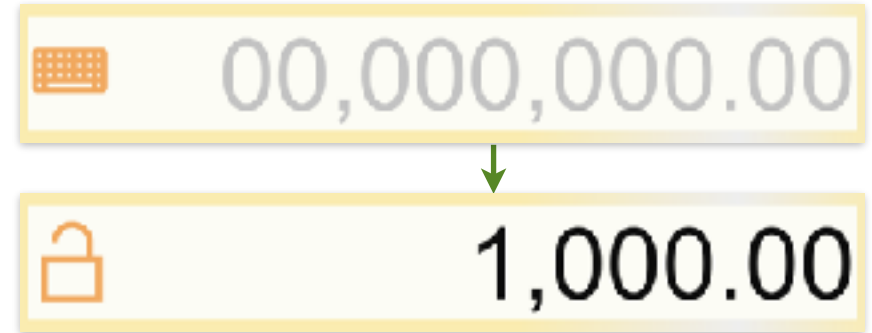
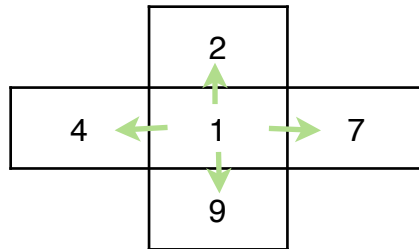
## Number Input

There are 4 ways to input number. (①Touch to number itself ②Copy/Paste ③Software keyboard ④Hardware keyboard)

### ① Touch to number itself

In number input field, if it is initial state, input guide is dimmed.  
(Right figure)

**Touch directly** the digit in the guide, the most significant digit of number you want to input. The digit changes to below table number depending on following action. (Release without move/Up/Down/Right/Left)  
Operate slowly. Stop a moment after touching and then move.

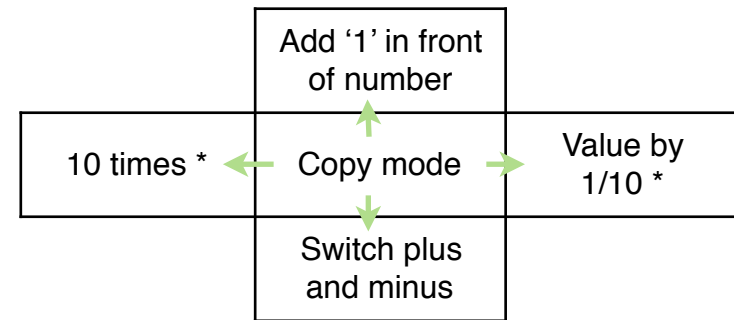


Adjust to aimed number by similar repeated touch actions to each digit.

After this, motion differs depending on whether on blank or on number, and following action. (Release without move/Up/Down/Right/Left)  
**On number**, below left table operations work. Only when moving up or down, continuous operation works, for adjusting the value.



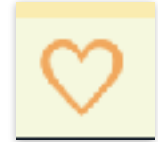
**On blank**, below right table operations work.



\* mark function doesn't work on value including symbol, like fraction.

## ② Copy/Paste

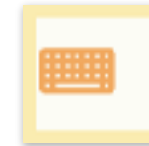
- (1) Touch and release on blank in front of the number you want to copy. Its color turns to thin.
- (2) Touch and release in destination number input field. The value (1) is pasted. The value is rounded following the settings (P.9).  
Or touch again on the same (1). The value is stored in clipboard.
- (3) By a touch on blank in front of input guide, the value in clipboard is pasted.  
In copy/paste operation, memory button (Right figure, bottom of sheet) is possible to use instead of number.  
When memory holds a value, the symbol is filled.



- (4) **Copy/Paste of whole sheet:** Touch and release on dark color behind. Select from appearing popup menu.  
(Selector is shown in the case only it works.)  
By copy choice, whole sheet text is stored in clipboard. By paste choice on another sheet, the clipboard content is recalled on it.  
And you can paste it into different application like Excel, NotePad.

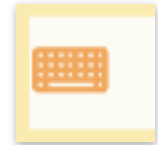
## ③ Software keyboard

Keyboard (P.7) appears by touch to the left side button (Either of right figure) in the number field.



## ④ Hardware keyboard

You can use hardware keyboard for number input. If software keyboard is on screen, the key input is entered on it. Otherwise, the key input is entered in number input field with keyboard button (Right figure). When 2 sheets are on screen, left sheet is entered. Until [Enter] key press, the number is not fixed.

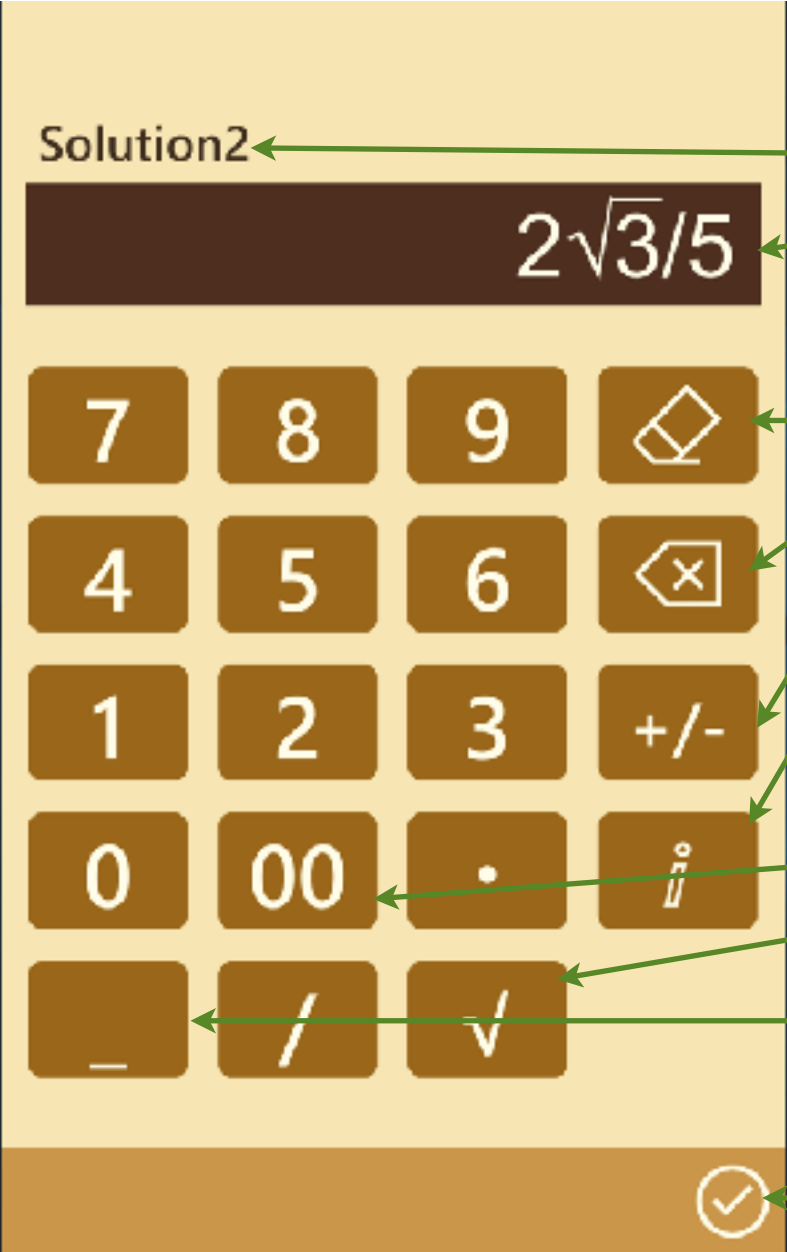


### \* Clear of number

By touch to the eraser button (Right figure, bottom right of sheet), whole sheet on screen is cleared.  
As a prevention of calculation loss by miss touch, it doesn't work by short touch. Memory is held in this sheet clear action.  
When you want to clear only one number or a memory, select it by the Copy/Paste(1) operation, and touch eraser button.



## Keyboard



2 keyboards (real, imaginary) are equipped and suitable keyboard is automatically selected corresponding to the content. (Below is imaginary keyboard)

Solution2 ← Label of the inputting number.

$2\sqrt{3}/5$  ← This displaying number is stored. Touch correction to number is possible. After storing, it is rounded according to the setting (P.9). If it is blank, nothing is stored.

← Clear inputted number. It doesn't work by short touch. (Hard key [Del])

← Delete last 1 character.

← Switch plus and minus. (No hard key)

← When complex number solution is ON (P.9), imaginary unit can be inputted in Solution2/4 field. And the imaginary part and the real part in Solution1/3 constitute one complex number. (This relation is the same in calculation result, too.) (Hard key [i])

← (Hard key [Space])

← (Hard key [R])

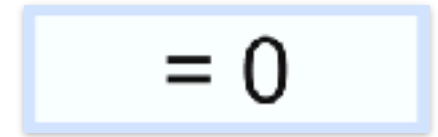
← Symbol keys vary equipped depending on the keyboard. [ ] is a separator integer part of the mixed fraction. [ / ] is a separator between numerator and denominator.

← Finish number input and **quit** this sheet. (Hard key [Enter])

## Other operations

### \* Selector

Thin colored bottom square of N-degree equation coefficient sheet is a selector (Right figure). You can choose from the defined contents by touch and following action (Release without move/Up/Down). Inequality can be solved. However, the input to the solution can be combined only with equality.



### \* Calculation result field

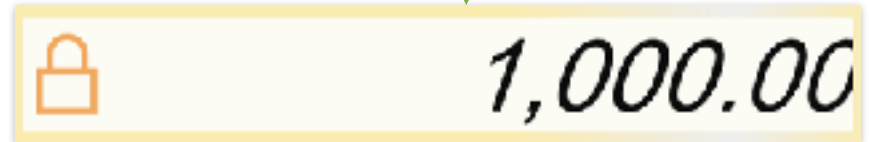
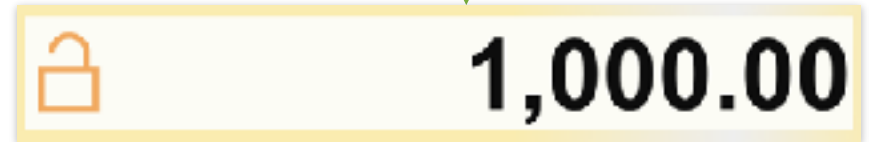
In calculation result field, before calculation, blank is displayed (Right figure).

At the time inputted number amount reaches to the possible level, the calculation is automatically done and the result is displayed when it is in the range.

The calculation result is rounded according to the setting (P.9) and displayed in thick.

Touch to calculation result field, regardless of which blank or result, changes it to number input field.

(However, there are cases logically impossible. Neither software keyboard nor lock button works in the situation.)



### \* Lock of number

Lock button is shown left side of both number inputted and calculated (Right figure). The number is locked by touch to the button.

The value is held while locking. However, it changes by reset or reload operation (P.9).

Re-touch to lock button releases this lock state. As a prevention of value change by miss touch, it doesn't work by short touch.

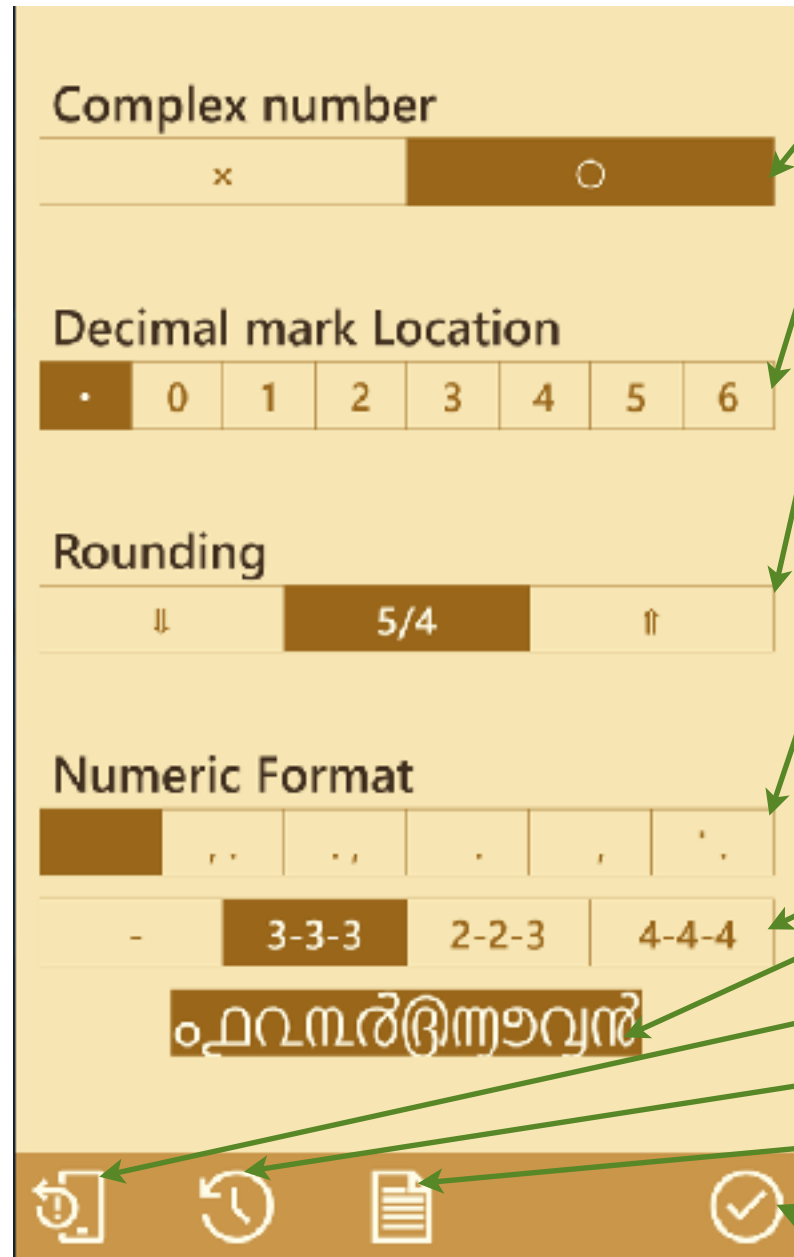
### \* Setting change

Settings sheet (P.9) appears by touch to the gear button (Right figure, bottom left of sheet).





# Settings



Switch showing **complex number solution** or not.

**Rounding location** is same in all numbers. Choose decimal part length.  
 At '!' setting, fraction/irrational number is displayed as it is.  
 Number is full digit display.(Until 10 or 14 digits. Digit is reduced depending on format.)

**Rounding rule** is same in all numbers. (Round down/Round off/Round up)

### Decimal point/Separator character

Blank: Default of the unit

,. : 1,234,567,890.

., : 1.234.567.890,

. : 1 234 567 890.

, : 1 234 567 890,

' : 1'234'567'890.

### Separator location

- : 1234567890.

3-3-3 : 1,234,567,890.

2-2-3 : 1,23,45,67,890.

4-4-4 : 12,3456,7890.

### Number type

19 type numbers are available and switched by touch.  
 (Up/Down)

**Reset:** Use it only when you want to initialize this application.

Reload the situation this application started. It doesn't work by short touch.

Show this manual.

Finish these settings and **quit** this sheet.

## Equation calculation

Outline graph of the N-degree equation/2-VLE simultaneous equation can be seen by touch to the graph button. (Right figure, bottom of sheet)

The ratio is automatically adjusted on the screen. (Right bottom figure)

When graph doesn't exist, graph button becomes coordinate axis only and it is no operation.



**N-VLE simultaneous equation:** By all input of either below, remains are automatically calculated.

\* All coefficients

\* All solution values, and all coefficients with the exception of one alphabet

2/3/4-VLE switching can be no operation in some case. Set solution to result field, and go to 1st coefficient sheet. Switching works.

**N-degree equation:** By all input of either below, it is automatically calculated.

\* From all coefficients, into solution values and coordinate of the extremes.

\* From all solution values and coefficient 'a', into rest coefficients and coordinate of the extremes.

\* From 2 points coordinates of the linear equation or 3 points coordinates of the quadratic equation, into all coefficients and solution values.

Coefficients calculated from coordinates are fixed even if it is input field.

\* If X-coordinate is entered in solution and slope sheet, slope of the point is calculated.

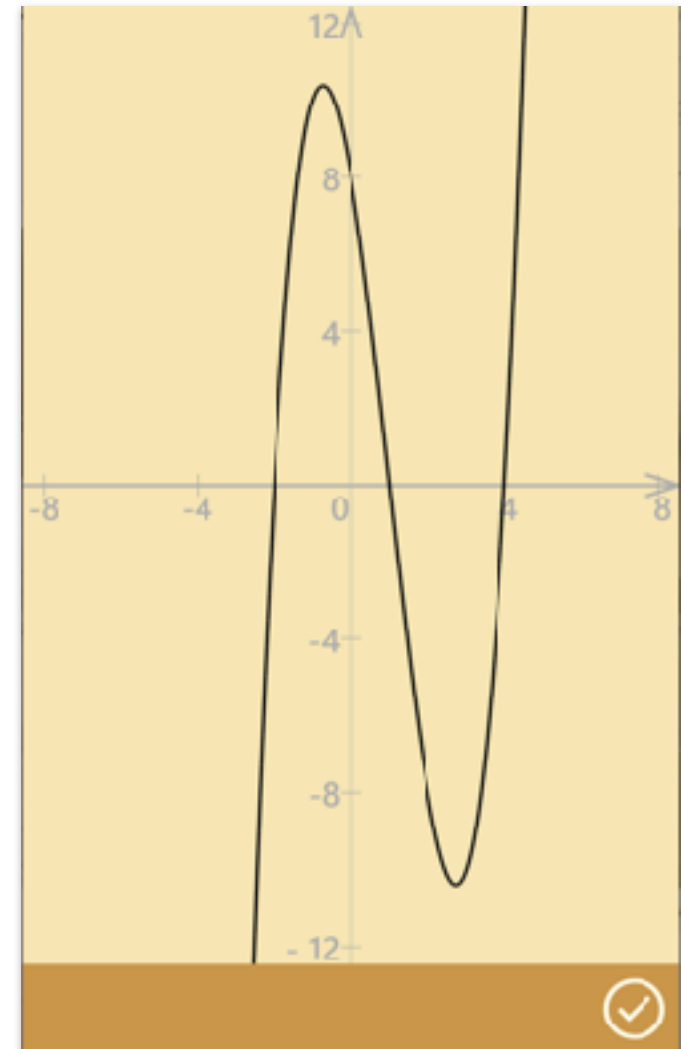
\* If X-coordinate is entered besides extremes in coordinate sheet, Y-coordinate of the point is calculated.

1/2/3/4-degree switching can be no operation in some case. Set solution to result field, go to coefficient sheet, and choose equality. Switching works.

**Note:** This application mainly aims engineering use and calculates decimal result.

But until the level I think necessary for the educational use, it equips with fraction/square root shape result. (Level like fractional solution in a cubic equation)

CAS sometimes shows the complicated expression result. Though it is accurate, I think it has no utility. It doesn't correspond to such CAS level.



## **Modification history**