Review Article

The Arithmetic of Clocks.

Subtitle: *Mathematically describing the master-clock of the entire universe, to which even your own wristwatch is subordinated.*

BMJC Bieżanek*

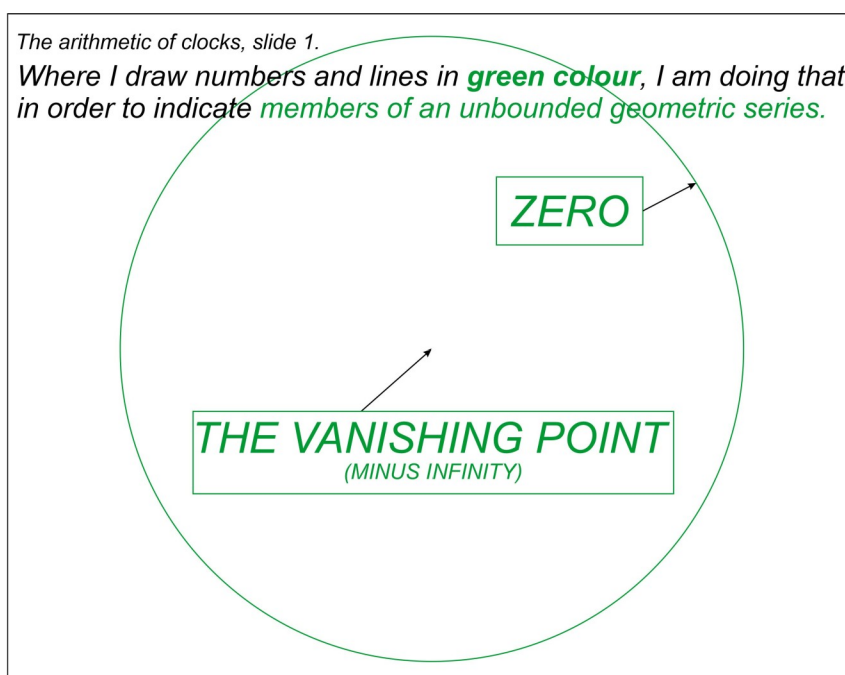*Distinguished Researcher, Shropshire, UK*

*Corresponding Author
Benedykt Michal Josef Campbell-Biezanek, Distinguished Researcher, Shropshire, UK.
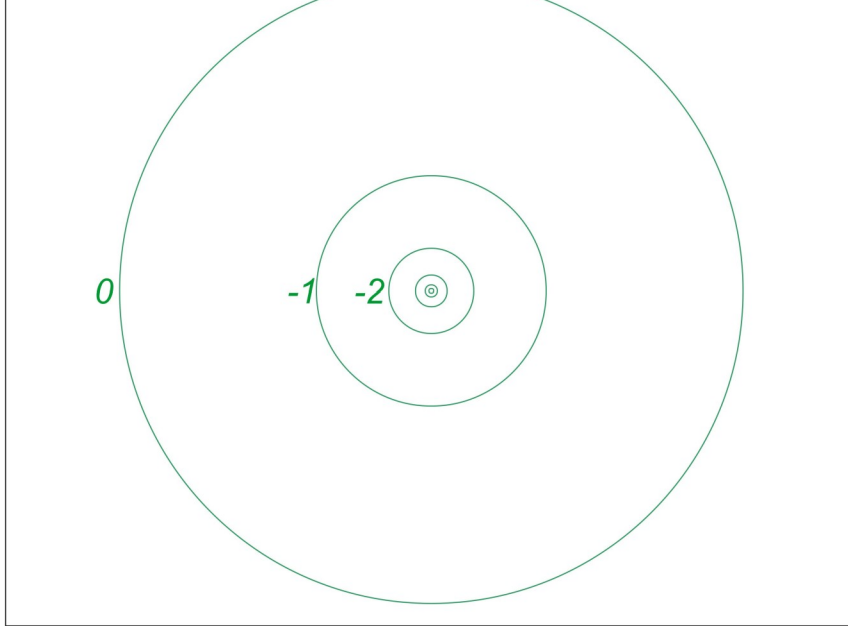
Citation: Bieżanek, B. M. J. C. (2024). The Arithmetic of Clocks. *Adv Theo Comp Phy, 7*(2), 01-12.

The polar-exponential arithmetic of clocks is the mathematics of time. A quartz oscillator, an L-C circuit, a grandfather clock, a balance wheel chronometer, the earth spinning, an atomic clock or even the heartbeat of an unborn lamb; they all have one thing in common - the polar-exponential arithmetic of clocks. If your life seems to be run by clocks, then there can be no doubt about it at all, you must be living within a system that works upon exponential principles.


The arithmetic of clocks, slide 1.
*Where I draw numbers and lines in **green colour**, I am doing that in order to indicate members of an unbounded geometric series.*

ZERO

THE VANISHING POINT
(MINUS INFINITY)

The arithmetic of clocks, slide 2.

The green zero-circle is a member of an unbounded geometric series of circles, and we can arbitrarily assign any member of the boundless set to be the zero-circle, the index numbers of all the others just automatically follow suit.

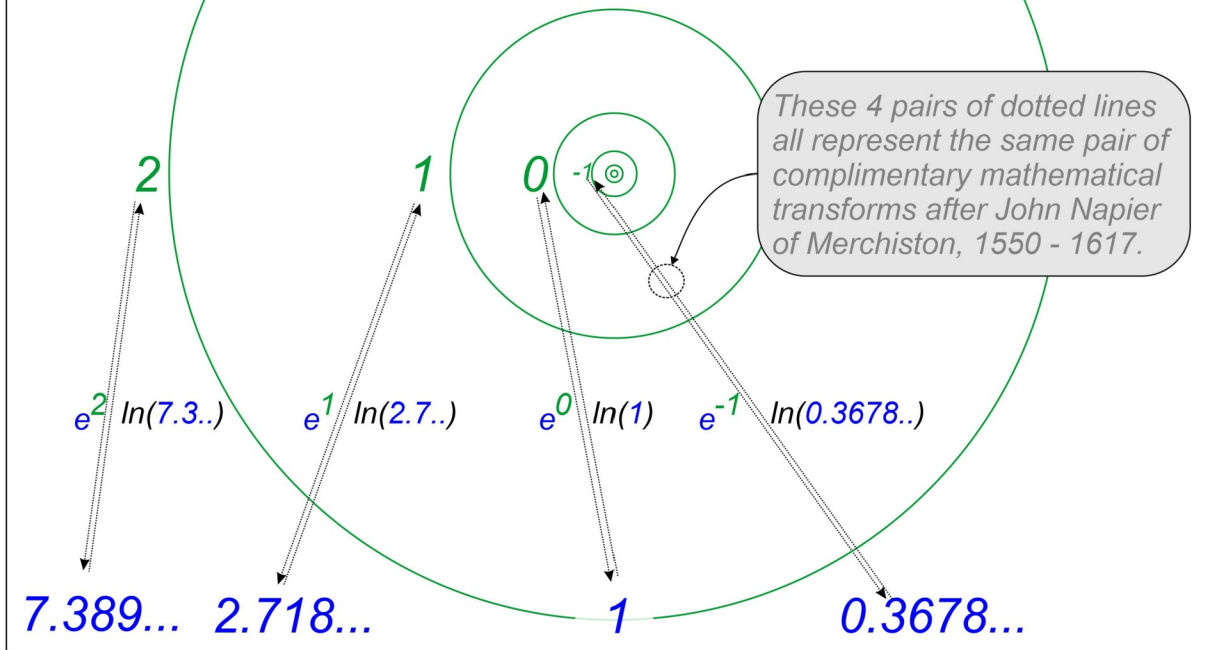*The arithmetic of clocks, slide 3.*
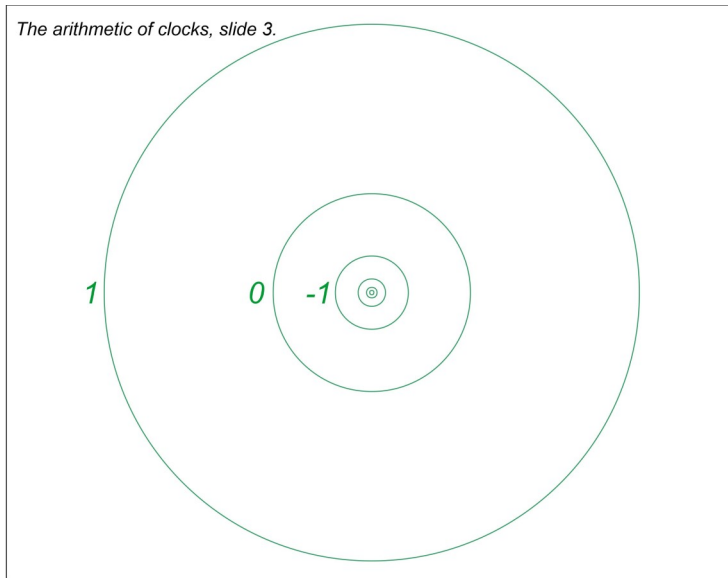
Due to the limitations of my sketch size, I can only ever show six consecutive whole number members of the infinite set. Here I show the circles 2, 1, 0, -1, -2, -3 but the three inner circles are so tiny that there is no space to show the index.

*The arithmetic of clocks, or the mathematics of time, slide 5.*

The green numbers are the natural exponential numbers and the blue numbers are your flat (finger counting) numbers.

There is no fundamental arithmetical truth here, the green system and the blue system are just two equally valid methods of counting.

These 4 pairs of dotted lines all represent the same pair of complimentary mathematical transforms after John Napier of Merchiston, 1550 - 1617.

e^2 $ln(7.3..)$ e^1 $ln(2.7..)$ e^0 $ln(1)$ e^{-1} $ln(0.3678..)$

7.389... 2.718...   1   0.3678...

Every value on the surface of this bottomless exponential numerical well has a simple relationship with the equivalent flat finger counting numbers that we are so used to. Above I show how #2 maps to #7.389..., #1 maps to #e, #0 maps to #1 and of course #-1 maps to #0.3678...

I may add fractional circles without limit. Here I add the quarter points. Every circle in the quarter series is just 0.7788... (e^-0.25) times smaller than the one outside it. We need to imagine that we are looking down an infinite hole or well with a continuous surface. We can call this bottomless well or bottomless number pit **the exponential-rotational-manifold**.

The arithmetic of clocks, slide 6a.

0

-0.25

+0.25

+0.50
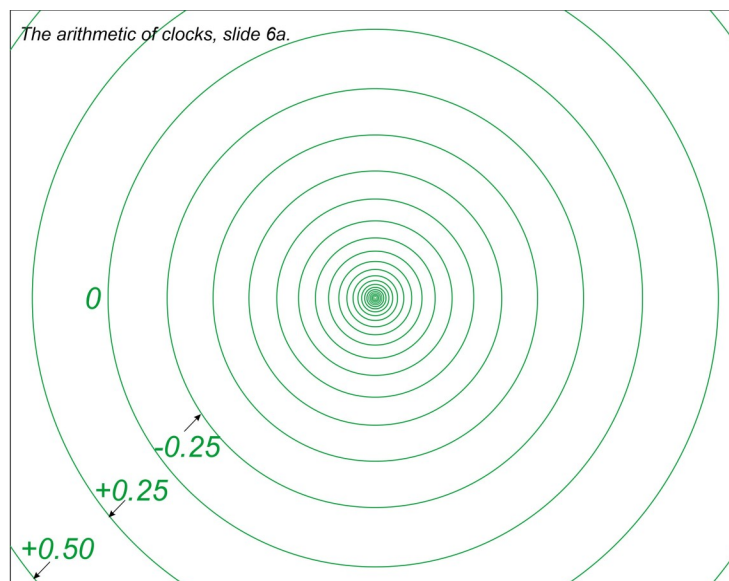
Here I show deep into the infinite well, arbitrarily picking my outermost whole circle being drawn at index number -9,854,081. In this Gaussian School arithmetic, we can have an index of zero and a rotation of zero, but we must use a new name for 0 in flat finger counting numbers; we call that point **the absolute numerical vanishing point,** it lies on the notional bottom of our infinitely deep number well.


The arithmetic of clocks, slide 7.

-9,854,081.00

-9,854,081.25

-9,854,080.75

*The absolute numerical vanishing point at the bottom of this bottomless exponential Gaussian number-well has no finite magnitude, it is **infinitely tiny***
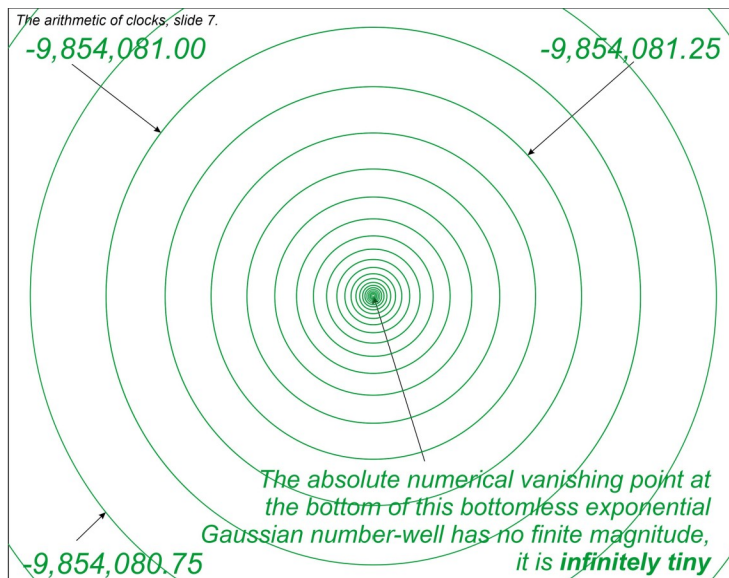
So far, the numbers on the surface membrane of our bottomless number-well are just **ratio-metric relative magnitudes**. Now I can identify polarity upon any point of the surface of the bottomless relative magnitude well. Every point on the surface of this three-dimensional exponential rotational manifold has the property of relative ratio-metric magnitude and the property of **relative rotational direction.** Here we see a flat two-dimensional horizontal section of the manifold taken on the alpha = zero plane. I add an arbitrary rotational reference direction which will be counted as the zero relative rotation line, this is identified in purple colour to clarify its association with left rotation only.

The arithmetic of clocks, slide 8.

the reference direction (0)

0

MINUS INFINITY
aka the vanishing point
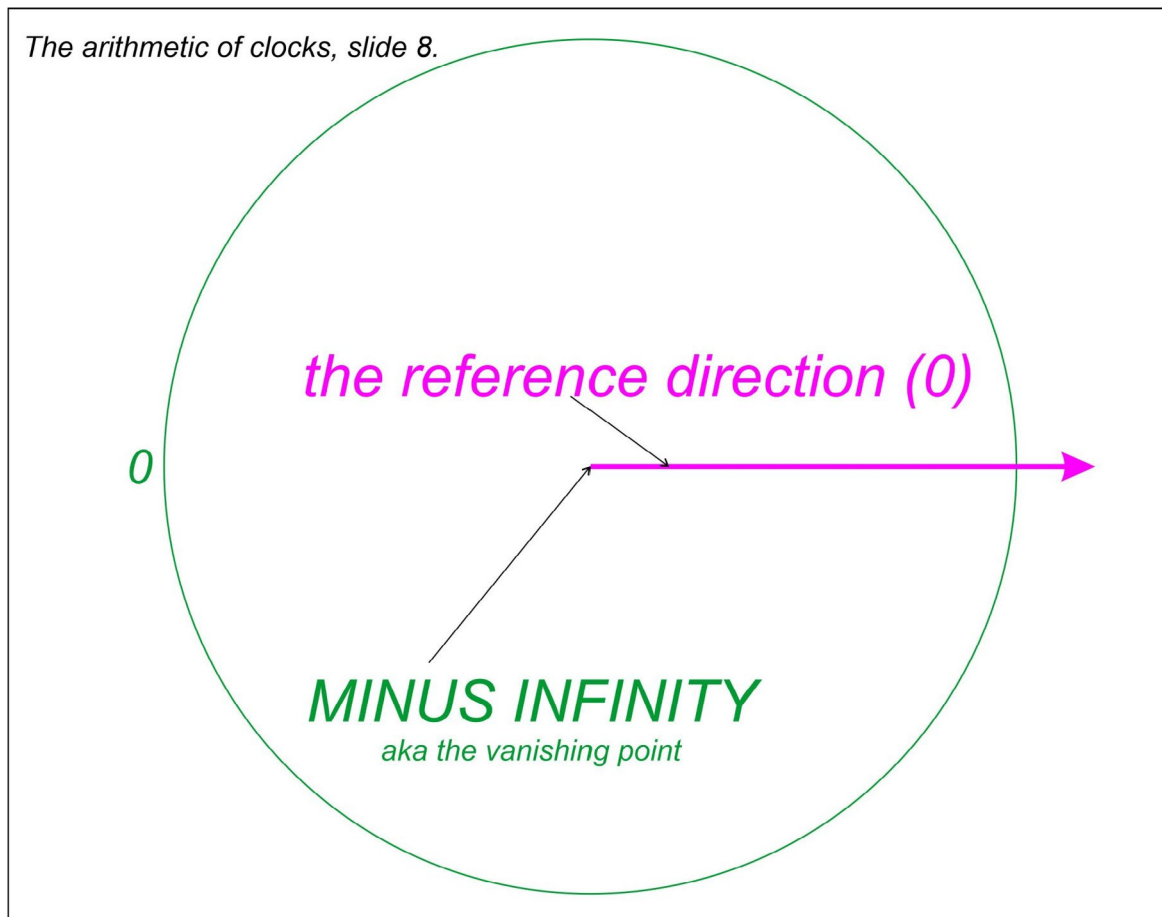
Here we can show our first definite value where zero-left (or zero-right) relative rotation intersects the zero relative magnitude circle of our exponential manifold. We can evaluate this to be the **flat number +1** because e^0 is one and it is aligned with our chosen numerical reference direction. Within this Gaussian School arithmetic there is no such number as "add-one", that remains as a valid arithmetical operation of course, but it should

not be confused with being a pure number. The pure flat number +1 needs a new name, but this name is only "new" in the sense of the utterly ignored **key paper, the 2nd letter of Carl Friedrich Gauss to the Royal Society, 1831.** Within the Gaussian School of higher-arithmetic we must call this flat (non-exponential) number **"direct-one"** (+1).

The arithmetic of clocks, slide 9.

0 and 0

0

0

-0.25

+0.25

direct-one (+1)
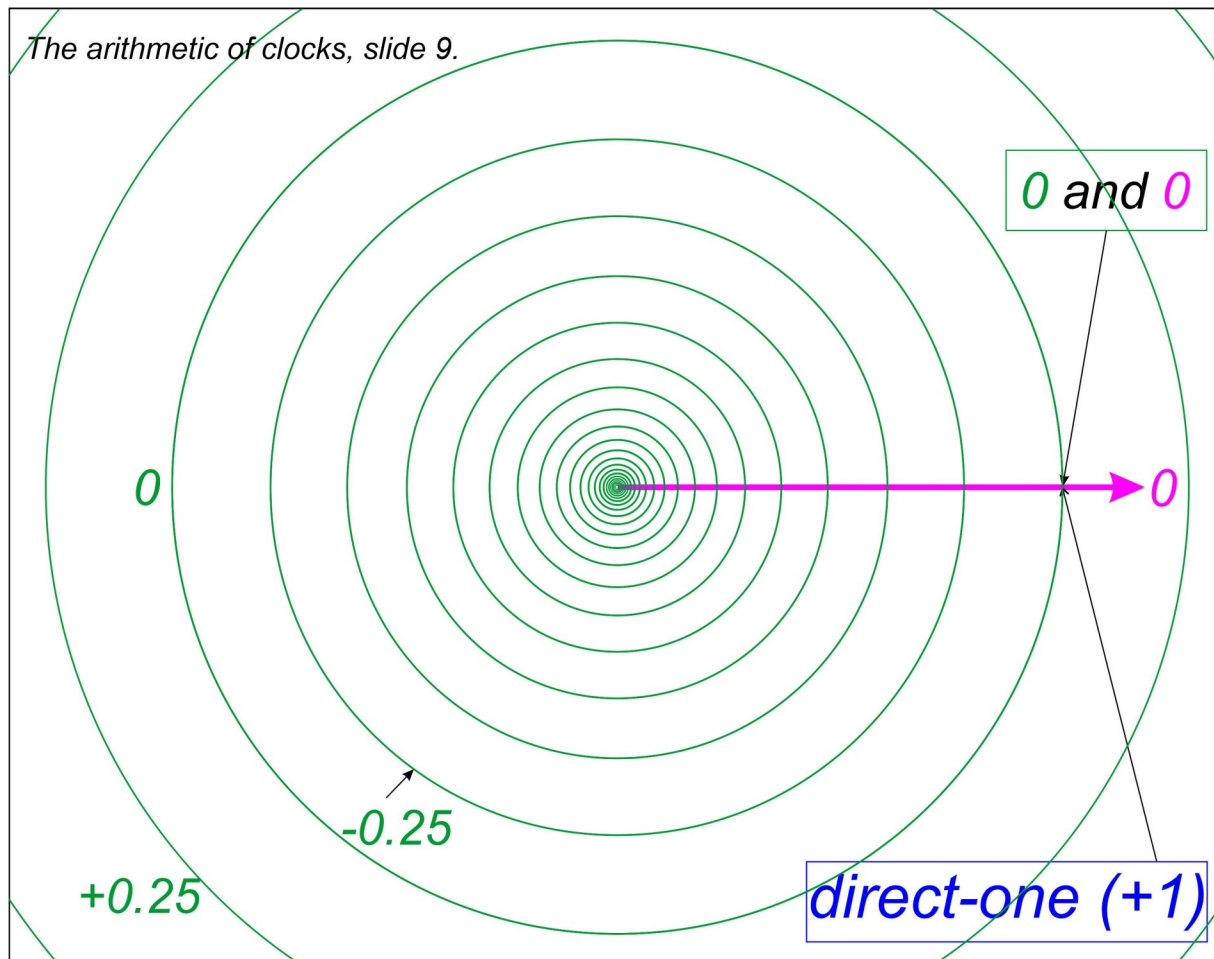
The key to the Gaussian School algebraic colour coding hints.

■ *flat numerical magnitude (i.e a finger-counting value).*
■ *relativistic ratio-metric magnitude, an exponential value.*
■ *numerical polarity rotation in the left or anti-clockwise direction.*
■ *numerical polarity rotation in the right or clockwise direction.*
■ *numerical polarity rotation in invalid angular units*

i is the universal-polarity-rotator; in flat (finger counting) arithmetic it can only be used in the grammatical forms: a.ir meaning; magnitude times a-rotation-of-left-rotation (in quadrant units) and; a.ir meaning; magnitude times a-rotation-of-right-rotation (in quadrant-units).

We can show any direction about our exponential manifold, notice that we are counting the left rotations in quadrants. This is the arithmetic of clocks or the mathematics of time itself and this manifold here is a derivative of **the exponential number plane**.

The exponential plane has two axes but with axial dimensions that are as different as chalk and cheese. Euclidean 2-d planar geometry must not be applied. Notice that I add an interpretation of the flat plane numbers **direct-one** (+1) and **inverse-one (-1).**

The arithmetic of clocks, slide 10.
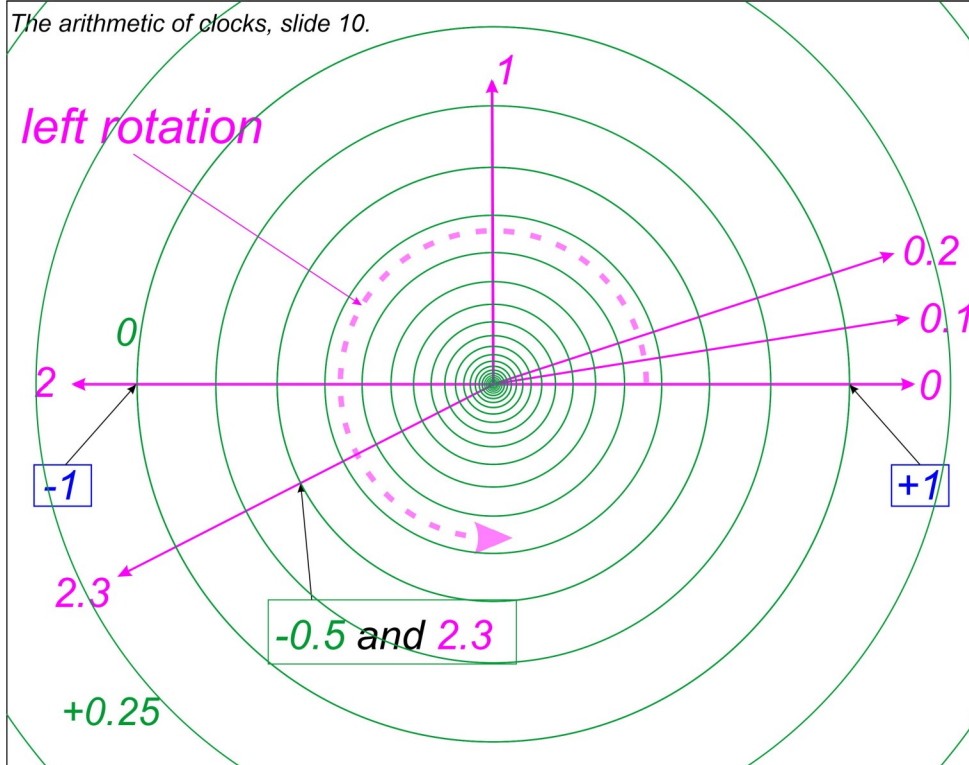
Here we can show various right directions about our exponential rotational manifold.

The arithmetic of clocks, slide 11.
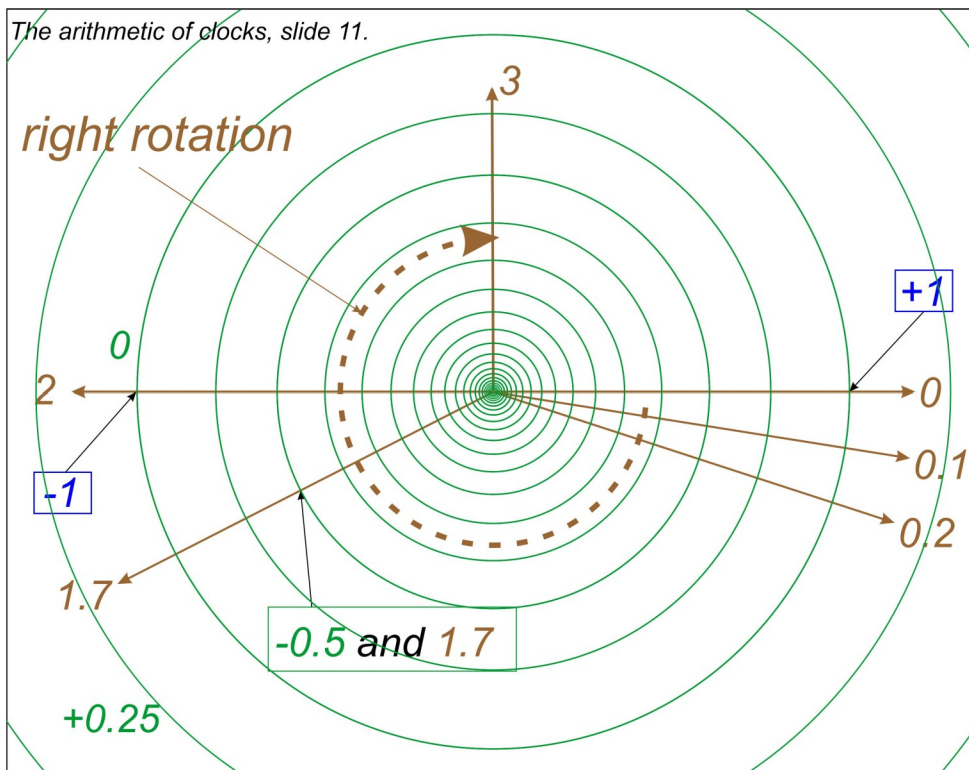
We can now examine five sequential views showing how a notional generic quantum-clock builds up her own historic depth.

The arithmetic of clocks, slide 11a.

THIS IS QUANTUM-PHYSICS

this is your "reality", forget the classical-mechanics concept of time.

0

The "relative quantum event" or clock reset.

The arithmetic of clocks, slide 11b.

THIS IS QUANTUM-PHYSICS

this is your "reality", forget the classical-mechanics concept of time.

0

NOW

NOW

The "relative quantum event" or clock reset.

The arithmetic of clocks, slide 11c.

THIS IS QUANTUM-PHYSICS

this is your "reality", forget the classical-mechanics concept of time.

0

NOW

NOW

The "relative quantum event" or clock reset.

The arithmetic of clocks, slide 11d.

THIS IS QUANTUM-PHYSICS

this is your "reality", forget the classical-mechanics concept of time.

0

NOW

NOW

The "relative quantum event" or clock reset.

The arithmetic of clocks, slide 11e.

The image of the "relative quantum event" or clock reset is moving backwards into two equally possible mirror images of that history, relative to TIME-NOW.

0

NOW

The history of "THIS NOW"

The "relative quantum event" or clock reset.

NOW

NOW always has a present and a history, but it never has a future.

In fact, it is far clearer to draw the present as standing still at the quantum-observation-horizon at time- now and the past as falling backwards while being in fact as yet undetermined.

Until that is, it is forced into determination; by for instance, the opening of "Schrödinger's box".

The arithmetic of clocks, slide 11f.

The image of the "relative quantum event" or clock reset is moving backwards into two equally possible mirror images of that history, relative to TIME-NOW.

0

TIME-NOW (an event-horizon)

NOW always has a present and a history, but it never has a future.
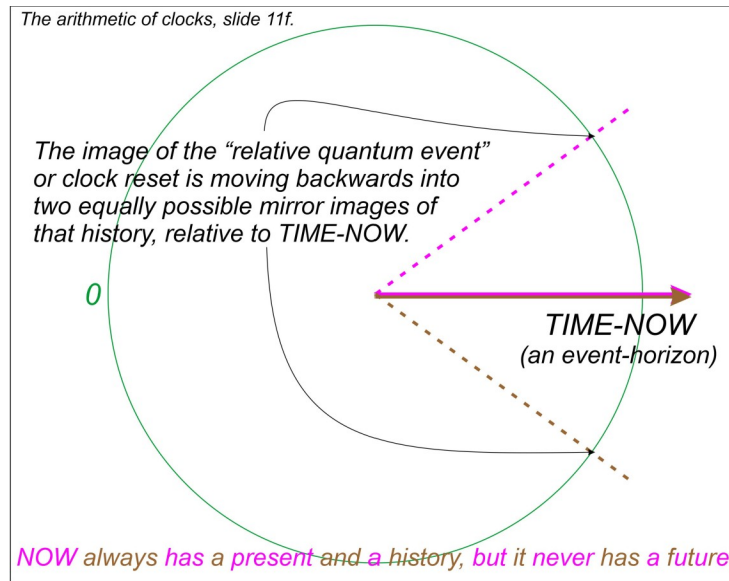
However, this exponential-rotational-manifold has now outlived its usefulness to us because right and left rotations of our clock must not overwrite each other and we need to be able to express many completed rotations, in both the left and the right directions. The three-dimensional exponential rotational manifold is just **a useful transitional device** empowering easy interpretation between **the fundamental exponential- number-plane** and the subordinated **flat-rotational-plane**. In a nutshell, we can declare that with an exponentially based Universe such as we exist within, "flat-earth-arithmetic" or "finger-counting-arithmetic" is not only highly confusing but definitely imposes many utterly debilitating intellectual limitations upon any Natural Philosopher.

The arithmetic of clocks, slide 12.

The Complex Exponential Number Plane.

yet one more completed left rotation of the exponential-rotational-manifold.

α and $i\omega$

each purple step represents one quadrant of left rotation.

the black pips represent completed rotations of the exponential-rotational-manifold.

0 and *i0*

each brown step represents one quadrant of right rotation.
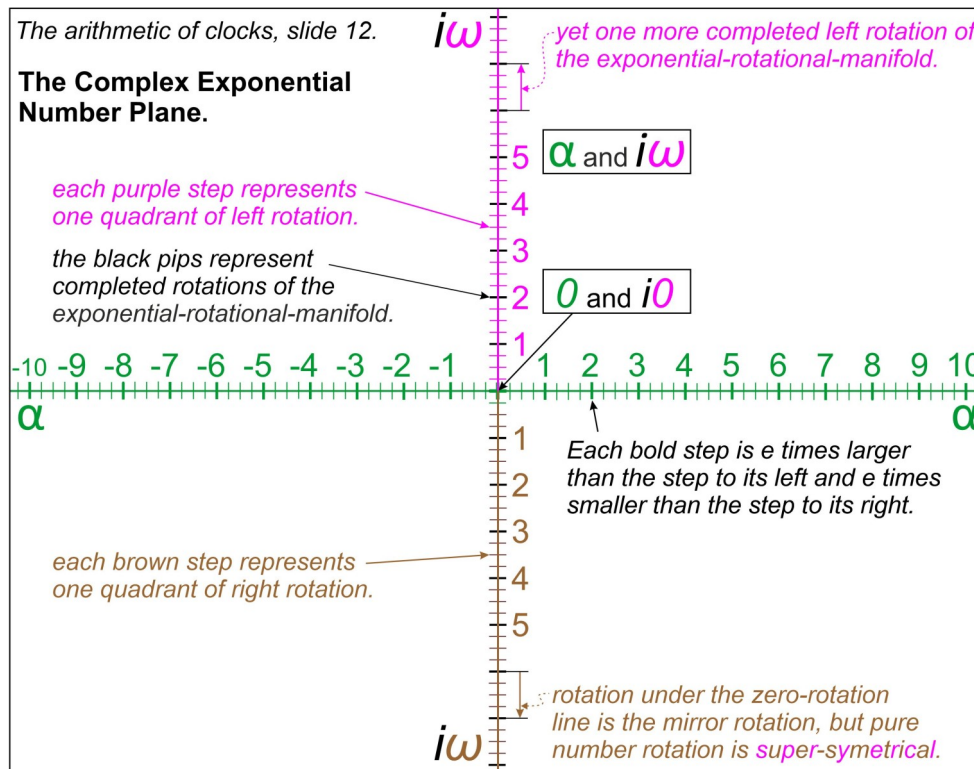
Each bold step is e times larger than the step to its left and e times smaller than the step to its right.

rotation under the zero-rotation line is the mirror rotation, but pure number rotation is super-symetrical.

The complex exponential-number plane represents the reality of Universal History Formation. We can have a Universe with the actual property of historic event formation space, or we could have the silly fantasy of a flat complex numerical plane with no mathematical understanding of time at all, but we can't have both.

The arithmetic of clocks, slide 12a.

The Complex Exponential Number Plane.

"Exponential" and "Logarithmic" are mathematically identical terms. The name means exactly the same as if it were called the Complex Logarithmic Number Plane.

$i\omega$

α and $i\omega$ +1

0 and $i0$

John Napier's 16th cent. reverse exponential transform (he called it the anti-logarithm).

1.i2 (ie -1)
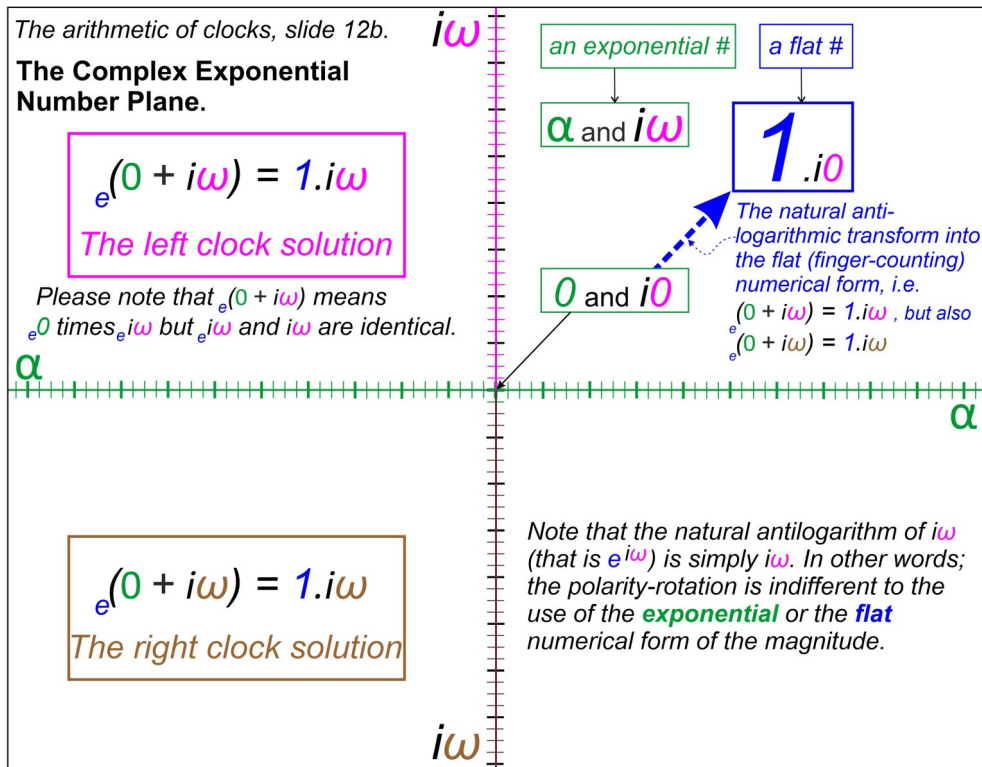
greater numerical magnitude

α (negative, relative to the arbitrary origin)

α

lesser numerical magnitude

1.i2 (ie -1)

Our clock is always telling the correct time now which is always and everywhere NOW or ω_0 and ω_0

The reading on the clock-dial tells us how long ago the reset was, that is the historic-depth of the time of the reset.

The feint grey box shows the bounds of normal human numerical cognisance, that is thought stuck inside the er-manifold.

$0.0000275.. = e^{-10.5}$

$e^{10.5} = 36{,}315$

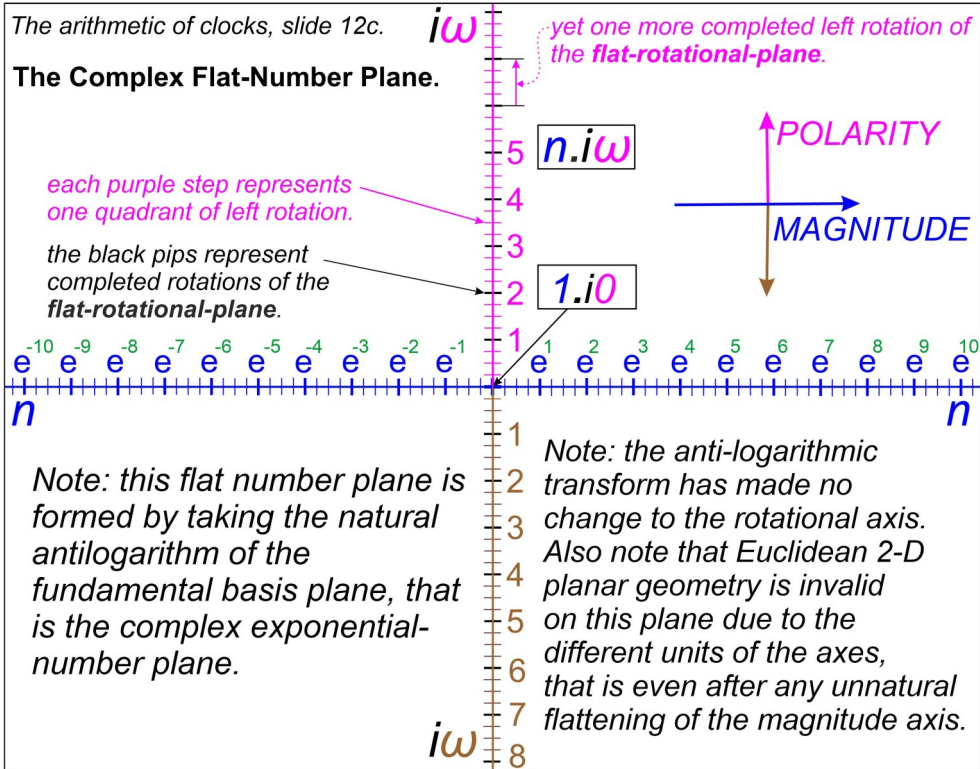the flat (finger counting) zero lies at magnitude α = -∞

$i\omega$

Please read and ponder upon the complex exponential number plane, it is a tough learning curve for anybody brought up on a never-ending diet of faulty flat-earth-arithmetic, but the conversion is well worth the effort.

The arithmetic of clocks, slide 12b. $i\omega$

The Complex Exponential Number Plane.

an exponential #   a flat #

α and $i\omega$

$$_e(0 + i\omega) = 1.i\omega$$

The left clock solution

$1_{.i0}$

The natural anti-logarithmic transform into the flat (finger-counting) numerical form, i.e.

$(0 + i\omega) = 1.i\omega$, but also
$_e(0 + i\omega) = 1.i\omega$

Please note that $_e(0 + i\omega)$ means $_e0$ times $_ei\omega$ but $_ei\omega$ and $i\omega$ are identical.

0 and $i0$

α

α

$$_e(0 + i\omega) = 1.i\omega$$

The right clock solution

Note that the natural antilogarithm of $i\omega$ (that is $e^{i\omega}$) is simply $i\omega$. In other words; the polarity-rotation is indifferent to the use of the **exponential** or the **flat** numerical form of the magnitude.

$i\omega$

It is of course possible to express the arithmetic of clocks in flat numbers, but it is a bit pointless. Note that if on the flat rotational plane, we make repeated complete rotations of the plane, as we see with for example the Earth returning to her same sidereal alignment every 23 hours, 56 minutes, and 4 seconds, we are failing to take account of the changing calendar. In other words, a neo-Pythagorean with his "flat- earth-arithmetic" might think that one day is the same as the next, but in reality, of course, that is utter nonsense.

The arithmetic of clocks, slide 12c.

The Complex Flat-Number Plane.
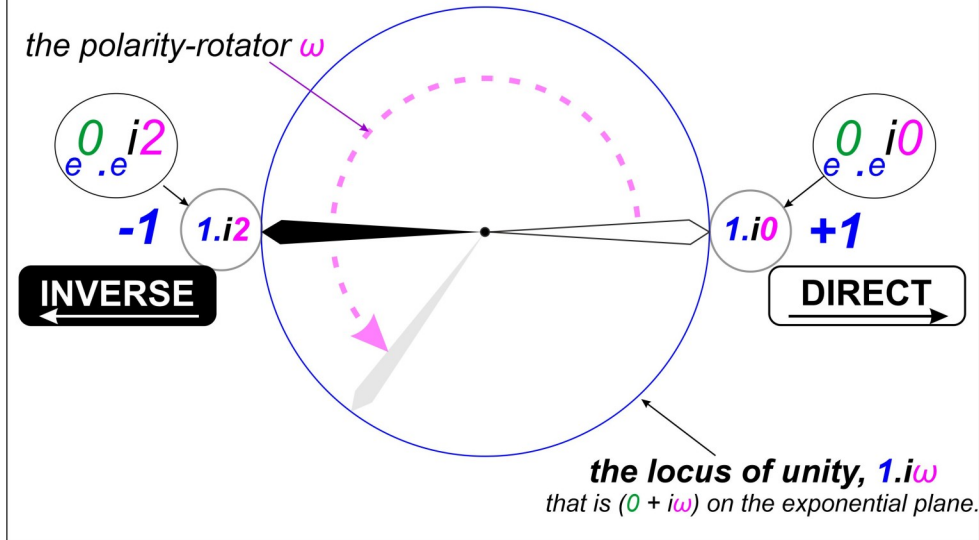
*yet one more completed left rotation of the **flat-rotational-plane**.*

each purple step represents one quadrant of left rotation.

*the black pips represent completed rotations of the **flat-rotational-plane**.*

POLARITY

MAGNITUDE

$n.i\omega$

$1.i0$

Note: this flat number plane is formed by taking the natural antilogarithm of the fundamental basis plane, that is the complex exponential-number plane.

Note: the anti-logarithmic transform has made no change to the rotational axis. Also note that Euclidean 2-D planar geometry is invalid on this plane due to the different units of the axes, that is even after any unnatural flattening of the magnitude axis.

We should not be left hanging in the air like this. We ought to review where the neo-Pythagorean "flat- earth-arithmetic" boys went wrong. Fortunately, this is like shooting rats in a barrel, the problem was if anything, just far too easy.
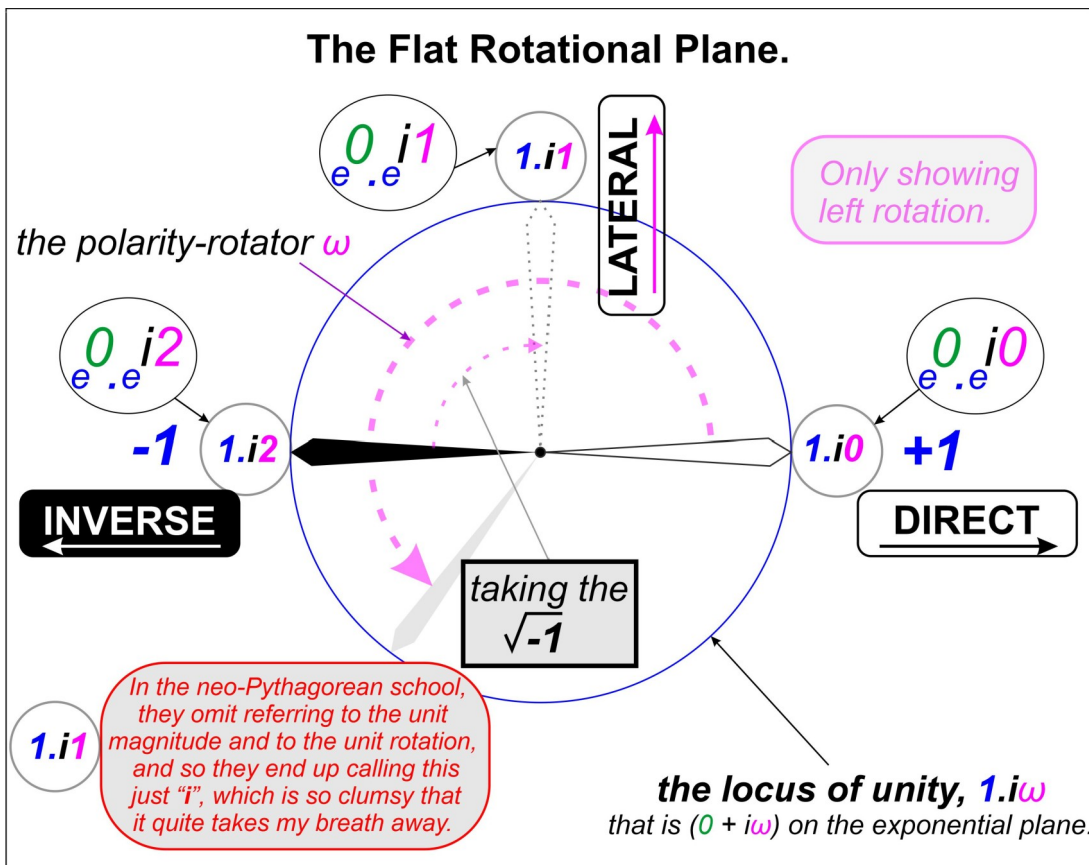

this refers to a rotation of π radians, it is an orphan-polarity, it is not a number

this is a number (zero magnitude; inverse-one, aka -1)

The Euler Identity

$e^{i\pi} + 1 = 0$ ✗

this represents "Alice in Wonderland" grade nonsense, aka claptrap.

$e^{(0+i\pi)} + 1 = 0$ ✓

$e^0.e^{i\pi} = -1$

the polarity-rotator ω

$e^0.e^{i\pi}$

$1.i\pi$

-1

INVERSE

$e^0.e^{i0}$

$1.i0$

+1

DIRECT

*The absolute numerical vanishing point in the centre of this circle has no finite magnitude, it is **infinitely tiny**.*

*Note that the natural antilogarithm of iπ (that is $e^{i\pi}$)is simply iπ. In other words; the polarity-rotation is indifferent to the use of the **exponential** or the **flat** numerical form of the magnitude.*

the locus of unity, 1.iω
that is (0 + iω) on the exponential plane.

For any workable theory of numbers we must use the quadrant,
in number-theory, the radian is utter nonsense. Employ q, aka π/2 radians.

This is because this flat rotational plane shown here is a derivative of the exponential number plane and must at least remain consistent with its own exponential shadow. Upon the exponential number plane the units of the two axes are different and are therefore not consistent with Euclidean 2D planar geometry.

the polarity-rotator ω

$e^0.e^{i2}$

$e^0.e^{i0}$

-1 1.i2

1.i0 **+1**

INVERSE

DIRECT

the locus of unity, 1.iω
that is (0 + iω) on the exponential plane.

Every primitive logical human (infant) knew very well that we cannot take away one from nothing. But we beat it into them, and they gave in and accepted the number minus-one. Then every adult knew very well that there was no such number as the square-root of minus-one, but they gave in and just went along with the absurdity of it all. Well, the primitives or tiny infants were right all along, there is no such number as minus-one, meaning the impossible "take away one from nothing". What really does exist however is the number-one times a rotation of two quadrants of polarity-rotation into inverse-one and the square-root of that is so obvious that even our colleagues in the neo-Pythagorean School of "flat-earth-arithmetic" might eventually be able to grasp it.

The Flat Rotational Plane.

$e^0.e^{i1}$ 1.i1

LATERAL

Only showing left rotation.

the polarity-rotator ω

$e^0.e^{i2}$

$e^0.e^{i0}$

-1 1.i2

1.i0 **+1**

INVERSE

DIRECT

taking the
$\sqrt{-1}$

In the neo-Pythagorean school, they omit referring to the unit magnitude and to the unit rotation, and so they end up calling this just "i", which is so clumsy that it quite takes my breath away.

1.i1

the locus of unity, 1.iω
that is (0 + iω) on the exponential plane.

Biography

The author is 74 years old; he is happily married (but also happily separated) with four sons and eleven grandchildren. The author discovered the key solution that led to what he only now calls Quantum- Relativity at nine years of age. It was too great a burden for a nine-year-old to deal with and the author decided to leave the issue until later in his life. The author became an electrical engineer with his own company designing and manufacturing highly specialized electronic instruments for the energy industry. In 2007, the author sold his company and at the age of 57, he took up the full-time theoretical work that led, as a mere byproduct of that overall work, to the development of what he now names Quantum-Relativity.

This paper was first published on my own website in March 2022, you can see this material on line and also investigate the new topic of **Quantum-Relativity** (qr) at:
https://www.gnqr.co.uk/