Totallity

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Agenda

- Advantages of totallity
- How to divide by zero
- Transmathematics
- Transphysics
- Transomputing

Advantages of Totallity

Totallity

- Every operation can be applied to any arguments giving a valid result
- No exceptions - *ever!*
- Every syntactically correct sentence is semantically correct

Totallity

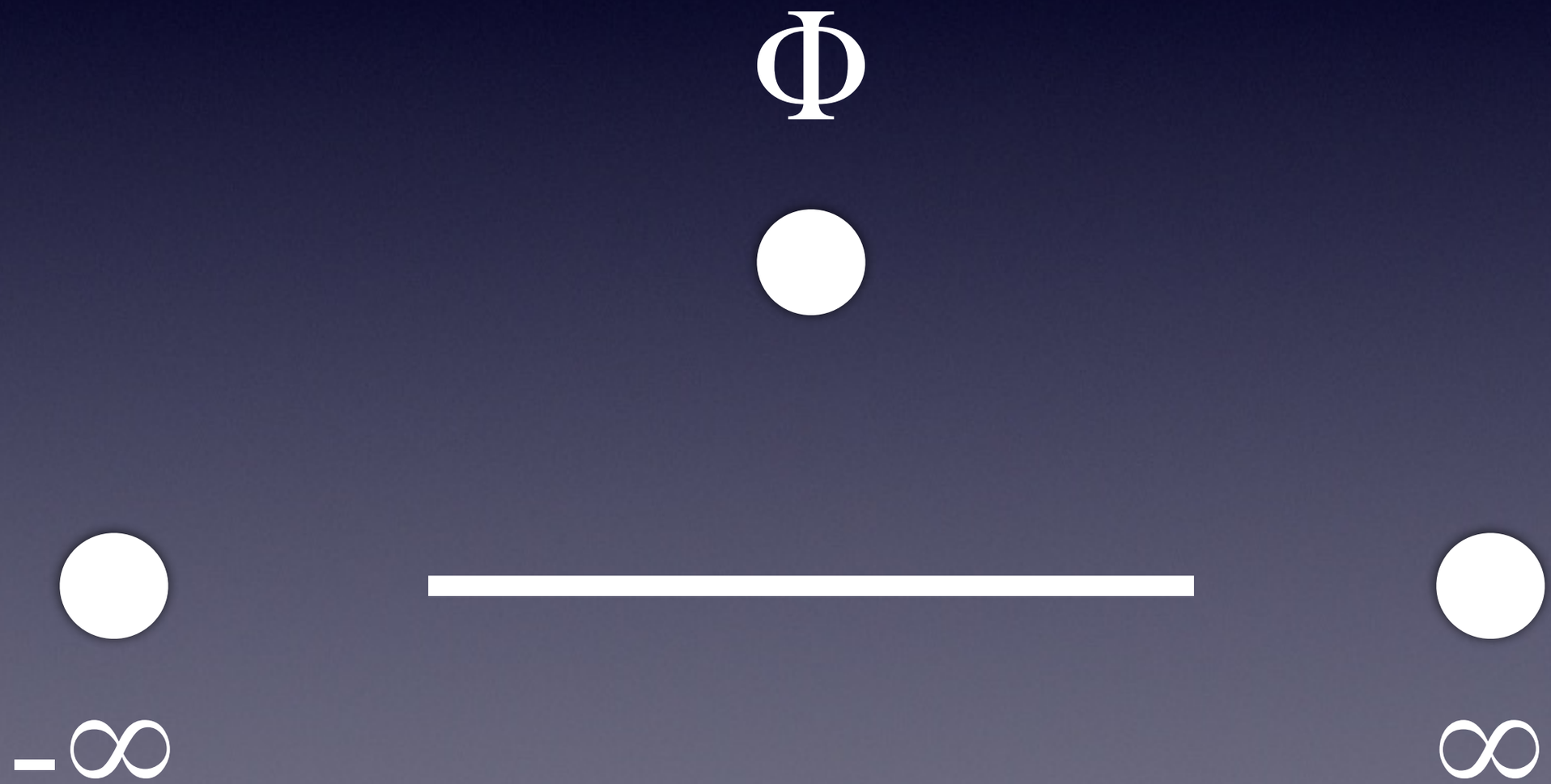
- Find x such that: $x < 0 \,\&\, x > 0$

- Find the set of x such that: $x < 0 \,\&\, x > 0$

- If an algorithm has a known waiting time then it is always possible for a computer to signal the empty solution set

How to Divide by Zero

Transreal Number Line



Transreal Numbers

Transreal numbers, t, are proper fractions of real numbers, with a non-negative denominator, d, and a numerator, n, that is one of -1, 0, 1 when d = 0

$$t = \frac{n}{d}$$

With k a positive constant:

$$-\infty = \frac{-k}{0} = \frac{-1}{0} \qquad \Phi = \frac{0}{0} \qquad \infty = \frac{k}{0} = \frac{1}{0}$$

Negative Denominators

An improper fraction may have a negative denominator (-k) which must be made positive *before* any arithmetical operator is applied

$$\frac{n}{-k} = \frac{-n}{-(-k)} = \frac{-1 \times n}{-1 \times (-k)} = \frac{-n}{k}$$

Multiplication

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$

Division

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

Addition of Two Infinities

$$\infty+\infty=\frac{1}{0}+\frac{1}{0}=\frac{1+1}{0}=\frac{2}{0}=\frac{1}{0}=\infty$$

$$\infty+(-\infty)=\frac{1}{0}+\frac{-1}{0}=\frac{1-1}{0}=\frac{0}{0}=\Phi$$

$$-\infty+\infty=\frac{-1}{0}+\frac{1}{0}=\frac{-1+1}{0}=\frac{0}{0}=\Phi$$

$$-\infty+(-\infty)=\frac{-1}{0}+\frac{-1}{0}=\frac{-1+(-1)}{0}=\frac{-2}{0}=\frac{-1}{0}=-\infty$$

General Addition

$$\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$$

Subtraction

$$\frac{a}{b} - \frac{c}{d} = \frac{a}{b} + \frac{-c}{d}$$

Associativity

$$a+(b+c)=(a+b)+c$$

$$a\times(b\times c)=(a\times b)\times c$$

Commutativity

$$a + b = b + a$$

$$a \times b = b \times a$$

Partial Distributivity

$$a(b+c) = ab + ac$$

When $a \neq \pm\infty$ or

$$bc > 0$$ or

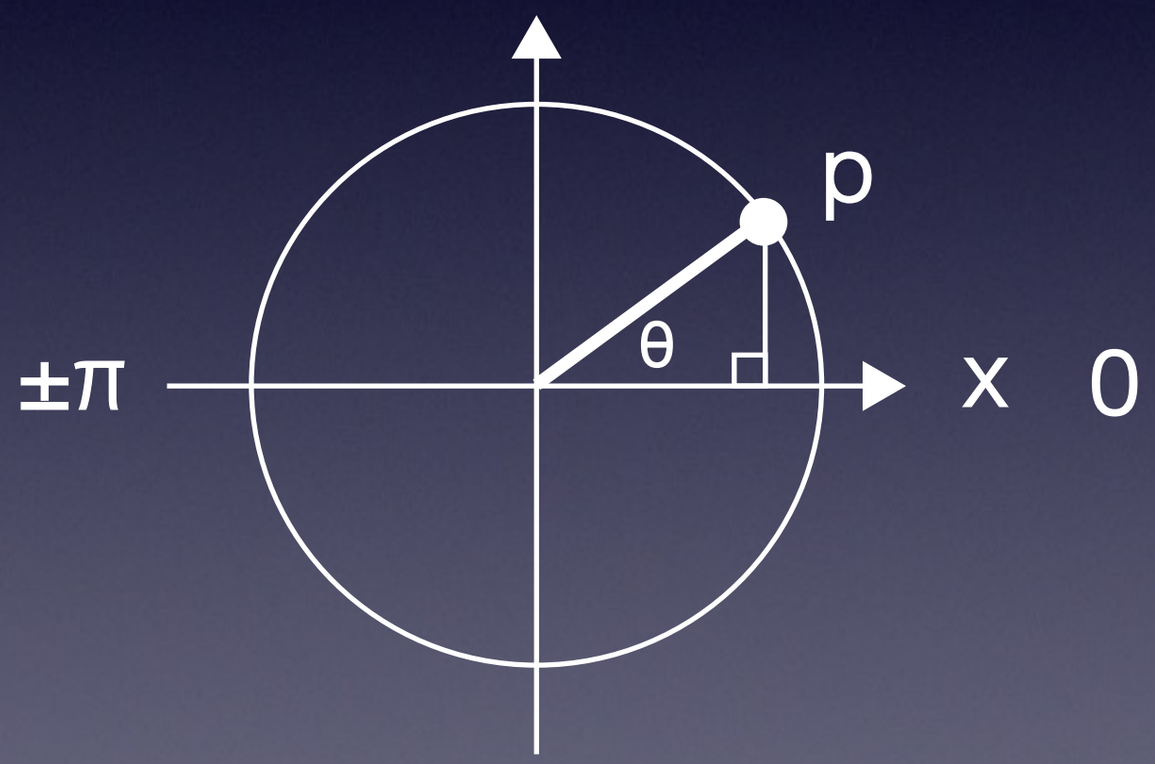
$$(b+c)/0 = \Phi$$

Comparison

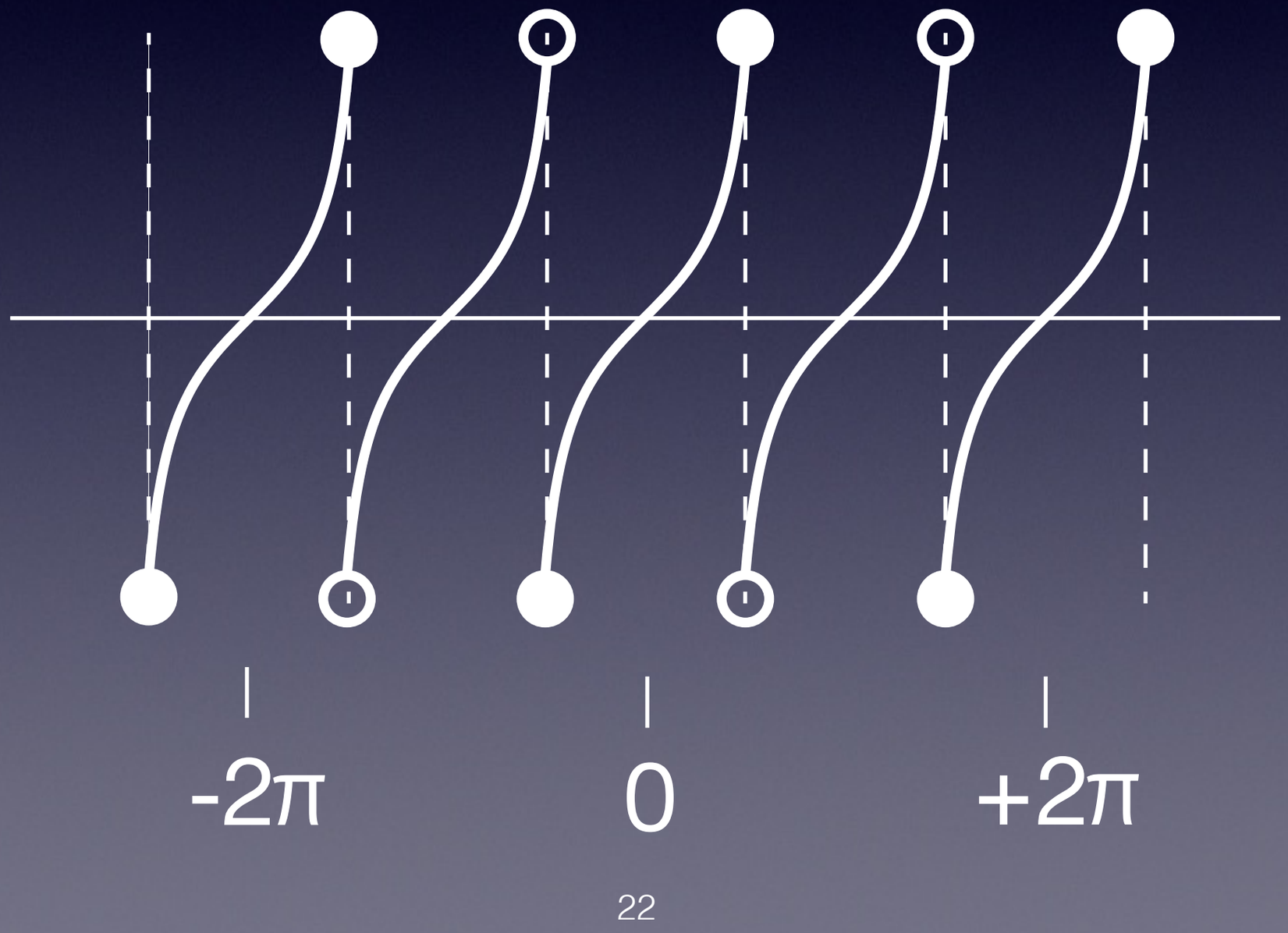
- Mathematics checks for division by zero and, if found, it fails
- Transmathematics checks for division by zero and always succeeds

Transmathematics

Transtangent



Transtangent



Transtangent

- Is defined for all transreal angles
- Is single valued everywhere
- Has period 2π, not π, over all real angles

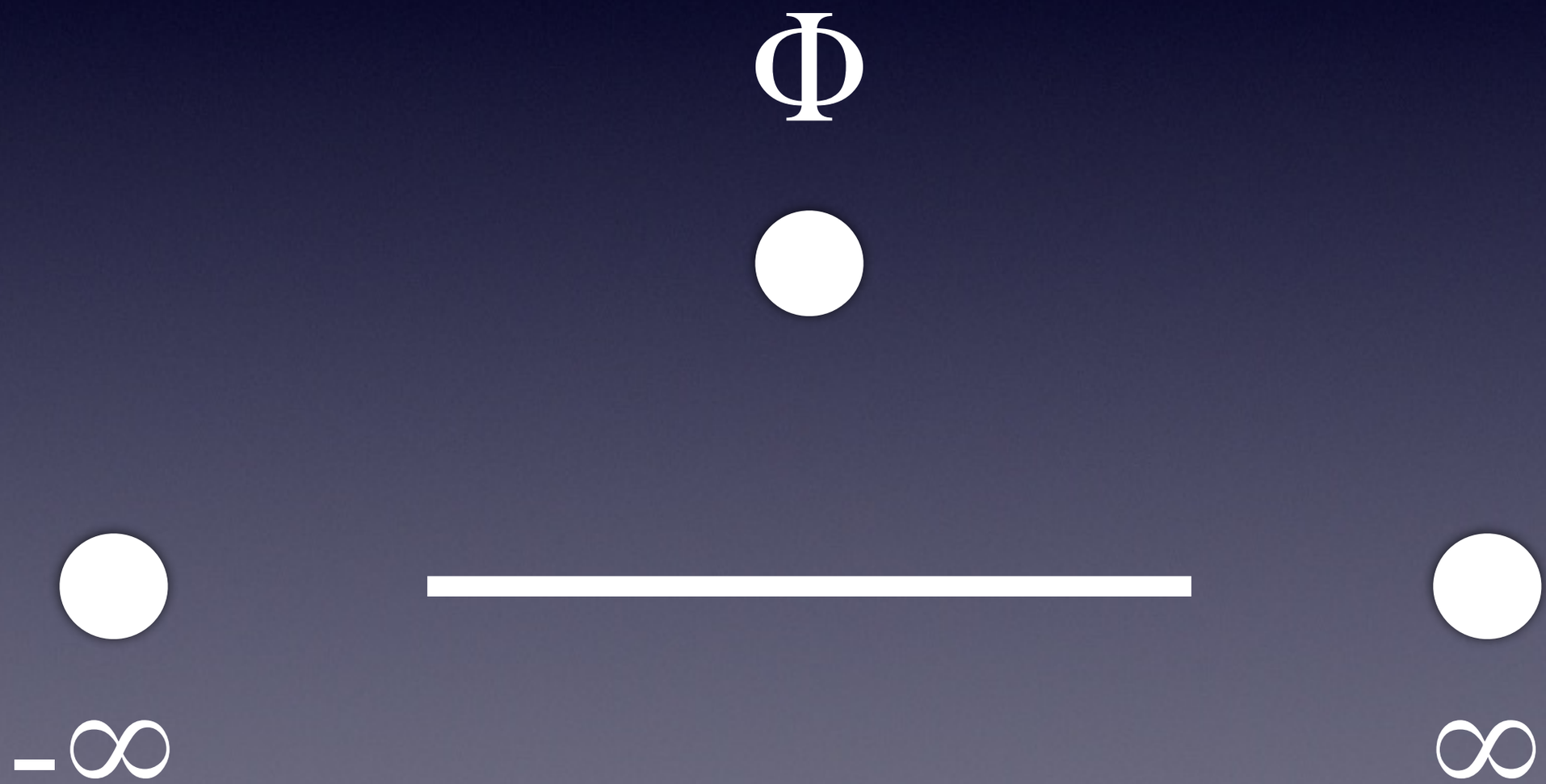
Trigonometry

- Which trigonometric identities are affected by the transreal totality of the tangent function?

- Which trigonometric identities are affected by transreal geometrical constructions?

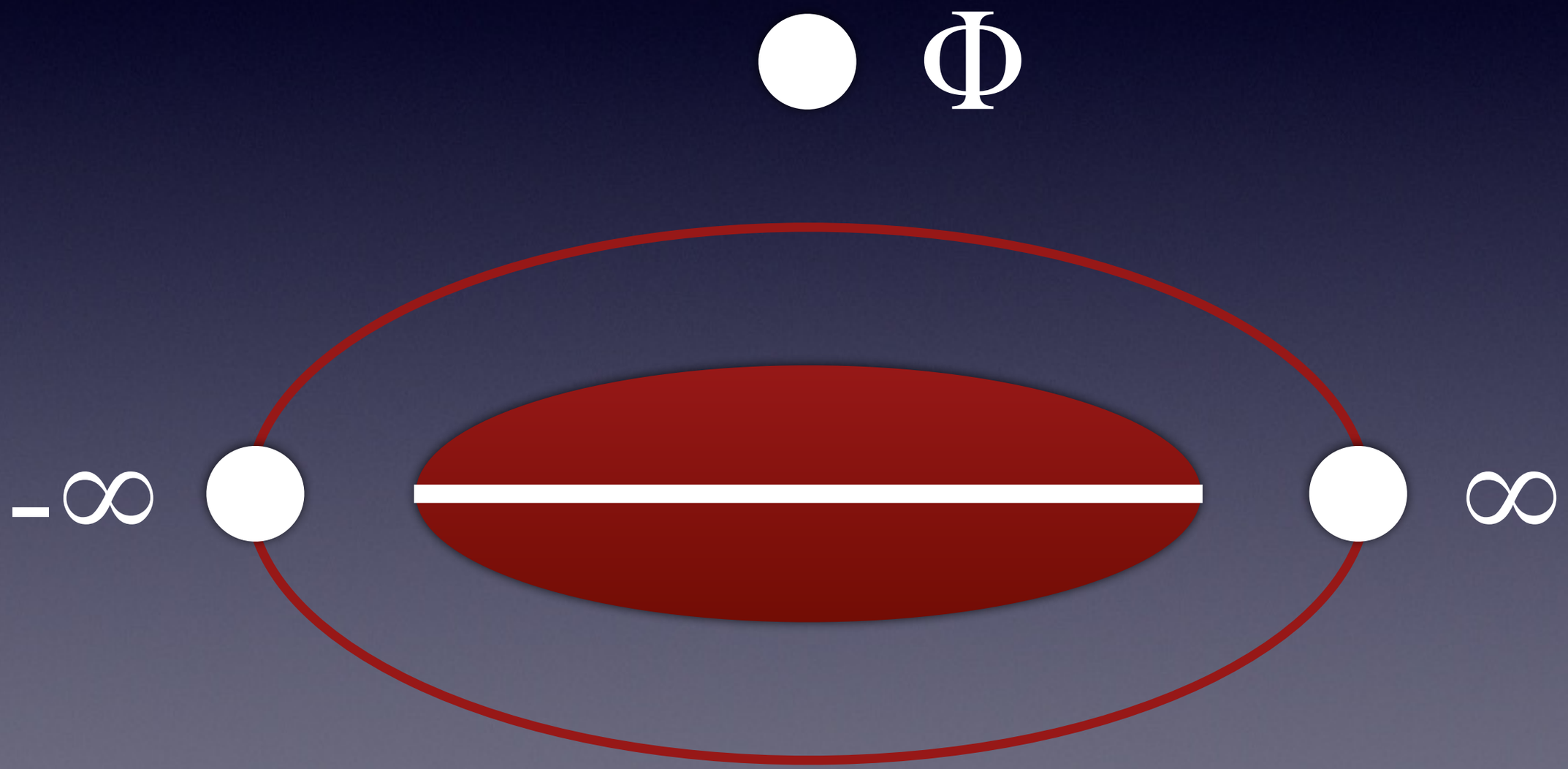
- How is complex analysis affected by transreal geometrical constructions?

Transreal Number Line



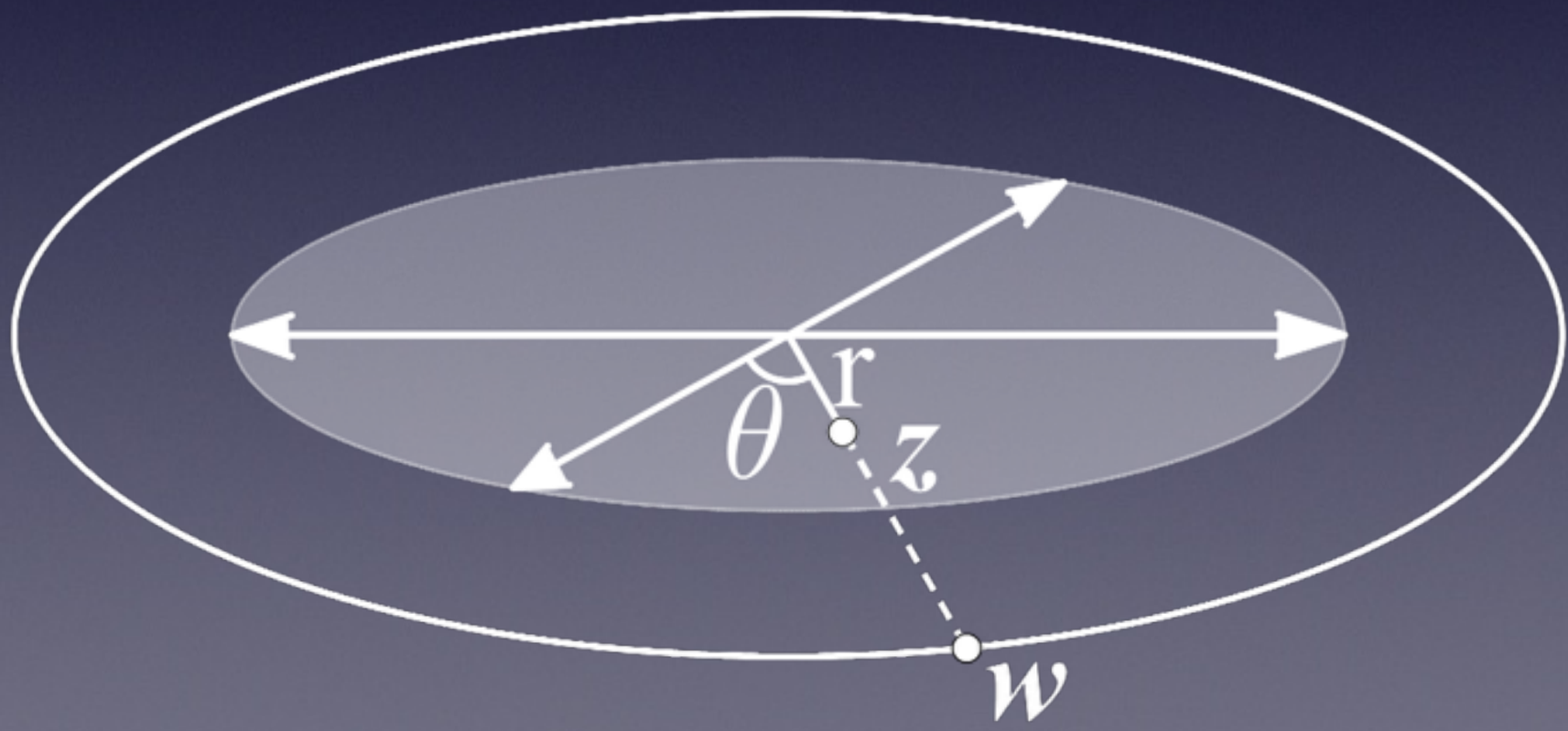
Transcomplex Plane

Revolution of the transreal number line



Transcomplex

$$\mathbb{C}^T = \mathbb{C} \cup \{(\infty, \theta); \theta \in (-\pi, \pi]\} \cup \{\Phi\}$$



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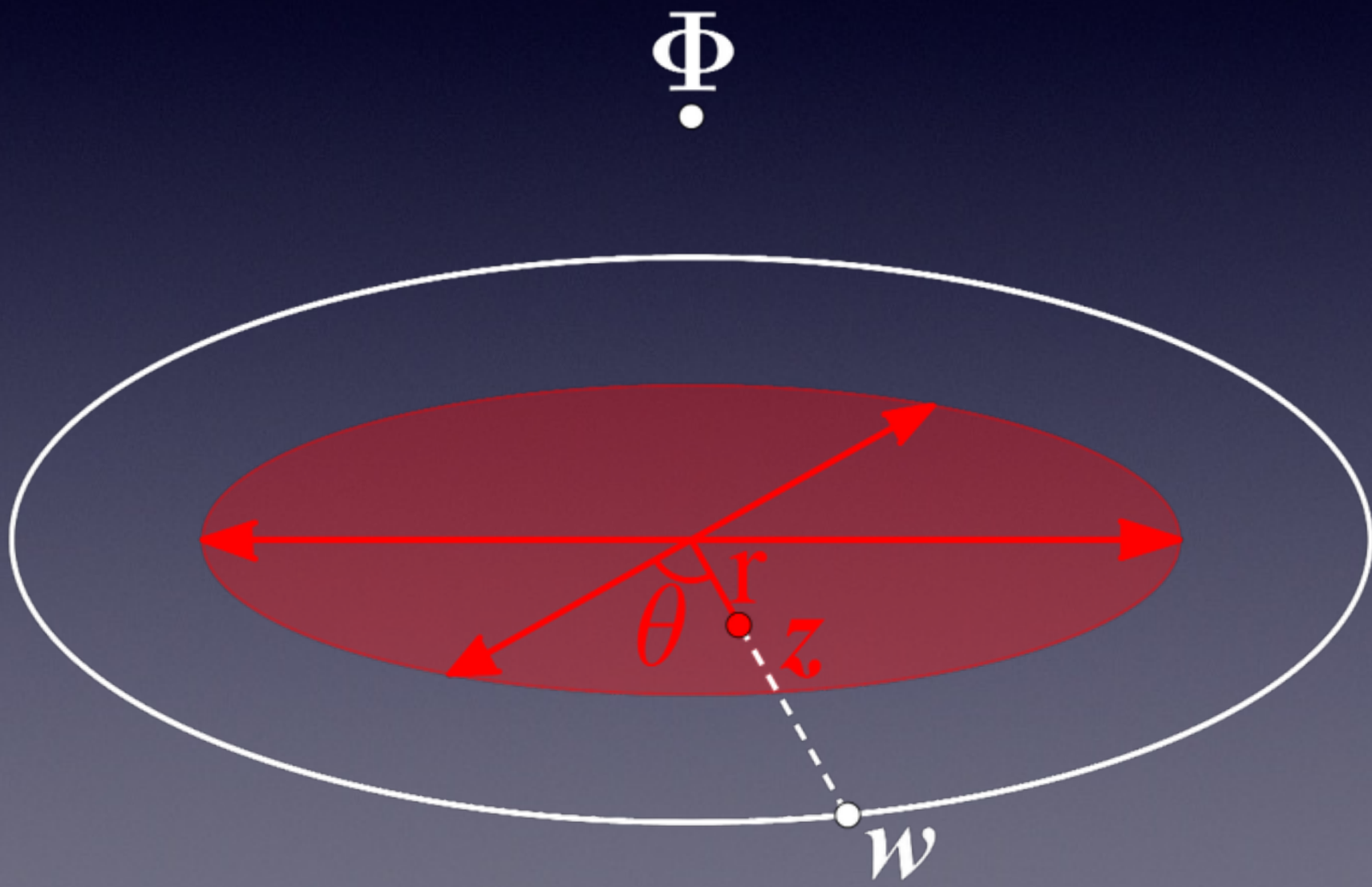

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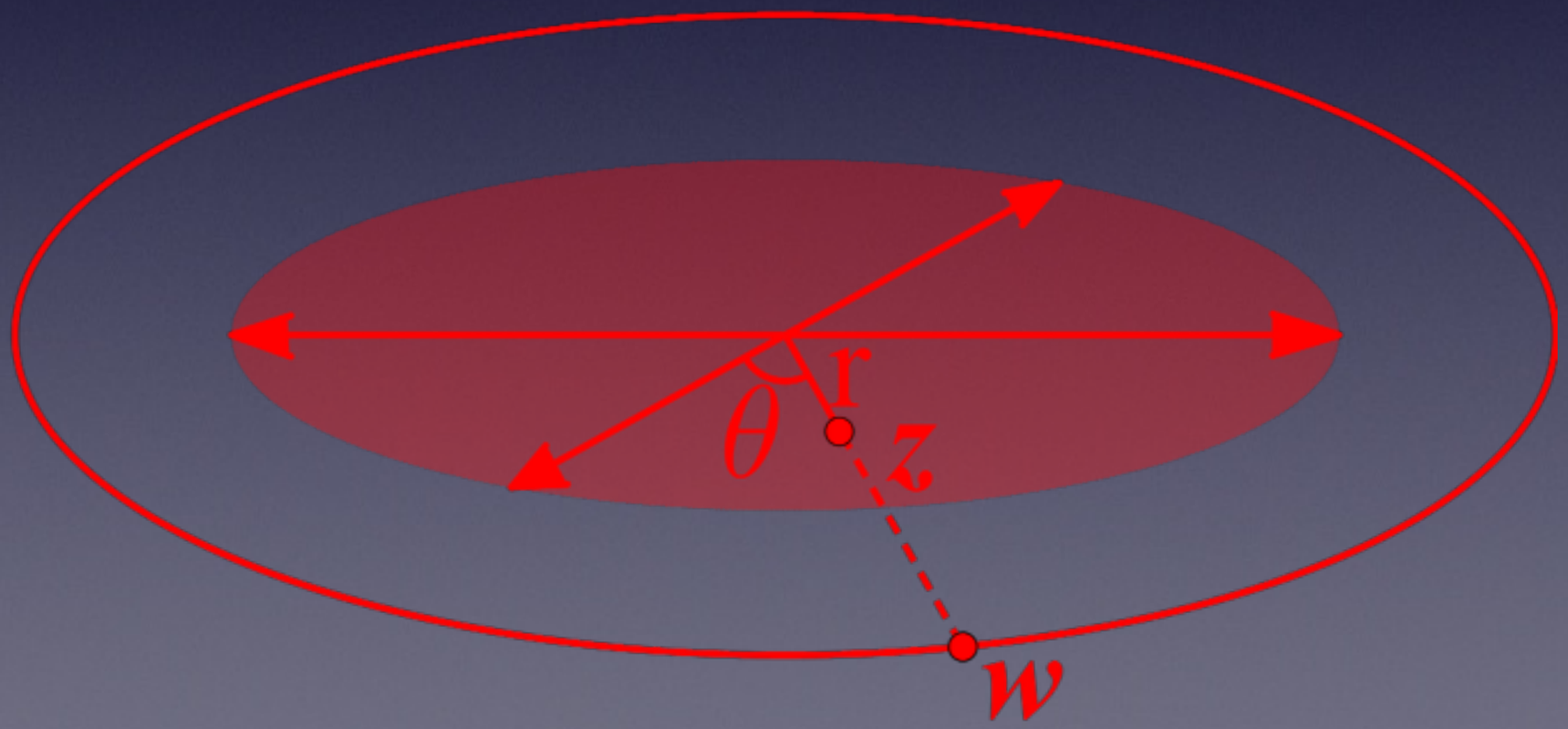

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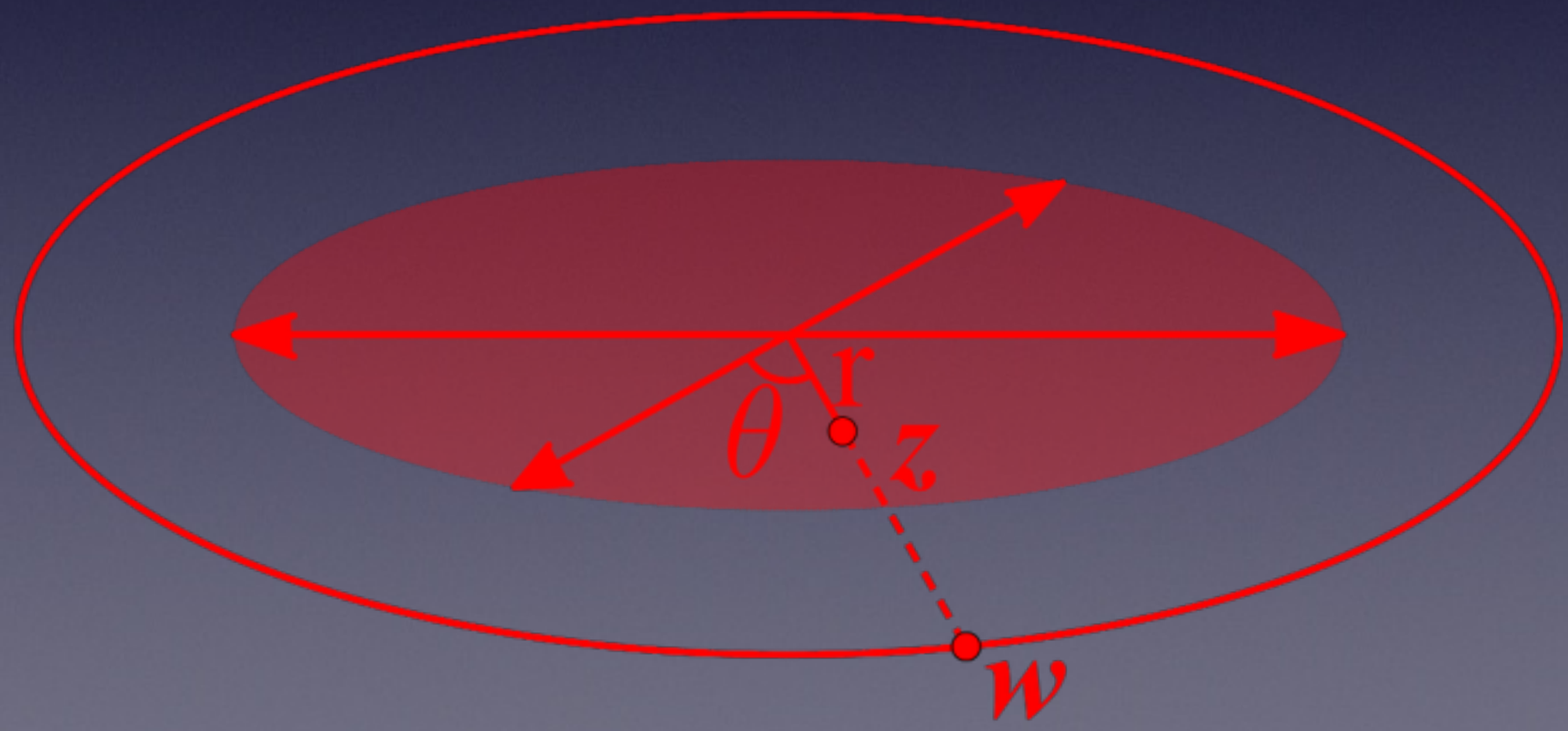
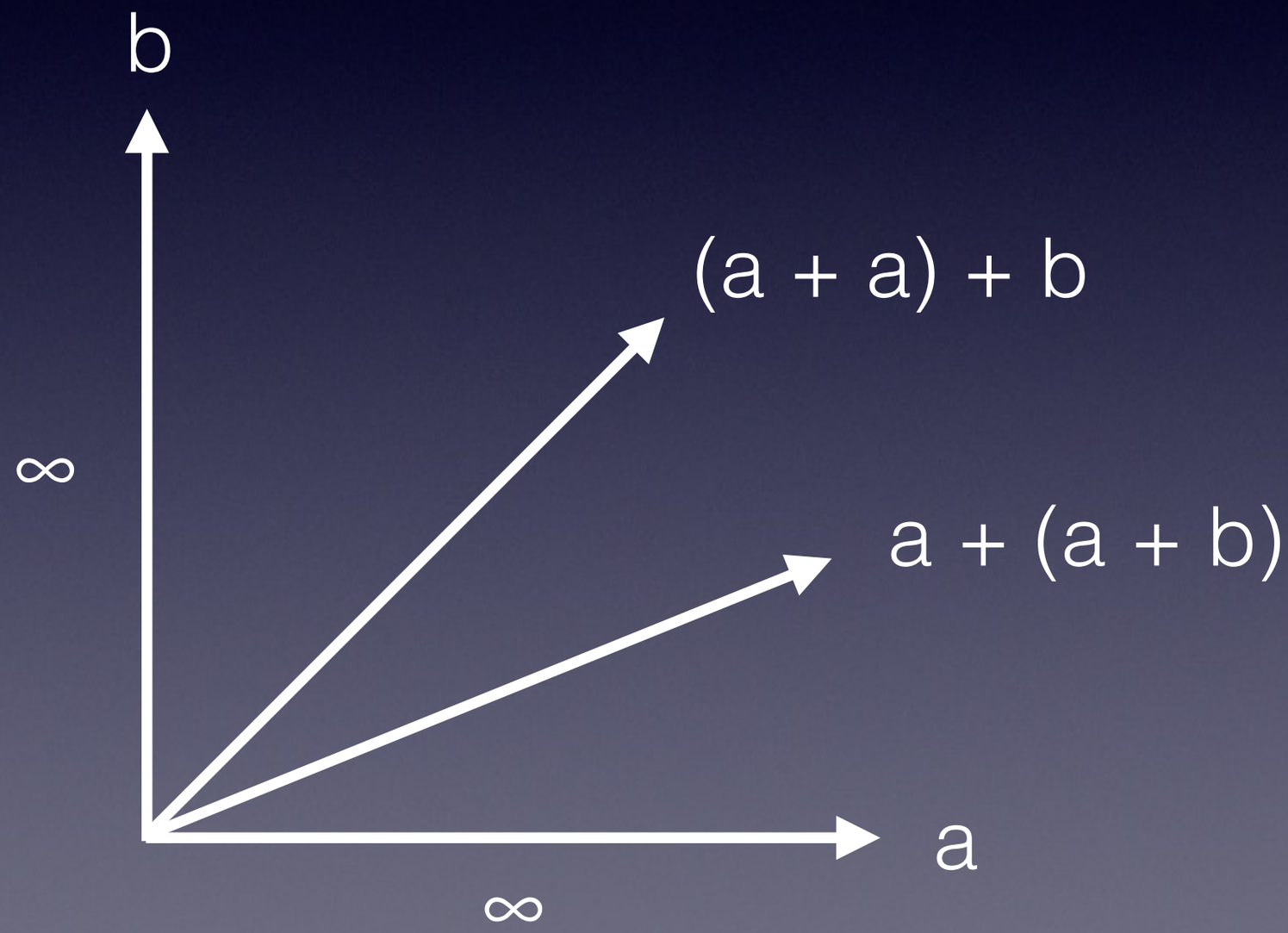


Transmathematics

- Transcomplex numbers are total in themselves but what is the best way to totalise transcomplex numbers over transreal components of magnitude and angle?

- Can the geometrical definition of angle be extended so that it applies naturally to zero vectors and nullity vectors?

Sum of Infinite Vectors



Sum of Infinite Vectors

$$a - a = \Phi$$

Sum with Nullity Vector

$$a + \Phi = \Phi$$

Transcalculus

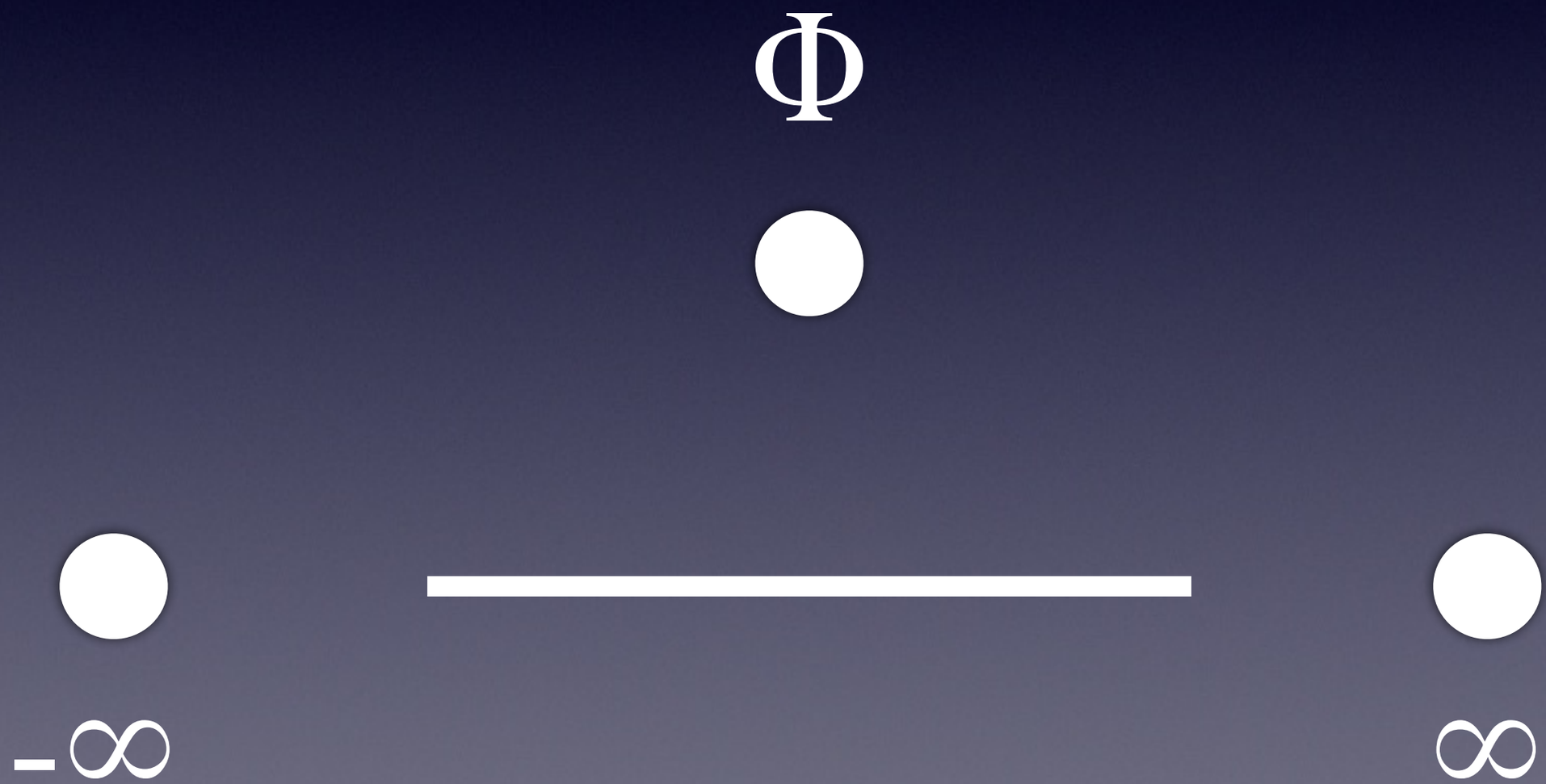
- Transreal limits are defined
- Transreal derivatives are defined
- Transreal integrals are defined

Transmathematics

- What is the best way to define vectors?
- What is the best way to define differential geometry?
- What is the best way to define transcomplex analysis?
- What non-finite solutions are there to Maxwell's and Schrödinger's equations?

Transphysics

Transreal Number Line



Nullity Force

- There is no component of nullity on the extended-real number line so nullity forces have no, i.e. zero, effect on the extended-real universe where we live

Newton’s Law 1

- A mass is accelerated only by a positive or negative force, not a zero or nullity force

Newton's Law 2

- $F = ma$ when $0 < m < \infty$ and a is transreal
- $a = F / m$ when $0 < m < \infty$ and F is transreal
- $m = F / a$ when a, F are transreal. When the computed mass is real, it is determined. When the computed mass is nullity, the true, finite mass, is hidden

Newton’s Law 3

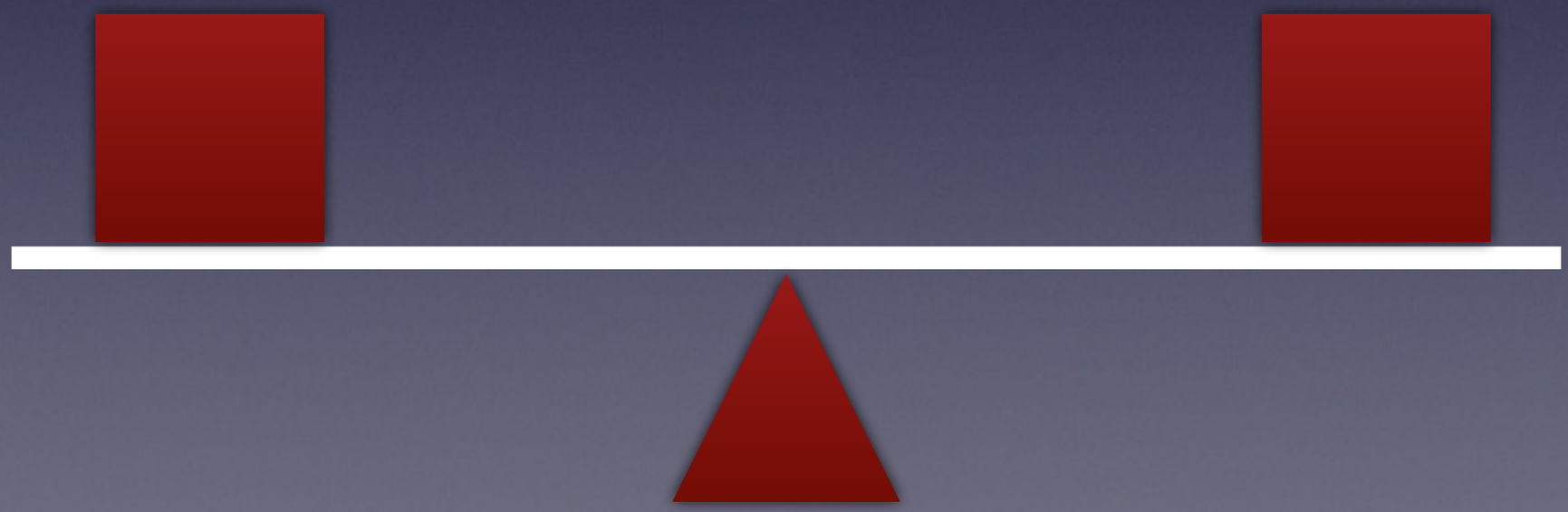
- To any action, F, there is always an opposite and equal reaction, -F

Information

- Real numbers have more information than infinite numbers
- Infinite numbers have more information than nullity
- Physical systems always adopt the transreal configuration with the highest possible information

Balance

$m_1 d_1 \longleftrightarrow m_2 d_2$



Moments

- Any two transreal masses balance when

$$m_1 d_1 = m_2 d_2$$

- A nullity moment does not act on a balance so what is the best way to use transreal arithmetic to model physical moments?

Black Hole

- Suppose we have two, same charged, massive particles at the singularity of a black hole

- Attraction $F_g = G\frac{m_1 m_2}{r^2} = G\frac{m_1 m_2}{r^2} = \infty$

- Repulsion $F_e = k_e\frac{q_1 q_2}{r^2} = k_e\frac{q_1 q_2}{r^2} = -\infty$

- Nett force $F = F_g + F_e = \infty - \infty = \Phi$

Black Hole

- The particles are bound by a nullity force at the singularity so are free to move but are not compelled to move
- A quantal fluctuation in position may move some effective mass away from the singularity - if it inflates, it may leave the event horizon, if not it falls back into the singularity in a convection current

Black Hole

- The convection current perturbs the event horizon:
- What is the event horizon's increase in surface area and Hawking radiation?
- If the whole effective mass of a black hole convects, is the heating of in falling gas measurably non-linear over distance to the singularity?
- Any greater effect may be due to inflation

Transcomputing

Von Neumann Computer

- Lies about the physics of the universe: data can be moved any distance in unit time!
- 2 GHz core stalls 90% of the time until the lie is true!
- The faster the core the lower its efficiency
- An infinitely fast von Neumann core does no computing!

Von Neumann Computer

- Typically 5 memory transactions per operation: c := a + b has four reads of +, a, b, c and one write of the result to c
- I/O bandwidth is 5c where c is the number of cores in a chip
- Can crash on logical exceptions

Serial Processing

Instruction 1

Data 1

Instruction 2

Instruction 3

Instruction n

Serial Processing

Instruction 1

Instruction 2

Data 1

Instruction 3

Instruction n

Serial Processing

Instruction 1

Instruction 2

Instruction 3

Data 1

Instruction n

Serial Processing

Instruction 1

Instruction 2

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Instruction n

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Serial Processing

Instruction 1

Instruction 2

Instruction 3

Instruction n

Data n

Slipstream Computer

- Data flow means travel-time is proportional to distance so never stalls
- Data flow means I/O bandwidth is independent of the number of cores
- Totallity means that if a program compiles it has no logical exceptions so it can crash only on a physical fault
- Totallity means pipelines never break

Slipstream Processing

Instruction 1

Data 1

Instruction 2

Instruction 3

Instruction n

Slipstream Processing

Instruction 1

Data 2

Instruction 2

Data 1

Instruction 3

Instruction n

Slipstream Processing

Instruction 1

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Slipstream Processing

Instruction 1

Instruction 2

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Data n

Instruction n

Data 3

Slipstream Processing

Instruction 1

Instruction 2

Instruction 3

Instruction n

Data n

Transreal Supercomputer

- 1 PFLOP cost US $ 5,000,000
- 40 G Bytes / Sec of data throughput
- What physical problems would you solve with this transreal supercomputer?

Transcomputing

- If a program compiles it can crash only on a physical fault
- Computers never stall
- Pipelines never break
- I am seeking US$ 25,000,000 to capitalise a company to build a transreal supercomputer

Conclusion

- Can divide real and complex numbers by zero
- Can find transreal derivatives and integrals
- Newton’s laws hold for division by zero
- Can solve physical problems at singularities
- Transreal supercomputers will be cheap

Transmathematica

- Join the Google+ Community Transmathematica
- I am setting up a journal to publish papers on any subject relating to division by zero, e.g.: mathematics, physics, computing, philosophy, pedagogy
- I am setting up a company to make and sell transreal computers