Transcomputation

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Agenda

- Transvectors
- Addition
- Polar-transcomplex arithmetic

Transvectors

Vectors

- A vector has a direction and a magnitude

Vectors

- What is the direction of the zero vector?

- If you find this question hard, what causes your difficulty?

Transvectors

- Sir Isaac Newton worked out how to add forces before vectors were invented:

- Used geometry to get the orientation of lines

- Used instructions to draft “from and to” to give the sense of lines

- Used calculus

Transvectors

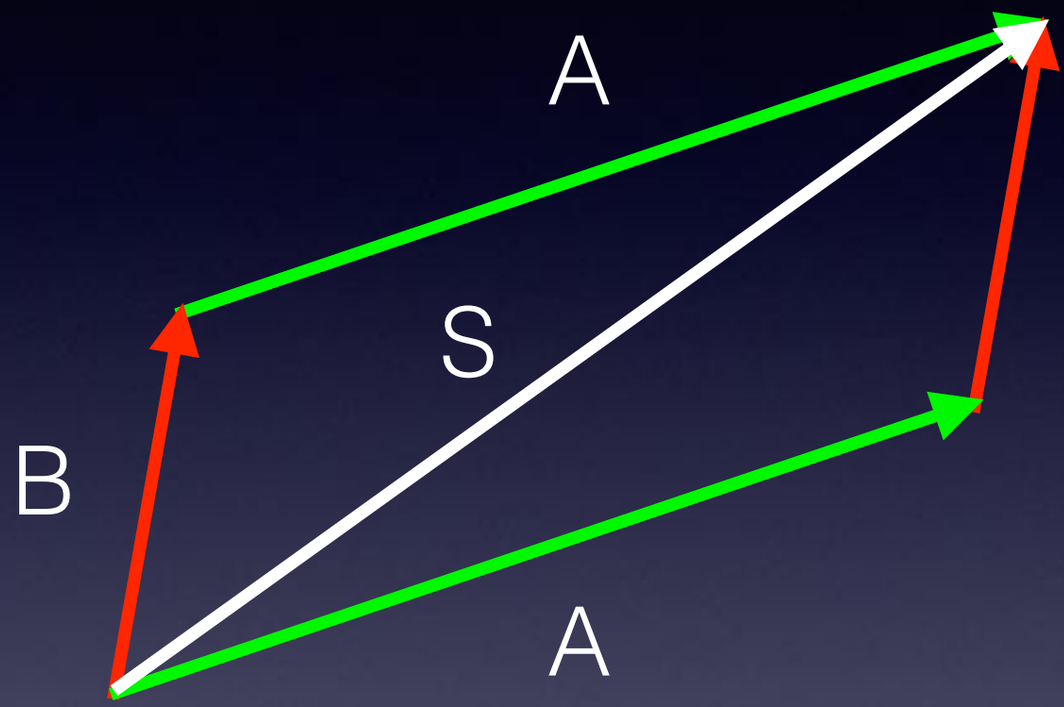
- A vector has a direction and a magnitude
- A transvector is a vector with a transreal angular direction and a transreal magnitude
- Very few vector operations have been totalised

Transvectors

- Polar-complex addition is the addition of 2D vectors
- Polar-transcomplex addition is the addition of 2D transvectors

Addition

Addition



- The sum, S, of two finite vectors, A and B, is the diagonal of the quadrilateral constructed by forming ABAB

Addition

- Why does this generally fail to get the direction and magnitude of two infinite vectors?

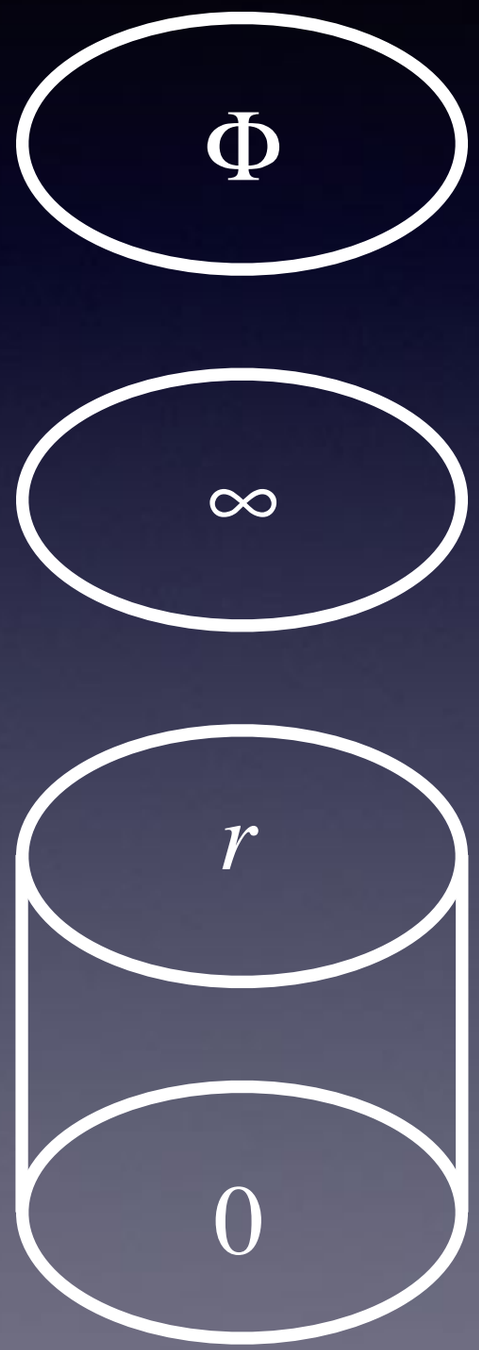
- How did Newton specify a drafting method that gets the direction (but not the magnitude)?

- Why does this generally fail to get the direction and magnitude of a sum with the nullity vector?

Conjecture

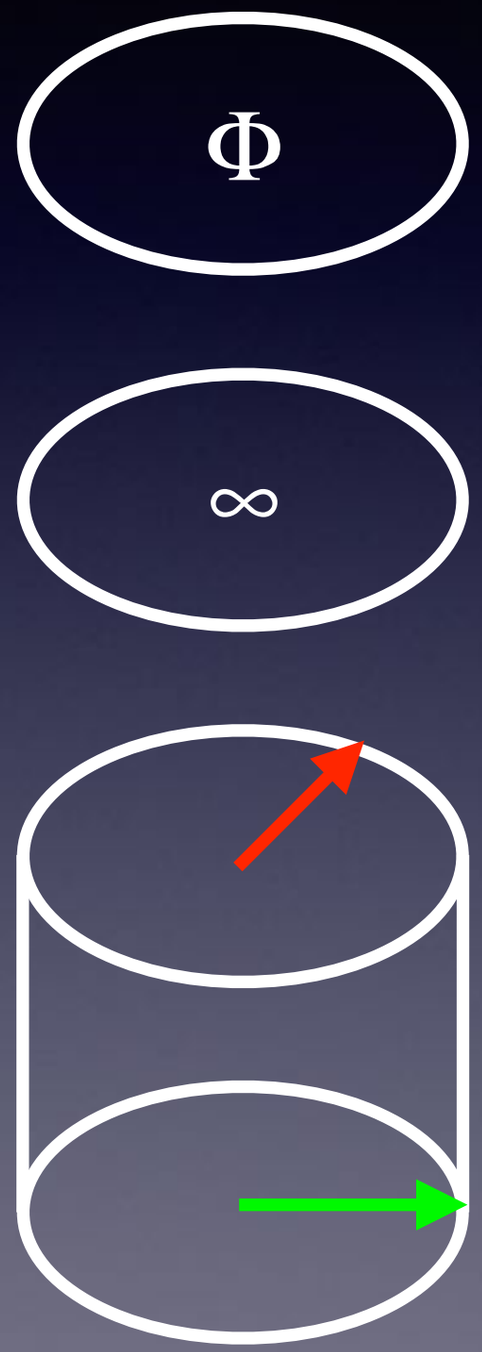
- If Sir Isaac Newton had been able to draw the sum of infinite vectors, we would now have a physics that works at singularities!

Transreal cylinder



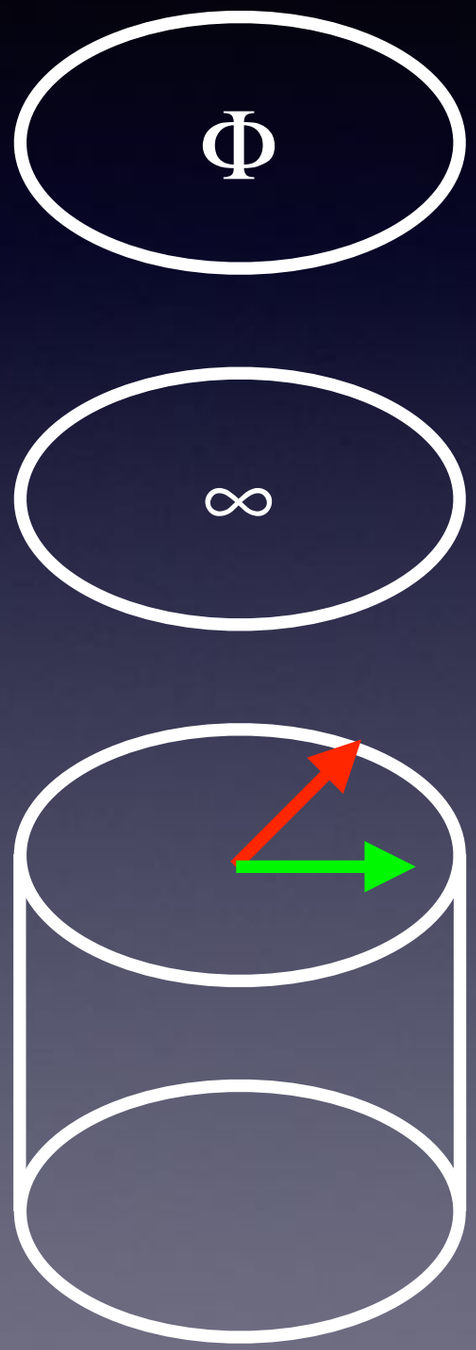
Addition

Lay off each vector as the unit radius of a disc that encodes the vector's magnitude as the height in the figure



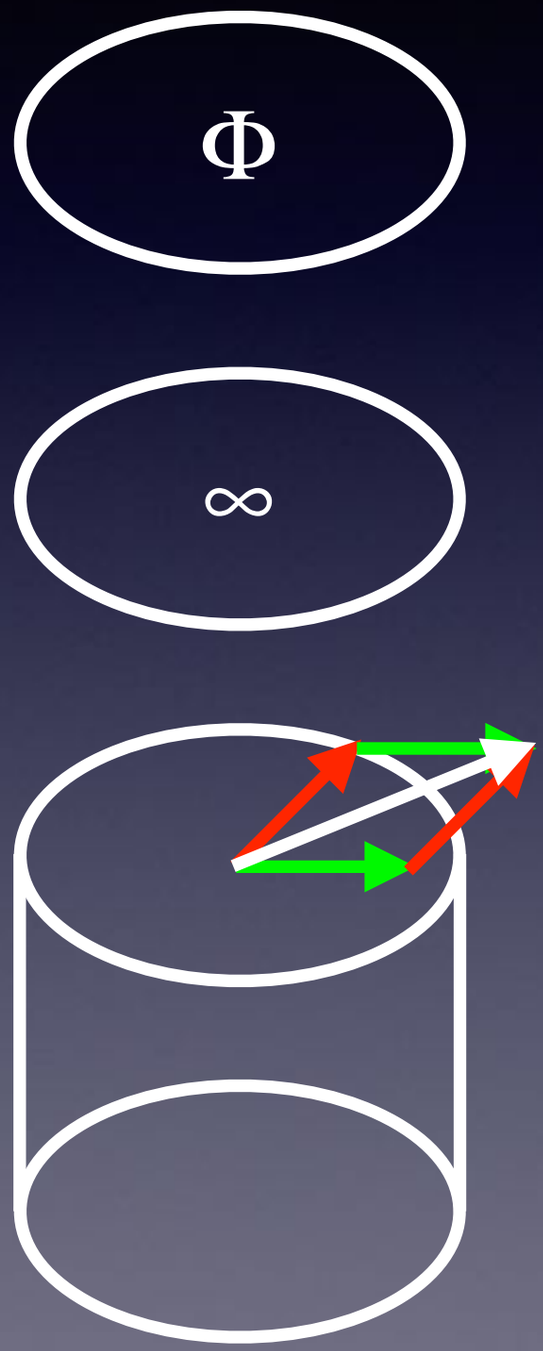
Addition

Scale the lower vector so it retains its relative size when drawn in the higher disc



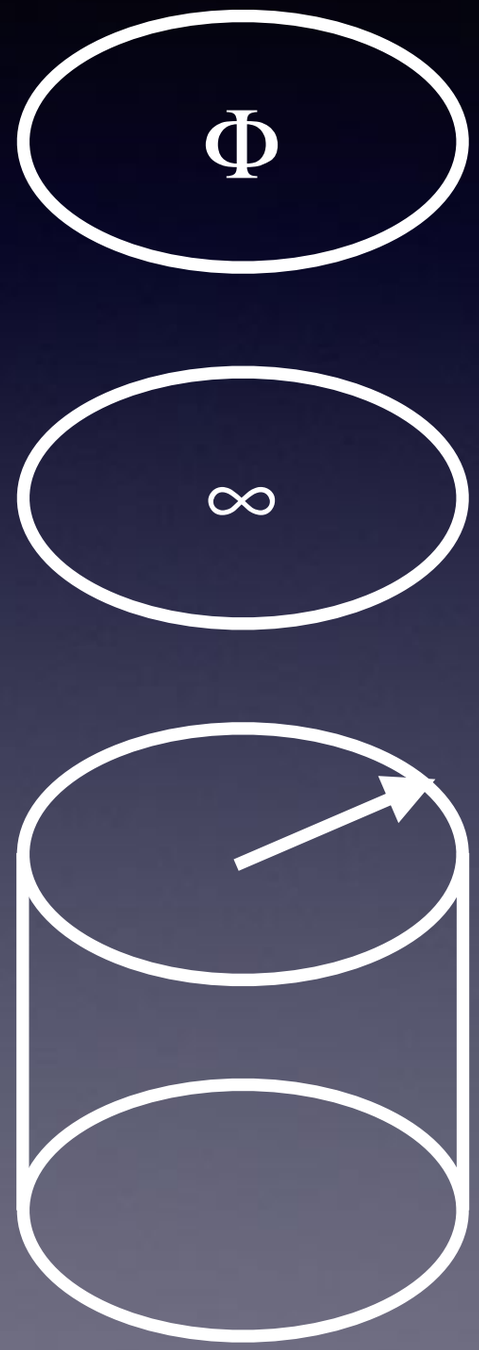
Addition

Construct the quadrilateral and identify the diagonal as the sum



Addition

Multiply the magnitude of the sum by its height in the figure and draw the resultant sum as a unit radius with the height encoding the magnitude of the sum



Addition

- This method works for all transreal vectors
- Try adding a finite vector to an infinite vector
- Try adding two non-opposite infinite vectors
- Try adding two opposite infinite vectors
- Try adding any vector to a nullity vector

Puzzle

- Why is the pair-wise sum of infinite vectors non-associative?
- How can the unique sum of many infinite vectors be computed (drawn)?

Convention

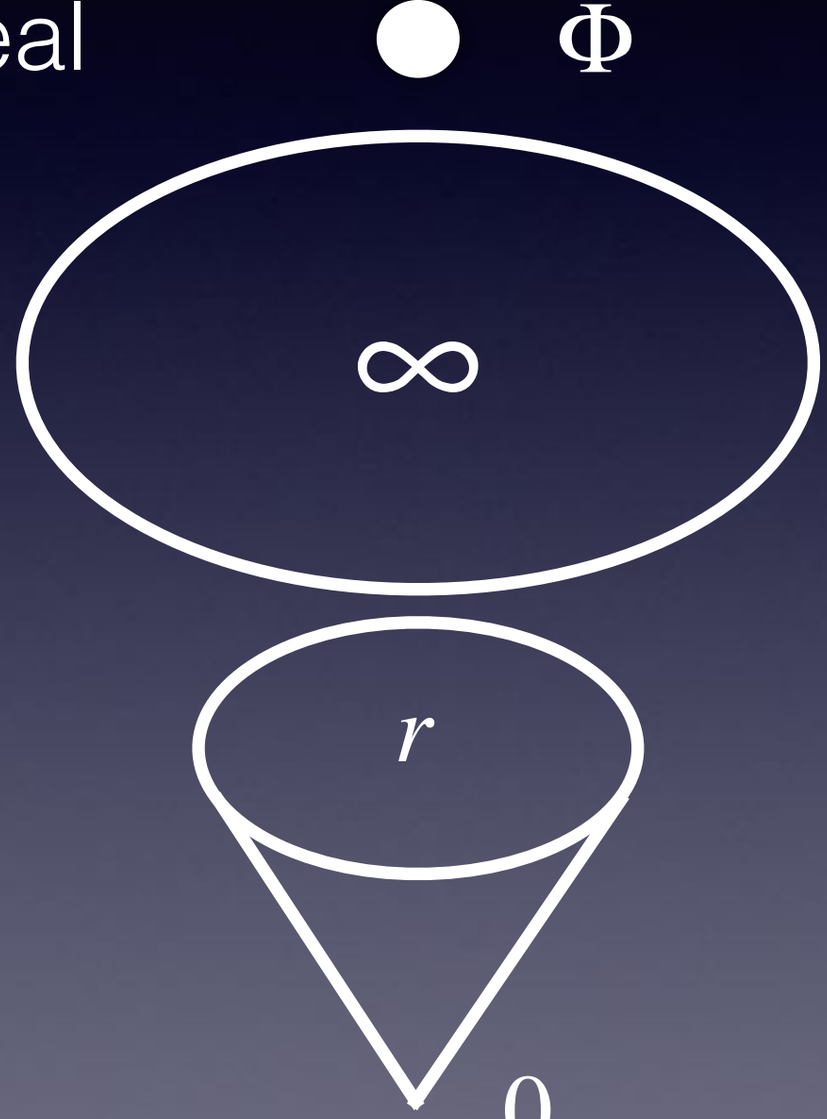
- All non-finite angles are written as the equivalent nullity angle so write Φ not $\pm\infty$

- All real angles of the zero length vector are written as the equivalent zero angle so write 0 not any other real number

- All angles of the nullity length vector are written as the equivalent zero angle so write 0 not any other transreal number

Transreal cone

Identify nullity at all transreal angles with a single point



Identify zero at all real angles with a single point

Polar-transcomplex arithmetic

Polar-transcomplex arithmetic

- The sum of two transcomplex numbers is their transvector sum

- The subtraction of a transcomplex number is the addition of its opposite transvector

- Addition and subtraction are transformations in the surface of the transreal cone

Polar-transcomplex arithmetic

- Multiplication is: $(r_1, \theta_1) \times (r_2, \theta_2) = (r_1 r_2, \theta_1 + \theta_2)$
- Division is: $(r_1, \theta_1) \div (r_2, \theta_2) = (r_1 / r_2, \theta_1 - \theta_2)$
- Multiplication and division are screws in the surface of the transreal cone

Transcomplex cone

- All operations on transcomplex numbers are operations in the surface of the transcomplex cone because the transcomplex cone is the space of all transcomplex numbers

- Earlier you saw the transomplex space flattened onto a transcomplex disc, this, too, is the space of all transcomplex numbers

Elementary functions

- All real elementary functions have been totalised as transreal elementary functions

- All complex elementary functions have been totalised as transcomplex elementary functions

Conclusion

- The sum of any transvector with the nullity vector is the nullity vector
- The sum of opposite infinite vectors is the nullity vector
- The sum of two general infinite vectors is their unique bisector
- The sum of an infinite vector with a finite vector is the infinite vector

Conclusion

- The sum of infinite vectors is non-associative so the order additions are done in matters

Conclusion

- Polar-transcomplex addition is transvector addition

- Polar-transcomplex subtraction is the addition of a vector in the opposite direction

- Polar-trancomplex multiplication and division are lexically identical, respectively, to polar-complex multiplication and division