

$$i * \begin{pmatrix} 3 \\ 4 \end{pmatrix} = \begin{pmatrix} -4 \\ 3 \end{pmatrix} = -4 + 3 * i \quad \text{and the "Manifesto di Bombelli"}$$

Introducing the dot-multiplication in the vector-space ( R2, +, r.s.m ) results in an Euklidian vectorspace, inside you can find a commutative field ( R2, +, \* ).

Here \* is the Bombelli-multiplication:  $i * i = -1$ , or in

Hamilton's notation:  $\begin{pmatrix} a \\ b \end{pmatrix} * \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} ac - bd \\ ad + bc \end{pmatrix}$ , and  $i$  rotates a vector 90 degrees to the left by  $i * \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -b \\ a \end{pmatrix}$ .

**In modern-talking math:** A vector, an ordered tuple by definition, can be expressed in the terms of a vectorspace-basis. In R(=R1) the vector (a) with the standard-basis { 1 } gives: (a)=a\*1 and that's -

of course - equal to a. Adjugate a foreign element to R, you go 2D.  $\begin{pmatrix} a \\ b \end{pmatrix}$  can be notated as a linear combination of the basis-elements:  $c*1+d*element$ . With the standard-basis

$\left\{ \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \end{pmatrix} \right\} = \left\{ 1, \begin{pmatrix} 0 \\ 1 \end{pmatrix} \right\}$  or  $\{ 1, i \}$  you get  $a + b * i$ , looking different from  $\begin{pmatrix} a \\ b \end{pmatrix}$ , but identical.

You can write and calculate vectors in mixed mode now.

I propose the name Bombelli vector-space.

Real arrows showing winds on a weather-map.

Attach (add) to a number of points the difference in coordinates from one central point, multiplied

by  $\begin{pmatrix} 0 \\ 1 \end{pmatrix} = i$ . Improve this first model by multiplying  $\begin{pmatrix} \cos \alpha \\ \sin \alpha \end{pmatrix} = \cos \alpha + i * \sin \alpha$  - allowing for friction  $\alpha$  from  $10^\circ$  (over sea) to  $35^\circ$  (over land)(- $\alpha$  on the southern hemisphere), and scale everything by a factor 1/10 (rsp. -1/10) and add a common velocity to the east. It models the winds of the inner part of a depression

- done solely with Bombelli's operations - and .....  
we stayed plain real.

Two questions arise, sensitive questions for some - and the answer is left to them :

Is there any difference to (C,+,\* )? - can you tell this difference to your computer?

If you call the y-axis an "imaginary axis", do you add any mathematical properties, or do you just change the name? Is the Gauss-plane, complex plane or the Argand-diagramm more than just a Fata-Motgana-Reflection of the real plane?

Why - twohundred years after Wessel - this question überhaupt ?

In a math-lesson you get sometimes the impression, an extraterrestical element has been Adjugated to R. My opinion:

$i$  - is - no - longer - imaginary