

Projet de VISI401

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Sujet : GeoGebra et algèbre géométrique

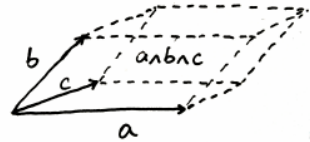
Sommaire :

- Présentation de l'algèbre géométrique
- Découverte de l'applet JS de GeoGebra
- Mise en pratique des connaissances sur l'algèbre géométrique pour GeoGebra

L'algèbre géométrique

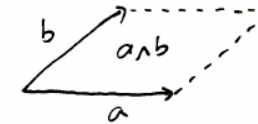
Trivector

- $\text{vector} \wedge \text{vector} \wedge \text{vector} = \text{3-vector}$
- computes an oriented volume
- expressed in a new basis



Bivector

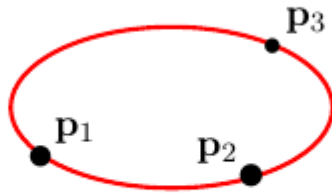
- $\text{vector} \wedge \text{vector} = \text{bivector}$
- represents an oriented surface
- expressed in a new basis



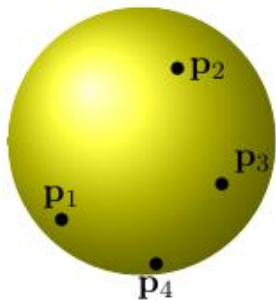
Vector:

linear algebra	geometric algebra
$\mathbf{a} = \begin{pmatrix} a_x \\ a_y \\ \vdots \end{pmatrix}$	$\mathbf{a} = a_x \mathbf{e}_x + a_y \mathbf{e}_y + \dots$
column of numbers	formal sum

Le produit extérieur



circle: $C = p_1 \wedge p_2 \wedge p_3$

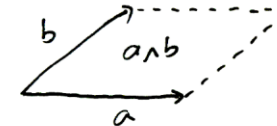


sphere: $S = p_1 \wedge p_2 \wedge p_3 \wedge p_4$

Outer Product

Introduction:

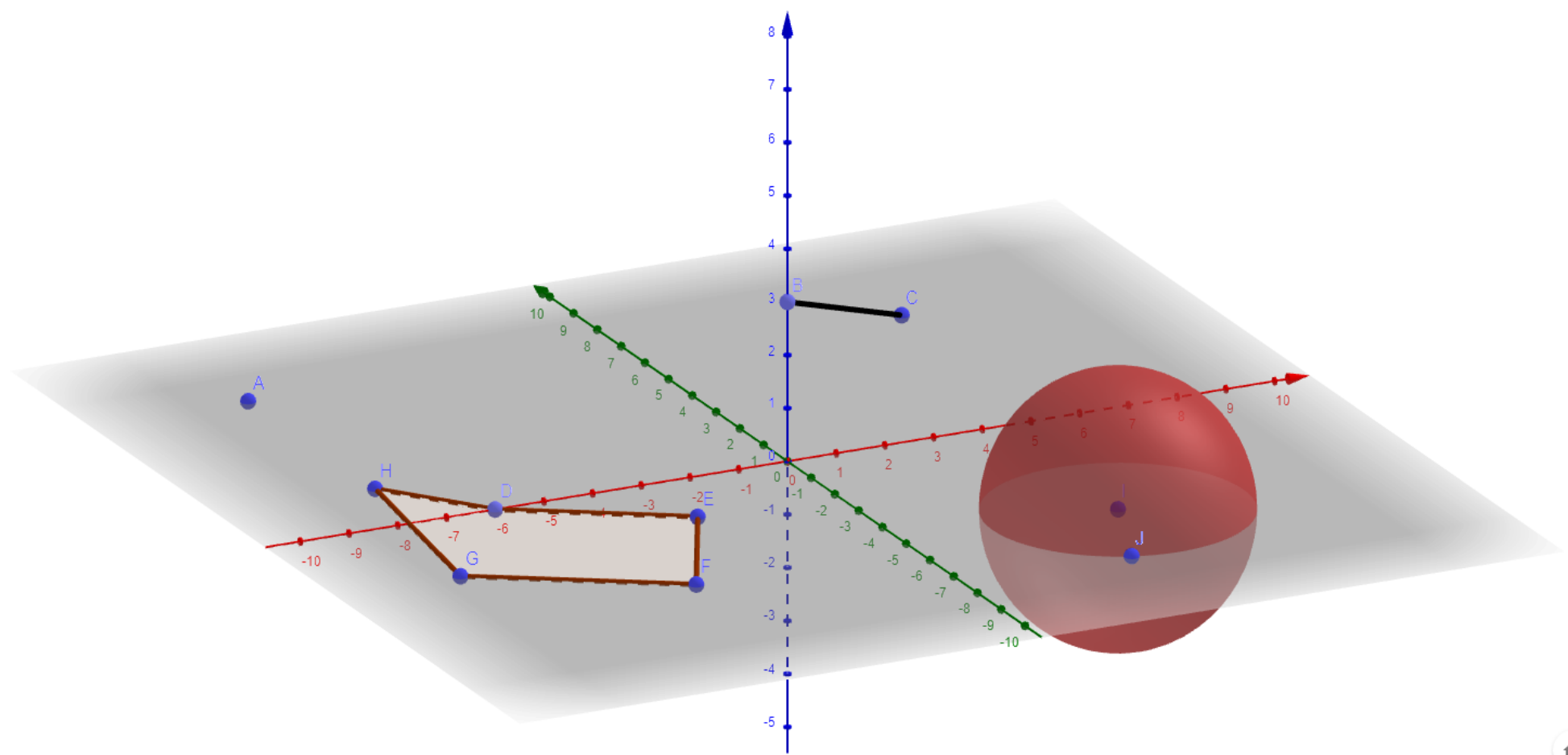
- written $a \wedge b$ (read a “wedge” b).
- express the oriented surface of the parallelogram build by a and b.



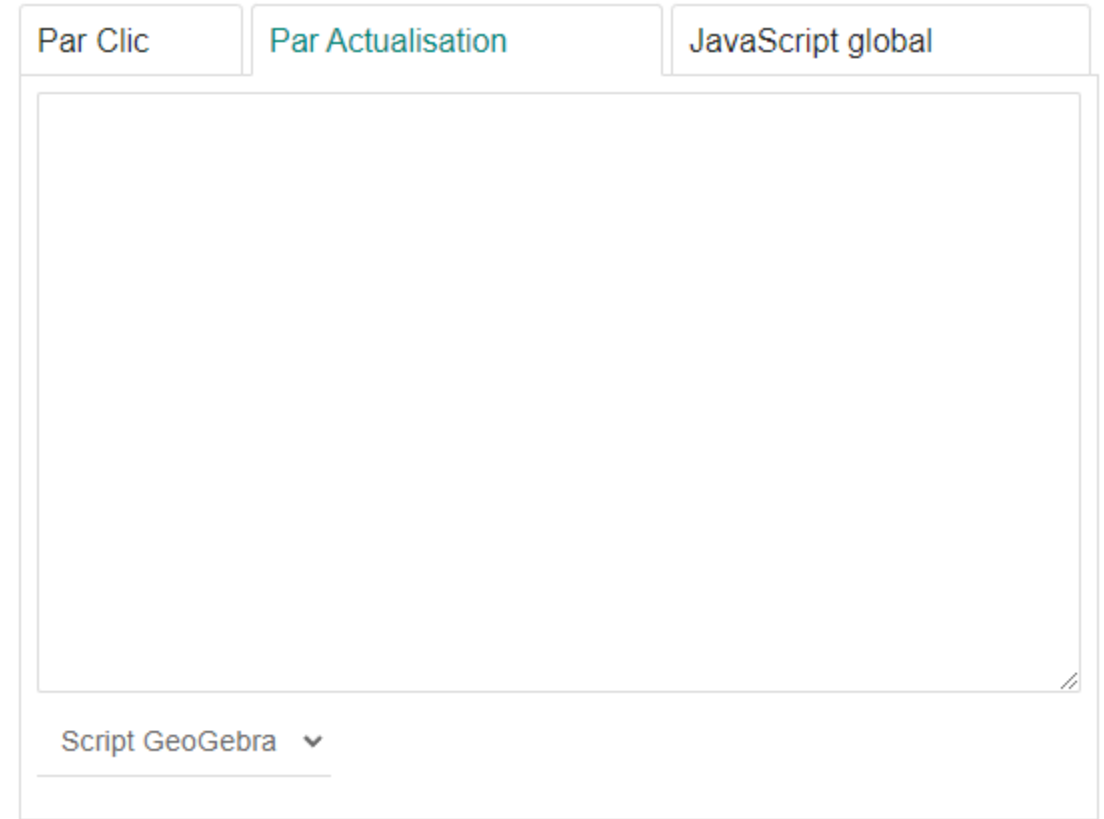
$$\mathbf{a} \cdot \mathbf{b} = \frac{1}{2} (\mathbf{ab} + \mathbf{ba})$$
$$\mathbf{a} \wedge \mathbf{b} = \frac{1}{2} (\mathbf{ab} - \mathbf{ba})$$

	$\rightarrow (-6, 0, 0)$	
	$E = (-2.82, -2, 0)$	
	$F = (-4.46, -5.31, 0)$	
	$G = (-8.18, -3, 0)$	
	$H = (-7.5, 1.98, 0)$	
	$d = \text{Segment}(D, E, \text{poly1})$	
	$\rightarrow 3.76$	
	$e = \text{Segment}(E, F, \text{poly1})$	
	$\rightarrow 3.7$	
	$f_1 = \text{Segment}(F, G, \text{poly1})$	
	$\rightarrow 4.37$	
	$g = \text{Segment}(G, H, \text{poly1})$	
	$\rightarrow 5.03$	
	$h = \text{Segment}(H, D, \text{poly1})$	
	$\rightarrow 2.48$	
	$\text{poly1} = \text{Polygone}(D, E, F, G, H)$	
	$\rightarrow 19.4$	
	$I = (4.33, -5.03, 0)$	
	$J = (3.44, -7.44, 0)$	
	$a : \text{Sphère}(I, J)$	
	$\rightarrow (x - 4.33)^2 + (y + 5.03)^2 + z^2 = 6.6$	
	Saisie...	

GeoGebra



L'applet GeoGebra



Method Signature	Since	Description
<code>boolean evalCommand(String cmdString)</code>	3.0	Evaluates the given string just like it would be evaluated when entered into GeoGebra's input bar. Returns whether command evaluation was successful. From GeoGebra 3.2 you can pass multiple commands at once by separating them with <code>\n</code> . Note: you must use English commands names