$$A = \begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix} \qquad B = \begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{pmatrix} \qquad C = \begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}$$

$$A + C = \begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix} + \begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix} = \begin{pmatrix}2 & 3\\ 4 & 5\end{pmatrix}$$

$$\begin{array}{cc} & \begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{pmatrix} \\ A * B = \begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix} & \begin{pmatrix}5 & 7 & 9\\ 5 & 7 & 9\end{pmatrix}\end{array}$$

$$A .* C = \begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix} . \begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix} = \begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}$$

$$v = (v_1, v_2, \dots, v_n)$$

$$\|v\| = \sqrt{v_1^2 + v_2^2 + \dots + v_n^2}$$

$$valor = 0$$
$$valor = v_1^2$$
$$valor = v_1^2 + v_2^2$$
$$\vdots$$
$$valor = v_1^2 + v_2^2 + \dots + v_n^2$$

$$A = \begin{array}{c} \\ \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} & \cdots & a_{1m} \\ a_{21} & a_{22} & & a_{2n} & \cdots & a_{2m} \\ \vdots & & & a_{in} & & \\ a_{k1} & a_{k2} & \cdots & a_{kn} & \cdots & a_{km} \end{pmatrix} \end{array}$$

$$v = [v_1, v_2, v_i, \dots, v_k]$$

$$\text{retval} = \begin{pmatrix} a_{11} & a_{12} & \cdots & v_1 & \cdots & a_{1m} \\ a_{21} & a_{22} & & v_2 & & a_{2m} \\ \vdots & \vdots & & \vdots & & \vdots \\ a_{k1} & a_{k2} & & v_k & & a_{km} \end{pmatrix}$$

(10) $A = \begin{pmatrix} 2 & 3 & 0 \\ 2 & -1 & -2 \\ 0 & 0 & 1 \end{pmatrix}$ $\qquad B = \{\overset{v_1}{(2,2,0)}, \overset{v_2}{(3,-1,0)}, \overset{v_3}{(0,-2,1)}\}$

$\langle (x_1,y_1,z_1),(x_2,y_2,z_2)\rangle = x_1x_2 + y_1y_2 + z_1z_2$

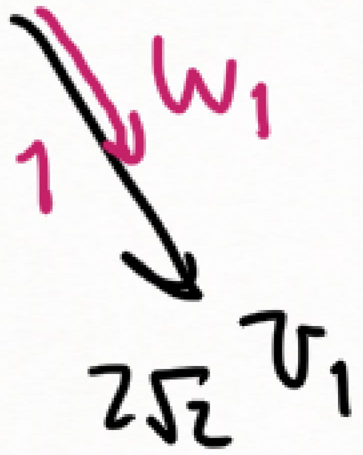
$B \to B'$ bon $\qquad B' = \{w_1, w_2, w_3\} \qquad \|w_i\| = 1 \qquad \langle w_i, w_j\rangle = 0 \quad i \neq j$

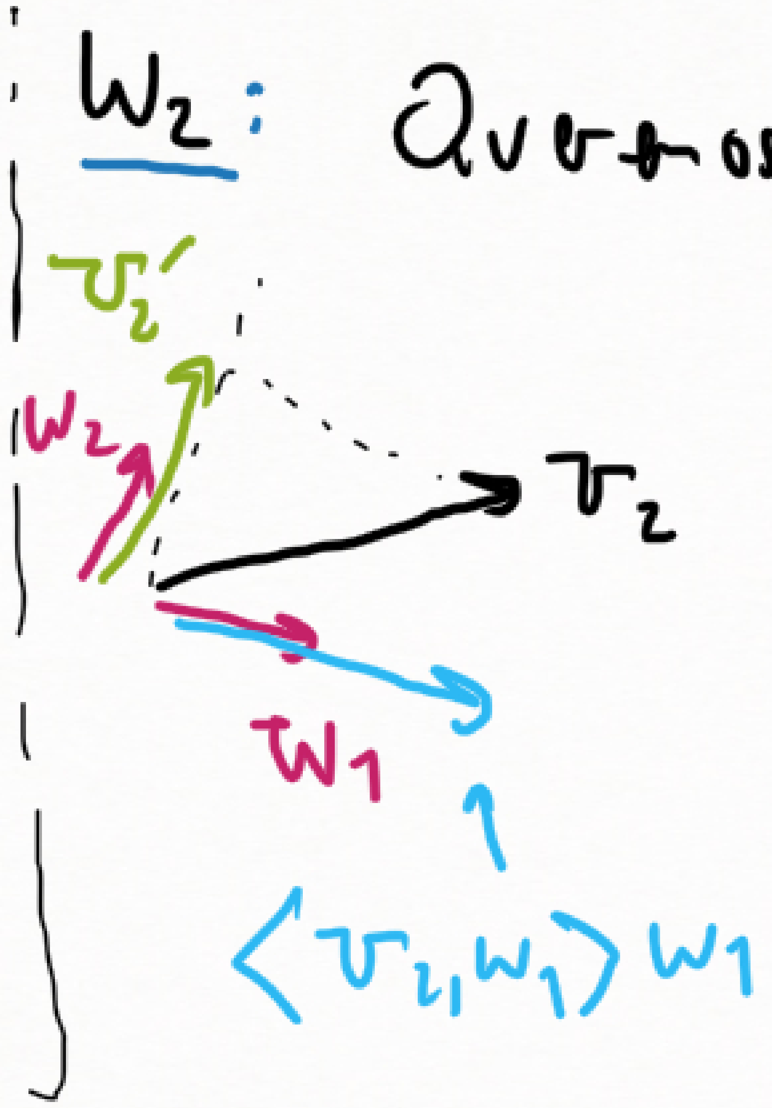
$(1,1,0)$

w_1:

$w_1 = \frac{v_1}{\|v_1\|} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$

$\|v_1\| = \sqrt{4+4} = 2\sqrt{2}$





w_2: Queremos: 1) $\langle w_1, w_2\rangle = 0$ $\qquad$ 2) $\|w_2\| = 1$

1: $v_2' = v_2 - \langle v_2, w_1\rangle w_1 = (3,-1,0) - \sqrt{2}\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$

$$\boxed{\langle v_2, w_1\rangle = \left\langle (3,-1,0), \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)\right\rangle = \frac{3}{\sqrt{2}} - \frac{1}{\sqrt{2}} = \sqrt{2} \quad \left(= \frac{2}{\sqrt{2}}\right)}$$

$v_2' = (2,-2,0) \leftarrow$ cumple $\langle v_2', w_1\rangle = 0$

$w_2 = v_2' / \|v_2'\| = \left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0\right)$

$$v_3 = (0,-2,1)$$

$$w_1 = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right) \qquad w_2 = \left(\frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, 0\right)$$

w_3:

$$v_3' = v_3 - \langle v_3, w_1\rangle w_1 - \langle v_3, w_2\rangle w_2 = (0,-2,1) + \sqrt{2}\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right) - \sqrt{2}\left(\frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, 0\right)$$

$$\langle v_3, w_1\rangle = -\frac{2}{\sqrt{2}} = -\sqrt{2}$$

$$= (0,-2,1) + (1,1,0) + (-1,1,0) = (0,0,1)$$

$$\langle v_3, w_2\rangle = \frac{2}{\sqrt{2}} = \sqrt{2}$$

$$\langle v_3', w_1\rangle = 0 \qquad \langle v_3', w_2\rangle = 0$$

$$w_3 = \frac{v_3'}{\underbrace{\|v_3'\|}_{1=}} \qquad w_3 = (0,0,1)$$

$$B' = \left\{\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right), \left(\frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, 0\right), (0,0,1)\right\}$$

$$w_1 = \frac{1}{\|v_1\|} v_1 \rightarrow v_1 = \|v_1\| w_1$$

$$w_2 = \frac{1}{\|v_2'\|} v_2' = \frac{1}{\|v_2'\|} \left(v_2 - \langle v_2, w_1 \rangle w_1 \right) = \frac{1}{\|v_2'\|} v_2 - \frac{\langle v_2, w_1 \rangle}{\|v_2'\|} w_1$$

despejo v_2

$$\rightarrow v_2 = \|v_2'\| w_2 + \langle v_2, w_1 \rangle w_1$$

$$\left(w_1 \middle| w_2 \middle| w_3 \right) \begin{pmatrix} \|v_1\| \\ 0 \\ 0 \end{pmatrix}$$

$$w_3 = \frac{1}{\|v_3'\|} \left(v_3 - \langle v_3, w_1 \rangle w_1 - \langle v_3, w_2 \rangle w_2 \right) \rightarrow v_3 = \|v_3'\| w_3 + \langle v_3, w_1 \rangle + \langle v_3, w_2 \rangle w_2$$

$$v_1 = \|v_1\| w_1$$

$$v_2 = \langle v_2, w_1 \rangle w_1 + \|v_2'\| w_2$$

$$v_3 = \langle v_3, w_1 \rangle w_1 + \langle v_3, w_2 \rangle w_2 + \|v_3'\| w_3$$

ya los calculamos
son números

$$A = \left(v_1 \middle| v_2 \middle| v_3 \right)$$

$$R = \begin{pmatrix} \|v_1\| & \langle v_2, w_1 \rangle & \langle v_3, w_1 \rangle \\ 0 & \|v_2'\| & \langle v_3, w_2 \rangle \\ 0 & 0 & \|v_3'\| \end{pmatrix}$$

$$Q = \left(w_1 \middle| w_2 \middle| w_3 \right)$$

$$A = QR$$

ortogonal xq las columnas son bon

$$QR = \left(w_1 \,\middle|\, w_2 \,\middle|\, w_3 \right) \begin{pmatrix} \|v_1\| & \langle v_2, w_1 \rangle & \langle v_3, w_1 \rangle \\ 0 & \|v_2'\| & \langle v_3, w_2 \rangle \\ 0 & 0 & \|v_3'\| \end{pmatrix}$$

$$= \left(\underbrace{\|v_1\| w_1}_{= v_1} \,\middle|\, \underbrace{\langle v_2, w_1 \rangle w_1 + \|v_2'\| w_2}_{= v_2} \,\middle|\, \underbrace{\langle v_3, w_1 \rangle w_1 + \langle v_3, w_2 \rangle w_2 + \|v_3'\| w_3}_{= v_3} \right)$$

$$= \left(v_1 \,\middle|\, v_2 \,\middle|\, v_3 \right) = A$$

$$\begin{pmatrix} + & \cdot & \cdot \\ 0 & \cdot & \cdot \\ 0 & 0 & \cdot \end{pmatrix}$$

$$\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 \\ \frac{1}{\sqrt{2}} & \frac{-1}{\sqrt{2}} & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 & 3 & 0 \\ 2 & -1 & -2 \\ 0 & 0 & 1 \end{pmatrix}$$