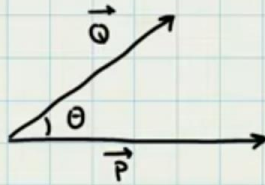




Producto Escalar o Punto



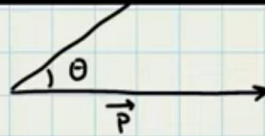
$$\vec{P} \cdot \vec{Q} = PQ \cos \theta = |\vec{P}| |\vec{Q}| \cos \theta$$

$$0 \leq \theta \leq 180^\circ$$

$$0 \leq \theta \leq \pi$$

PRODUCTO ESCALAR = CANTIDAD NUMÉRICA - ESCALAR

NO ES UN VECTOR



$$\vec{P} \cdot \vec{Q} = PQ \cos \theta = |\vec{P}| |\vec{Q}| \cos \theta$$

$$0 \leq \theta \leq 180^\circ$$

$$0 \leq \theta \leq \pi$$

PRODUCTO ESCALAR = CANTIDAD NUMÉRICA - ESCALAR

NO ES UN VECTOR

PUEDEN SER (+), (-), (0)

PRODUCTO ESCALAR ES

COMUTATIVO

$$0 \leq \theta < 90^\circ - (+)$$

$$\vec{P} \cdot \vec{Q} = \vec{Q} \cdot \vec{P}$$

$$\theta = 90^\circ - (0)$$

$$90^\circ < \theta \leq 180^\circ - (-)$$

PUEDEN SER (+), (-), (0)

PRODUCTO ESCALAR ES

COMMUTATIVO

$$0^\circ \leq \theta < 90^\circ - (+)$$

$$\theta = 90^\circ - (0)$$

$$90^\circ < \theta \leq 180^\circ - (-)$$

$$\vec{P} \cdot \vec{Q} = \vec{Q} \cdot \vec{P}$$

TRABAJO EFECTUA UNA FUERZA $\rightarrow W = \vec{F} \cdot \vec{x}$

$$W = Fx \cos \theta$$

VECTORES UNITARIOS $\rightarrow \vec{P} = P_x \hat{i} + P_y \hat{j} + P_z \hat{k}$

$$\vec{Q} = Q_x \hat{i} + Q_y \hat{j} + Q_z \hat{k}$$

TRABAJO EFECTUA UNA FUERZA $\rightarrow W = \vec{F} \cdot \vec{x}$

$$W = Fx \cos \theta$$

VECTORES UNITARIOS $\rightarrow \vec{P} = P_x \hat{i} + P_y \hat{j} + P_z \hat{k}$

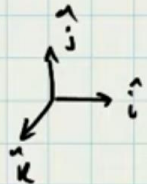
$$\vec{Q} = Q_x \hat{i} + Q_y \hat{j} + Q_z \hat{k}$$

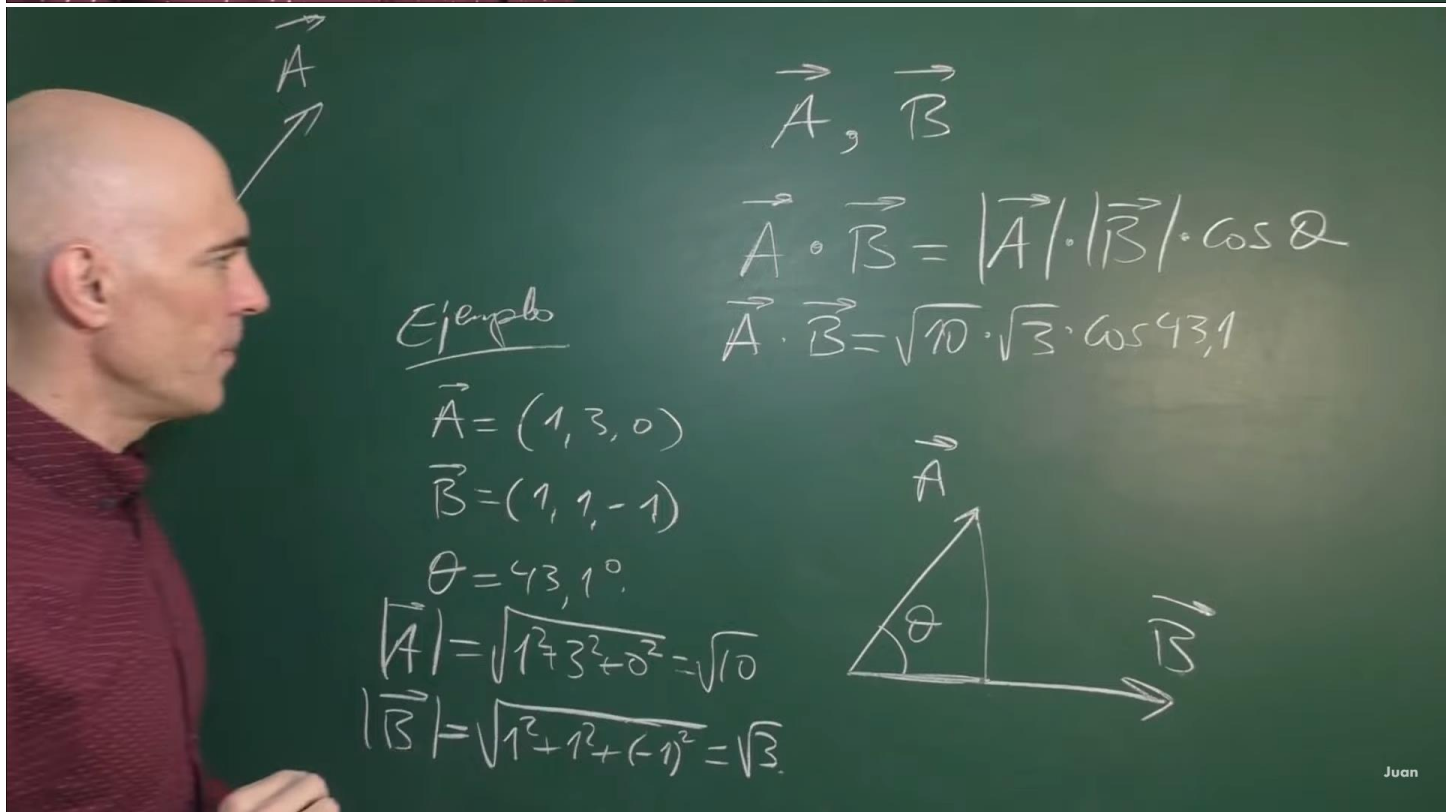
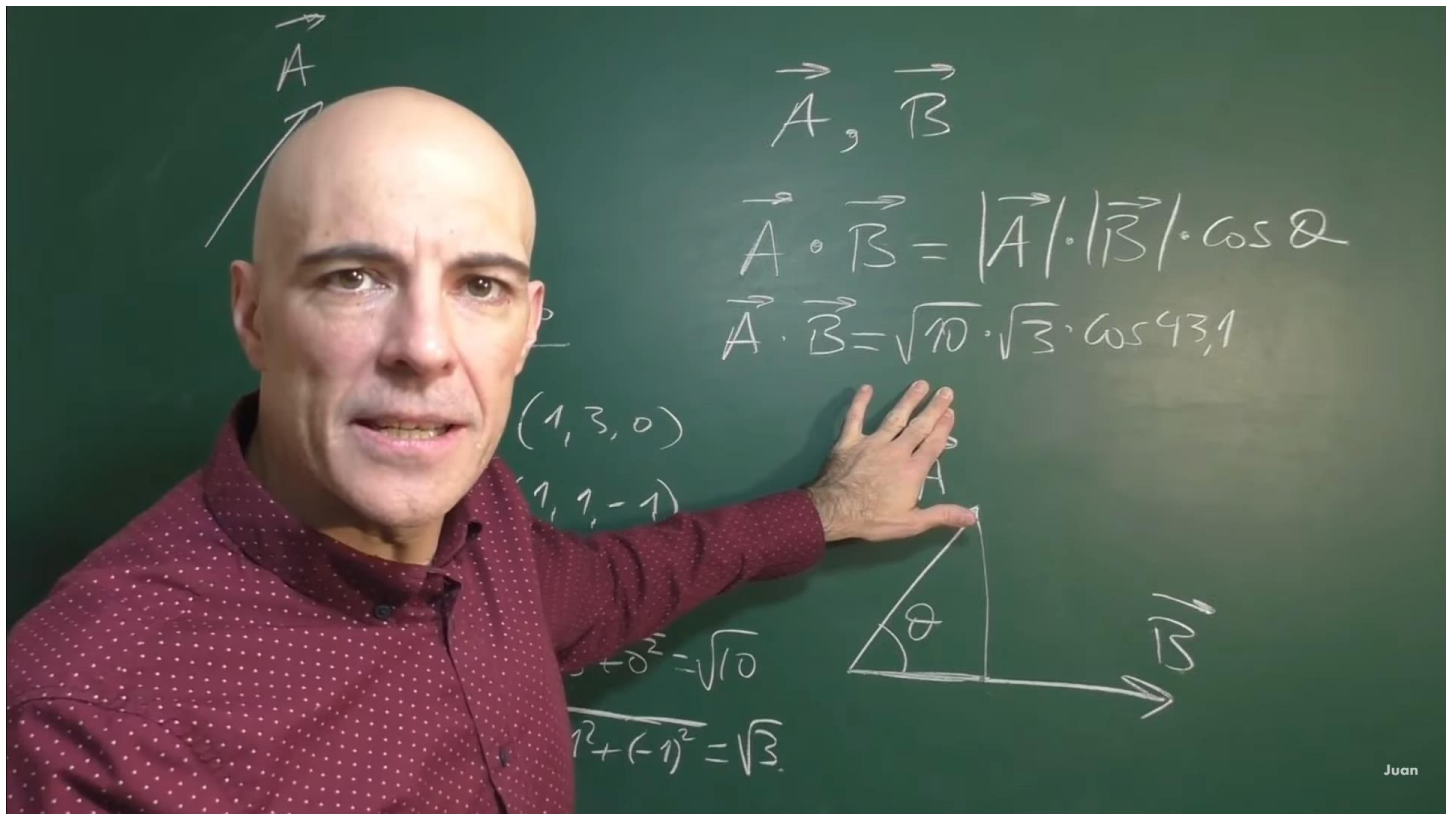
$$\vec{P} \cdot \vec{Q} = (P_x \hat{i} + P_y \hat{j} + P_z \hat{k}) (Q_x \hat{i} + Q_y \hat{j} + Q_z \hat{k})$$

$$\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = (1)(1) \cos 0 = 1$$

$$\hat{i} \cdot \hat{j} = \hat{i} \cdot \hat{k} = \hat{j} \cdot \hat{k} = (1)(1) \cos 90^\circ = 0$$

$$\boxed{\vec{P} \cdot \vec{Q} = P_x Q_x + P_y Q_y + P_z Q_z}$$





PRODUCTO ESCALAR. Qué es y para qué sirve



$$\vec{A}, \vec{B}$$

$$\vec{A} \cdot \vec{B} = |\vec{A}| \cdot |\vec{B}| \cdot \cos \theta$$

$$\vec{A} \cdot \vec{B} = \sqrt{10} \cdot \sqrt{3} \cdot \cos 43,1^\circ = \underline{\underline{4}}$$

Ejemplo

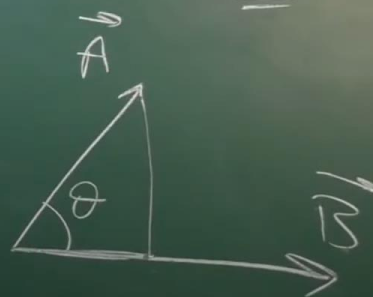
$$\vec{A} = (1, 3, 0)$$

$$\vec{B} = (1, 1, -1)$$

$$\theta = 43,1^\circ$$

$$|\vec{A}| = \sqrt{1^2 + 3^2 + 0^2} = \sqrt{10}$$

$$|\vec{B}| = \sqrt{1^2 + 1^2 + (-1)^2} = \sqrt{3}$$



Juan

3:20 / 12:19



$$\vec{A} = (A_x, A_y, A_z)$$

$$\vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \cdot \vec{B} = (A_x, A_y, A_z) \cdot (B_x, B_y, B_z) =$$

$$= A_x B_x + A_y B_y + A_z B_z$$

Ejemplo

$$\vec{A} = (1, 3, 0)$$

$$\vec{B} = (1, 1, -1)$$

$$\theta = 43,1^\circ$$

$$|\vec{A}| = \sqrt{1^2 + 3^2 + 0^2} = \sqrt{10}$$

$$|\vec{B}| = \sqrt{1^2 + 1^2 + (-1)^2} = \sqrt{3}$$

$$\vec{A} \cdot \vec{B} = (1, 3, 0) \cdot (1, 1, -1) =$$
$$= 1 \cdot 1 + 3 \cdot 1 + 0 \cdot (-1) =$$
$$= \underline{\underline{4}}$$

Juan

PRODUCTO ESCALAR. Qué es y para qué sirve

$$W = \vec{F} \cdot \vec{d}$$

Ejemplo.

$$\vec{F} = (3, 0, 0) \text{ N}$$

$$\vec{d} = (1, 0, 0) \text{ m}$$

$$W = \vec{F} \cdot \vec{d} = (3, 0, 0) \text{ N} \cdot (1, 0, 0) \text{ m} =$$

$$= (3 \cdot 1 + 0 \cdot 0 + 0 \cdot 0) \text{ Nm} =$$

$$= 3 \text{ Nm} = 3 \text{ J}$$

Juan

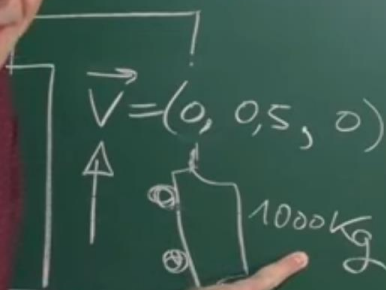
7:58 / 12:19



$$P = \vec{F} \cdot \vec{v}$$

Ejemplo.

$$\vec{v} = (0, 0, 5, 0) \frac{\text{m}}{\text{s}}$$



Juan

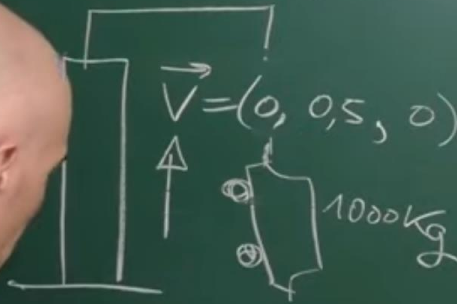
Salir del modo de pantalla completa (f)

$$P = \vec{F} \cdot \vec{V}$$

Ejemplo

$$\vec{F} = (0, 1000 \cdot 10, 0) \text{ kg} \frac{\text{m}}{\text{s}^2}$$

$$\vec{V} = (0, 0,5, 0) \frac{\text{m}}{\text{s}}$$



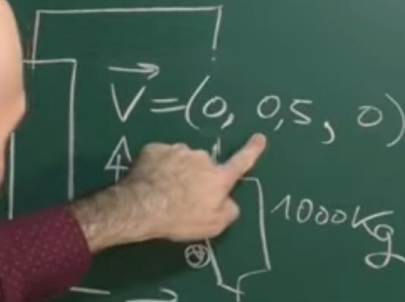
Juan

$$P = \vec{F} \cdot \vec{V}$$

Ejemplo

$$\vec{F} = (0, 1000 \cdot 10, 0) \text{ kg} \frac{\text{m}}{\text{s}^2}$$

$$\vec{V} = (0, 0,5, 0) \frac{\text{m}}{\text{s}}$$



$$\vec{P} = \vec{F} \cdot \vec{V} = (0, 1000 \cdot 10, 0) \cdot (0, 0,5, 0)$$

Juan

$$P = \vec{F} \cdot \vec{V}$$

Ejemplo

$$\vec{F} = (0, 1000 \cdot 10, 0) \text{ kg} \frac{\text{m}}{\text{s}^2}$$



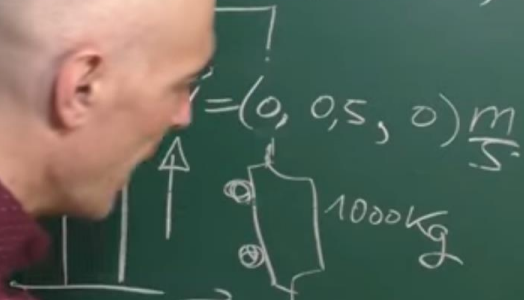
$$P = \vec{F} \cdot \vec{V} = (0, 1000 \cdot 10, 0) \cdot (0, 0.5, 0) \text{ kg} \frac{\text{m}}{\text{s}^2} \cdot \frac{1}{\text{s}}$$

Juan

$$P = \vec{F} \cdot \vec{V}$$

Ejemplo

$$\vec{F} = (0, 1000 \cdot 10, 0) \text{ kg} \frac{\text{m}}{\text{s}^2}$$



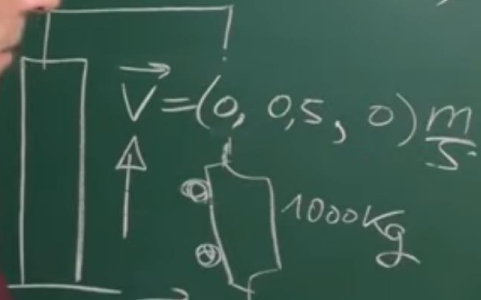
$$P = \vec{F} \cdot \vec{V} = (0, 1000 \cdot 10, 0) \cdot (0, 0.5, 0) \text{ kg} \frac{\text{m}}{\text{s}^2} \cdot \frac{1}{\text{s}}$$

Juan

$$P = \vec{F} \cdot \vec{V}$$

Ejemplo

$$\vec{F} = (0, 1000 \cdot 10, 0) \text{ kg} \frac{\text{m}}{\text{s}^2}$$



$$\vec{V} = (0, 0.5, 0) \frac{\text{m}}{\text{s}}$$

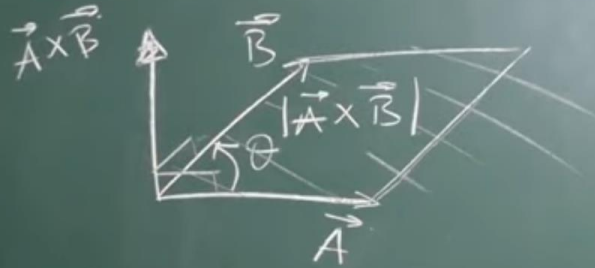
$$5000 \frac{\text{J}}{\text{s}}$$

$$P = \vec{F} \cdot \vec{V} = (0, 1000 \cdot 10, 0) \cdot (0, 0.5, 0) \text{ kg} \frac{\text{m}}{\text{s}^2} \cdot \frac{\text{m}}{\text{s}}$$

PRODUCTO VECTORIAL

\vec{A}, \vec{B}

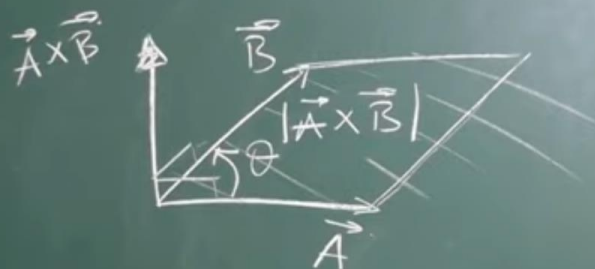
$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



Juan

$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$

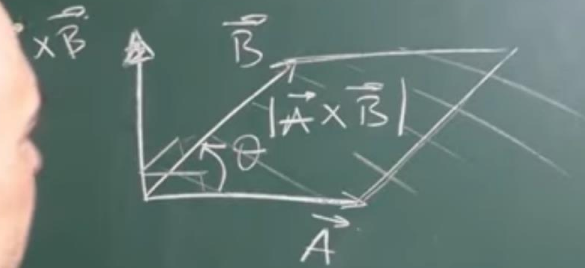
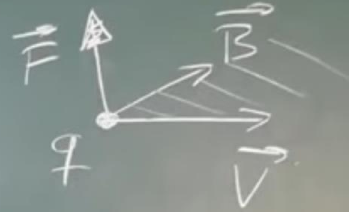


$$\vec{A} \times \vec{B} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix} = (A_y B_z - A_z B_y) \vec{i} - (A_x B_z - A_z B_x) \vec{j} + (A_x B_y - A_y B_x) \vec{k}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$

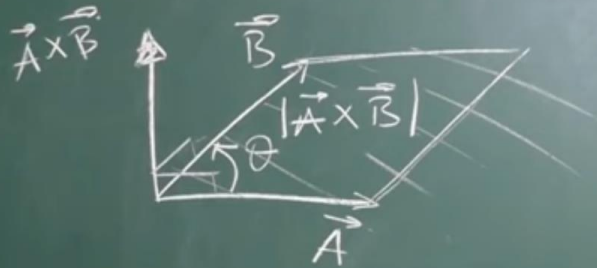
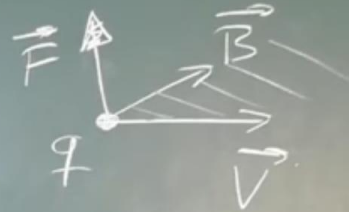


$$\vec{A} \times \vec{B} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix} = (A_y B_z - A_z B_y) \vec{i} - (A_x B_z - A_z B_x) \vec{j} + (A_x B_y - A_y B_x) \vec{k}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{A} \times \vec{B} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix} = (A_y B_z - A_z B_y) \vec{i} - (A_x B_z - A_z B_x) \vec{j} + (A_x B_y - A_y B_x) \vec{k}$$

$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

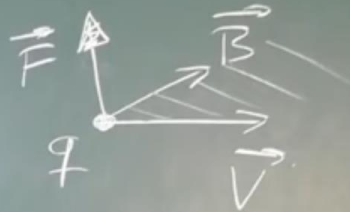
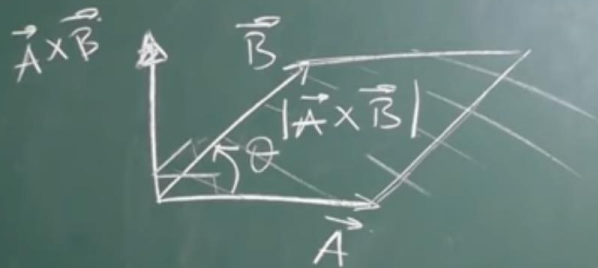
$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

$$\vec{B} = (0, 0, 2) \text{ T}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

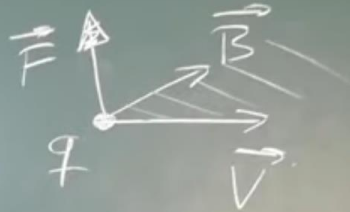
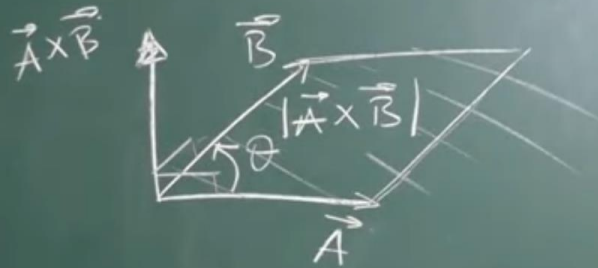
$$\vec{B} = (0, 0, 2) \text{ T}$$

$$\vec{F} = q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix} = (A_y B_z - A_z B_y) \vec{i} - (A_x B_z - A_z B_x) \vec{j} + (A_x B_y - A_y B_x) \vec{k}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

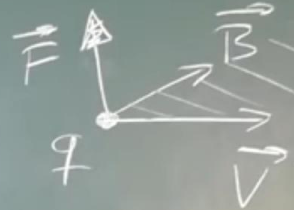
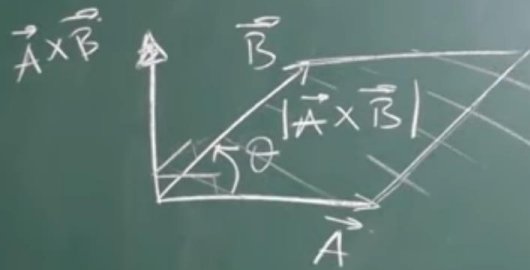
$$\vec{B} = (0, 0, 2) \text{ T}$$

$$\vec{F} = q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix} = [(V_y B_z - V_z B_y) \vec{i} - (V_x B_z - V_z B_x) \vec{j} + (V_x B_y - V_y B_x) \vec{k}] q$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

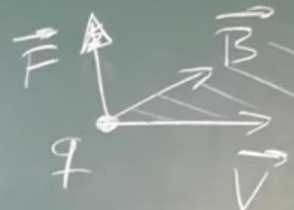
$$\vec{B} = (0, 0, 2) \text{ T}$$

$$-(V_x B_z - V_z B_x) \vec{j} \cdot q$$

$$\vec{F} = q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix}$$

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

$$\vec{B} = (0, 0, 2) \text{ T}$$

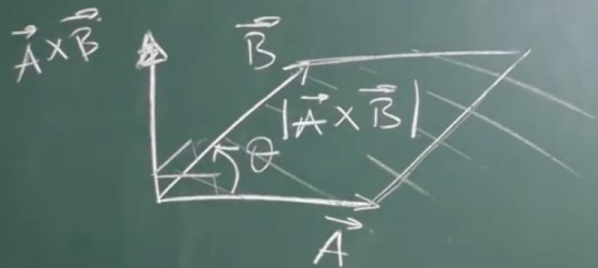
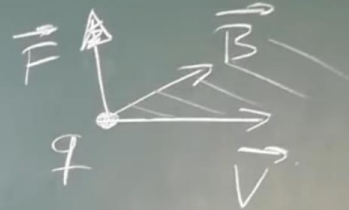
$$\vec{F} = q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix} = -V_x B_z q \cdot \vec{j}$$

Juan

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

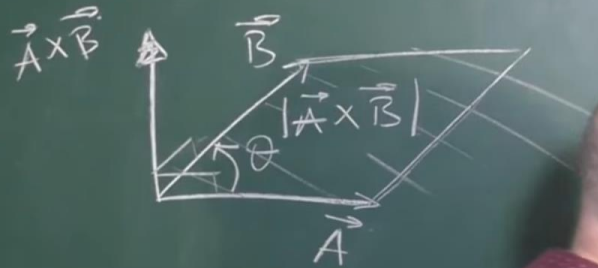
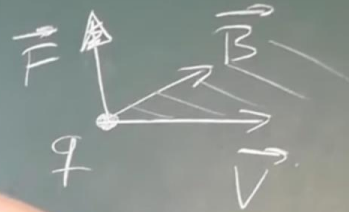
$$\vec{B} = (0, 0, 2) \text{ T}$$

$$\vec{F} = q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix} = -V_x B_z q \cdot \vec{j} = -4 \cdot 10^4 \cdot 2 \cdot 1,6 \cdot 10^{-19} \cdot \vec{j} \cdot \frac{\text{N}}{\text{C}}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{V} \times \vec{B}$$

$$q = 1,6 \cdot 10^{-19} \text{ C}$$

$$(4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

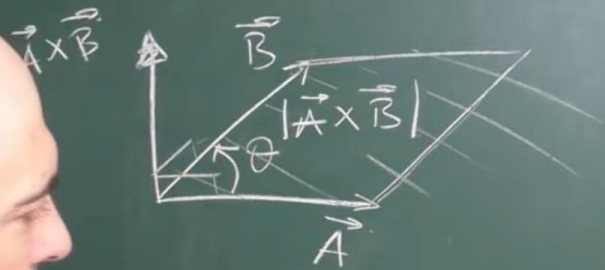
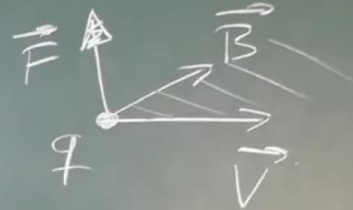
$$(0, 0, 2) \text{ T}$$

$$\vec{F} = q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix} = -4 \cdot 10^4 \cdot 2 \cdot 1,6 \cdot 10^{-19} \cdot \vec{j}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

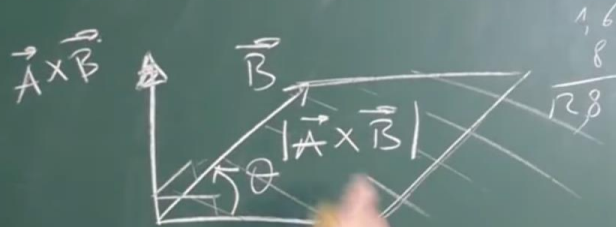
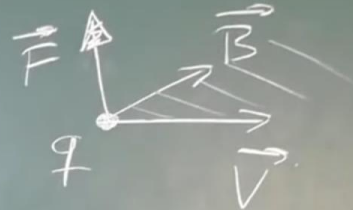
$$\vec{B} = (0, 0, 2) \text{ T}$$

$$q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix} = -V_x B_z q \cdot \vec{j} = -4 \cdot 10^4 \cdot 2 \cdot 1,6 \cdot 10^{-19} \vec{j} \text{ N}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

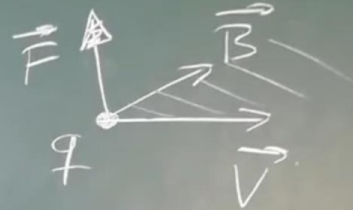
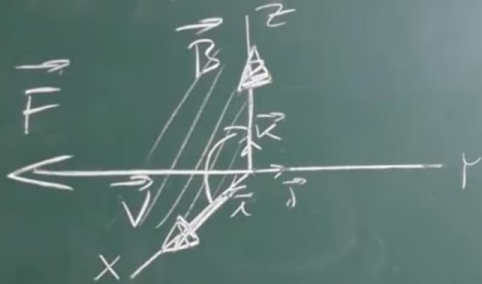
$$\vec{B} = (0, 0, 2) \text{ T}$$

$$\vec{F} = q \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix} = -V_x B_z q \cdot \vec{j} = -4 \cdot 10^4 \cdot 2 \cdot 1,6 \cdot 10^{-19} \vec{j} \text{ N} = 12,8 \cdot 10^{-14} \vec{j} \text{ N}$$

Juan

$$\vec{A}, \vec{B}; \vec{A} = (A_x, A_y, A_z); \vec{B} = (B_x, B_y, B_z)$$

$$\vec{A} \times \vec{B} = |\vec{A}| \cdot |\vec{B}| \sin \theta \cdot \vec{u}_n$$



$$\vec{F} = q \cdot \vec{V} \times \vec{B}$$

$$\text{DATOS: } q = 1,6 \cdot 10^{-19} \text{ C}$$

$$\vec{V} = (4 \cdot 10^4, 0, 0) \frac{\text{m}}{\text{s}}$$

$$\vec{B} = (0, 0, 2) \text{ T}$$

$$= q \cdot \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ V_x & V_y & V_z \\ B_x & B_y & B_z \end{vmatrix} = -V_x B_z q \cdot \vec{j} = -4 \cdot 10^4 \cdot 2 \cdot 1,6 \cdot 10^{-19} \vec{j} \text{ N} =$$

$$= -1,28 \cdot 10^{-14} \vec{j} \text{ N}$$