
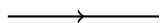


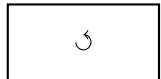


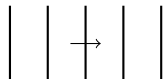






Homework 1 - Tensors

Q1.1. Draw diagrams illustrating

- (a) \vec{v} , $2\vec{v}$ and $-\vec{v}$
- (b) $\vec{\underline{v}}$, $2\vec{\underline{v}}$ and $-\vec{\underline{v}}$
- (c) $\underline{\omega}$, $2\underline{\omega}$ and $-\underline{\omega}$
- (d) $\underline{\underline{\omega}}$, $2\underline{\underline{\omega}}$ and $-\underline{\underline{\omega}}$

in two dimensions.

- A1.1. (a) \vec{v} 
- $2\vec{v}$ 
- $-\vec{v}$ 
- (b) $\vec{\underline{v}}$ 
- $2\vec{\underline{v}}$ 
- $-\vec{\underline{v}}$ 
- (c) $\underline{\omega}$ 
- $2\underline{\omega}$ 
- $-\underline{\omega}$ 
- (d) $\underline{\underline{\omega}}$ 
- $2\underline{\underline{\omega}}$ 
- $-\underline{\underline{\omega}}$ 

Q1.2. Draw diagrams illustrating

(a) $\vec{v} \cdot \underline{\underline{\omega}}$

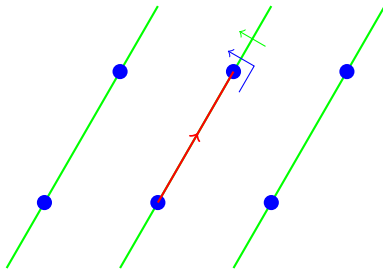
(b) $\underline{\underline{\omega}} \cdot \vec{v}$

(c) $\underline{\underline{\omega}} \cdot \vec{v}$

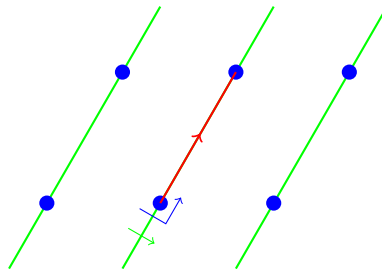
(d) $\vec{v} \cdot \underline{\underline{\omega}}$

in two dimensions.

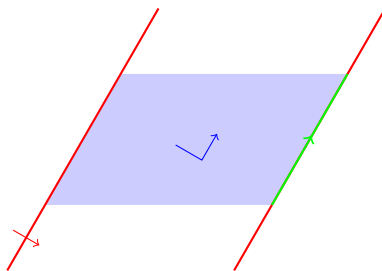
A1.2. (a) $\vec{v} \cdot \underline{\underline{\omega}} = \underline{\underline{\sigma}}$



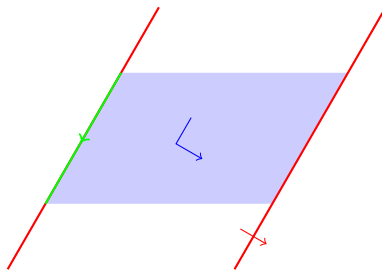
(b) $\underline{\underline{\omega}} \cdot \vec{v} = -\underline{\underline{\sigma}}$



(c) $\underline{\underline{\omega}} \cdot \vec{v} = \vec{u}$



(d) $\vec{v} \cdot \underline{\underline{\omega}} = -\vec{u}$



Q1.3. Write down the Lorentz force law, expressing every tensor in its natural form.
Draw a diagram illustrating your answer.

A1.3.

$$\underline{F} = q (\underline{E} + \underline{B} \cdot \underline{v}) \quad (\text{A1.3.1})$$

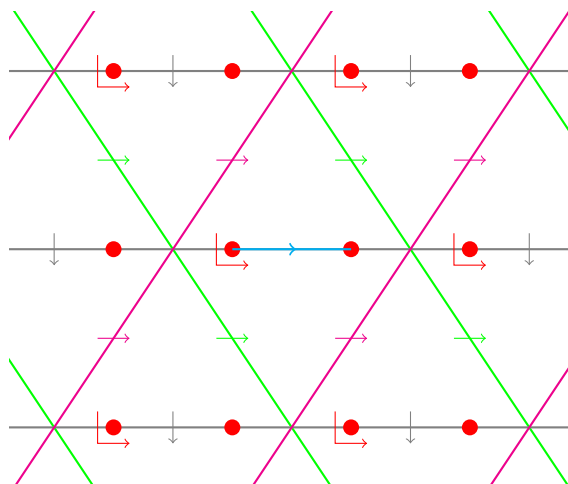


Figure A1.3.1: $\underline{F}/q = \underline{E} + (\underline{B} \cdot \underline{v})$