

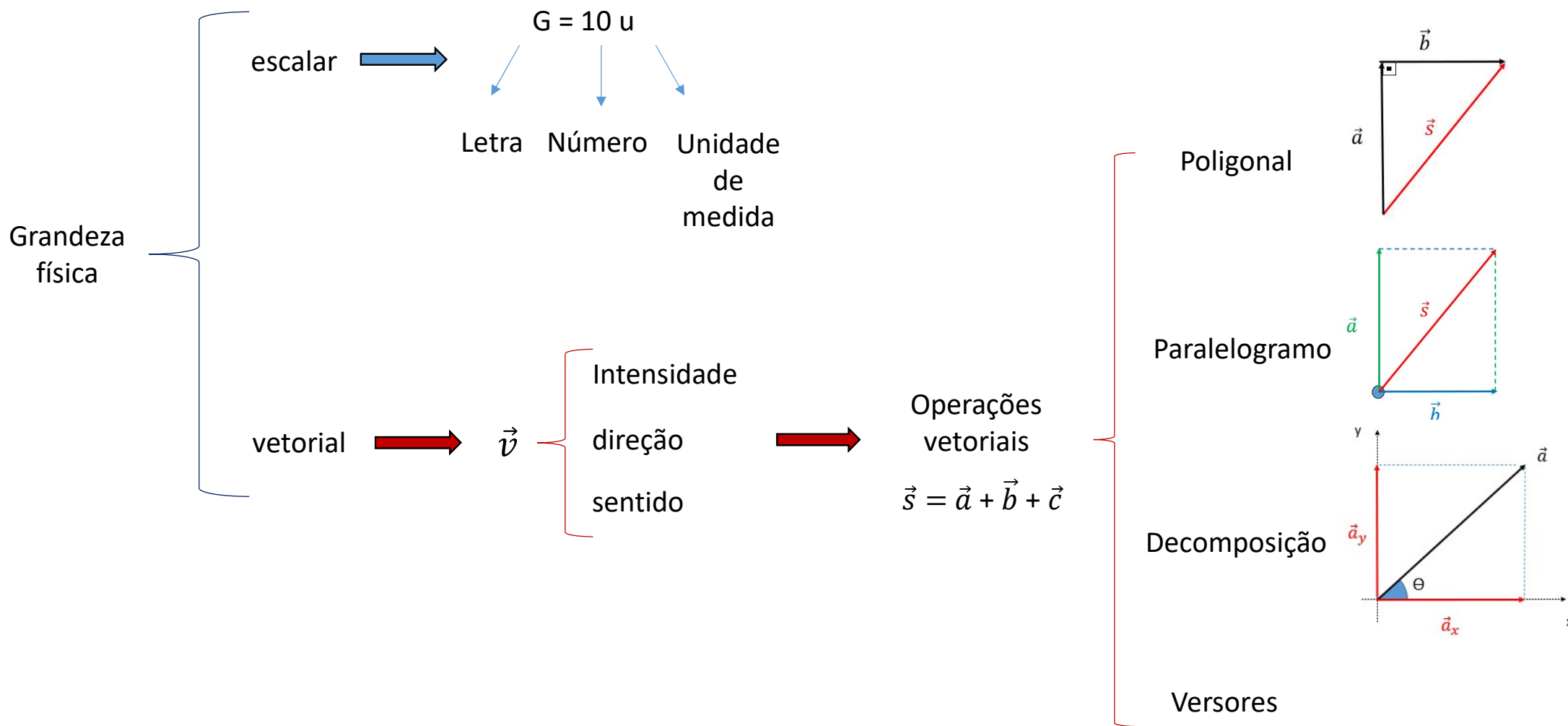
## **Aula 12 - Operações vetoriais**

- Estudos Avançados / Caderno 1 / Módulo 6 / Página 59

Apresentação e demais documentos: [fisicasp.com.br](http://fisicasp.com.br)

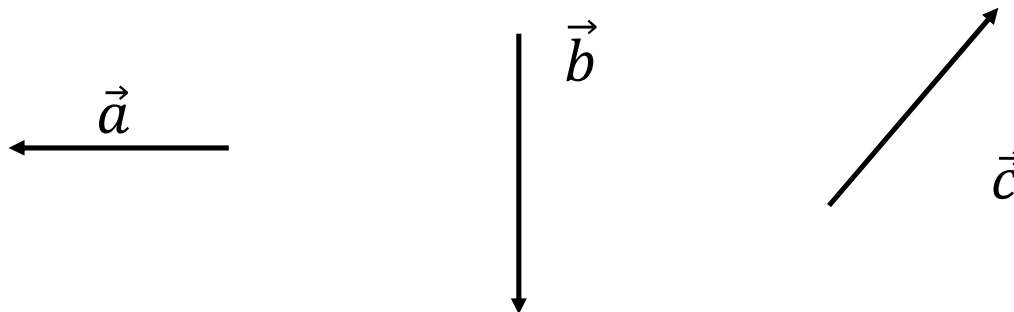
**Professor Caio**

# 1. Grandeza escalar x vetorial



## 2. Resultante de dois ou mais vetores

$$\vec{s} = \vec{a} + \vec{b} + \vec{c}$$

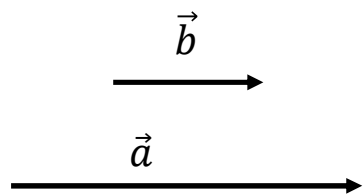


Não é a simples soma algébrica de suas intensidades!



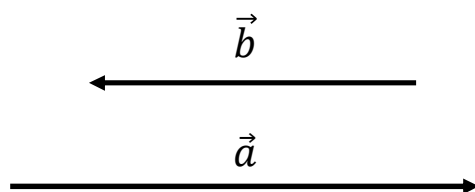
### 3. Regra da linha poligonal

Mesma direção e sentido



$$a = 4 \text{ e } b = 3$$

Mesma direção e sentidos contrários

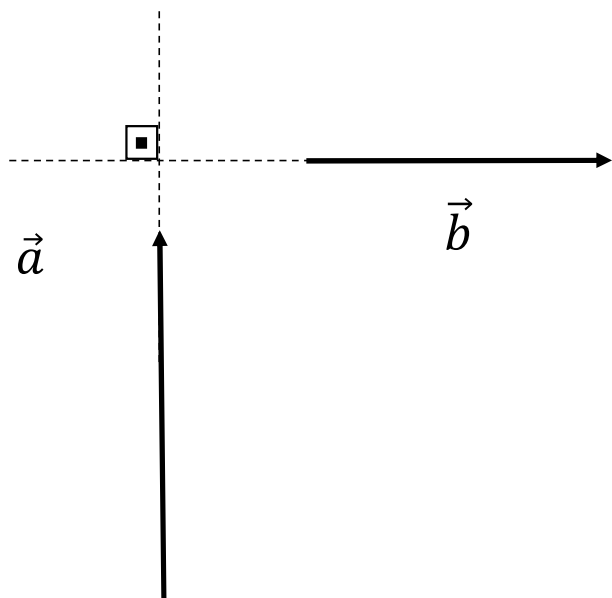


$$a = 4 \text{ e } b = 3$$

### 3. Regra da linha poligonal

Vetores perpendiculares entre si

$$\vec{s} = \vec{a} + \vec{b}$$

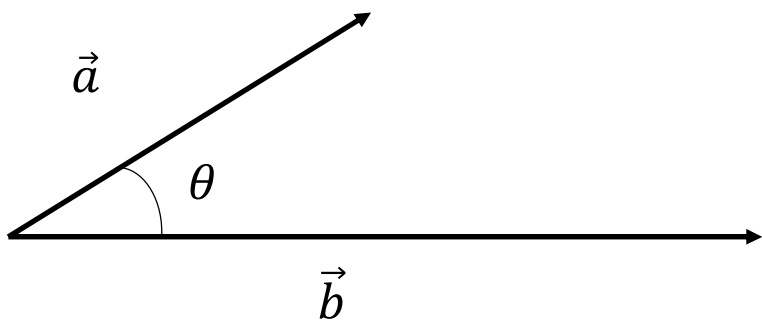


$$a = 4 \text{ e } b = 3$$

### 3. Regra da linha poligonal

Ângulo qualquer entre os vetores

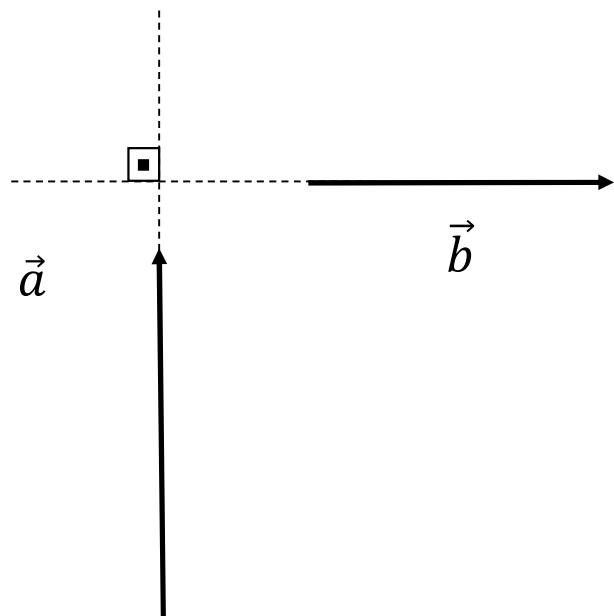
$$\vec{s} = \vec{a} + \vec{b}$$



## 4. Regra do paralelogramo

Vetores perpendiculares entre si

$$\vec{s} = \vec{a} + \vec{b}$$

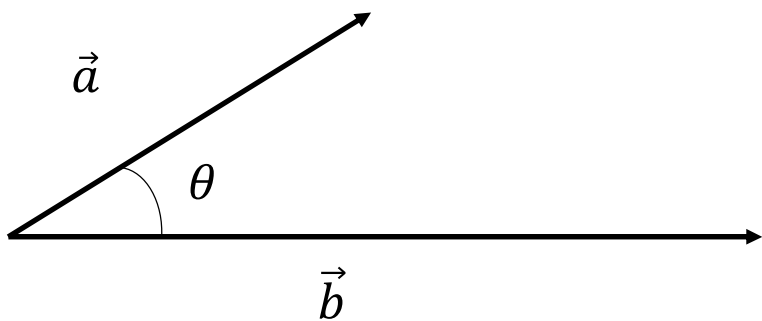


$$a = 4 \text{ e } b = 3$$

## 4. Regra do paralelogramo

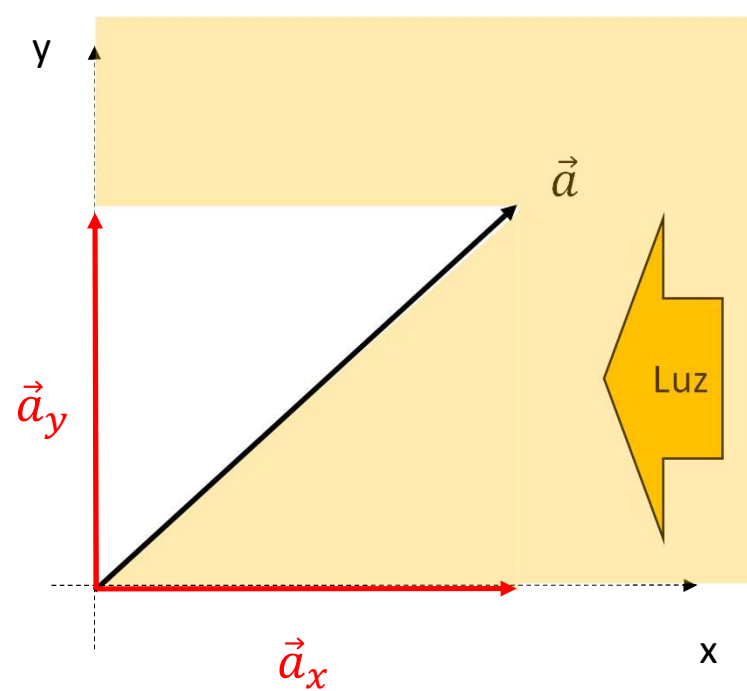
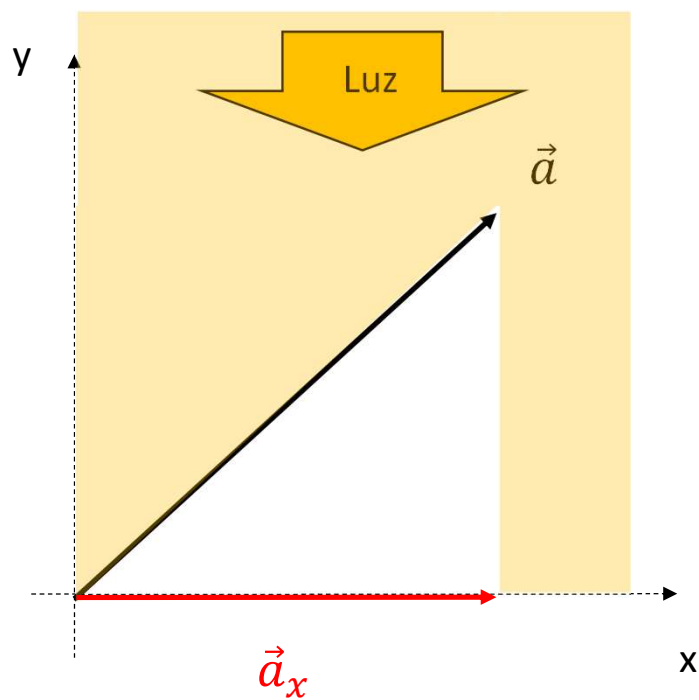
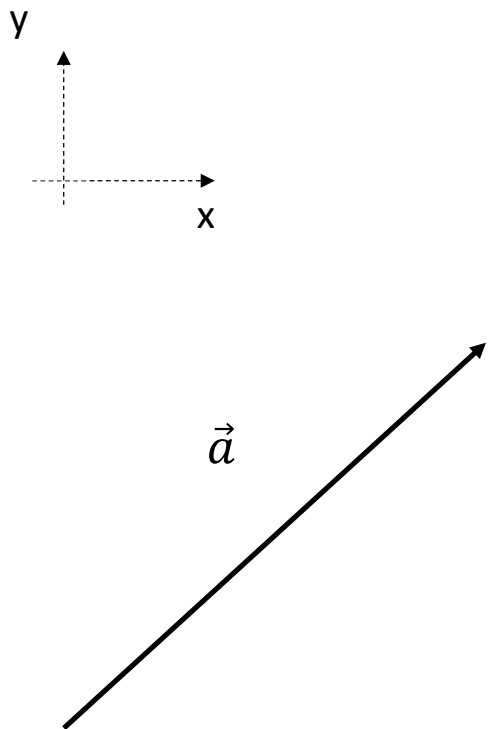
Ângulo qualquer entre os vetores

$$\vec{s} = \vec{a} + \vec{b}$$

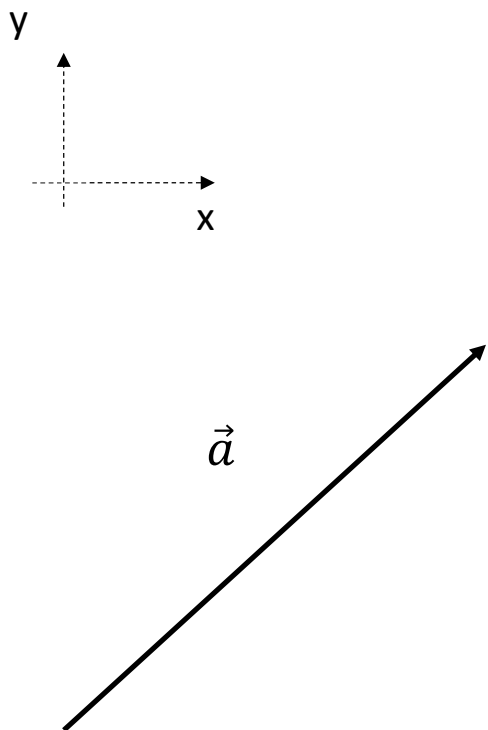




## 5. Decomposição de um vetor

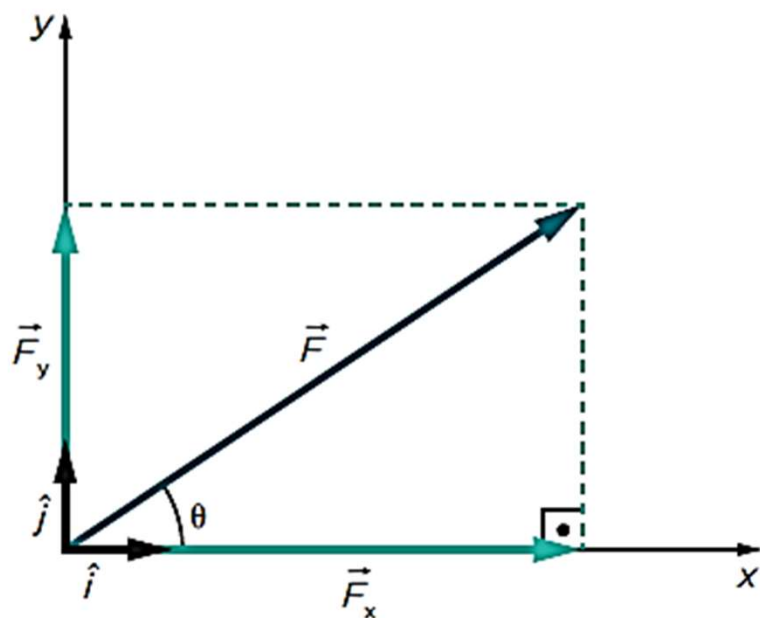


## 5. Decomposição de um vetor



## 5. Vetores unitários ou versores

Versores são vetores unitários utilizados para indicar a direção e o sentido das componentes de um vetor. É convenção que:



$$\hat{i} = \{1 \text{ unidade, horizontal, para a direita}\}$$

$$\hat{j} = \{1 \text{ unidade, vertical, para cima}\}$$

$$\vec{F} = F_x \cdot \hat{i} + F_y \cdot \hat{j}$$

## 6. Multiplicação de um vetor ( $\vec{V}$ ) por um número real ( $x$ )

$$\vec{V}_1 = x \cdot \vec{V}_2$$

*Intensidade*

$$V_1 = |x| \cdot V_2$$

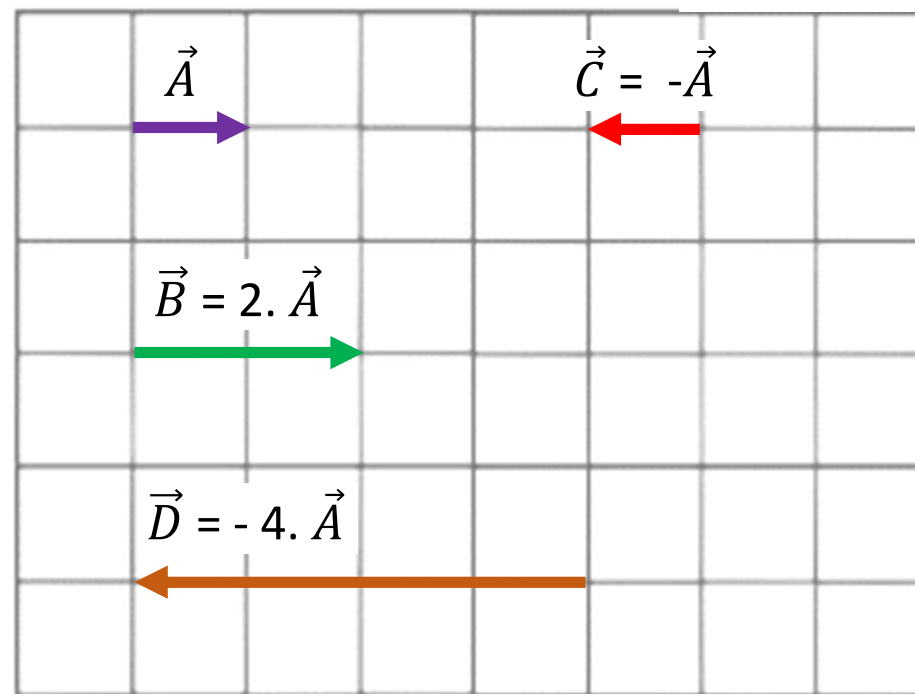
*Direção*

$\vec{V}_1$  e  $\vec{V}_2$  têm mesma direção

*Sentido*

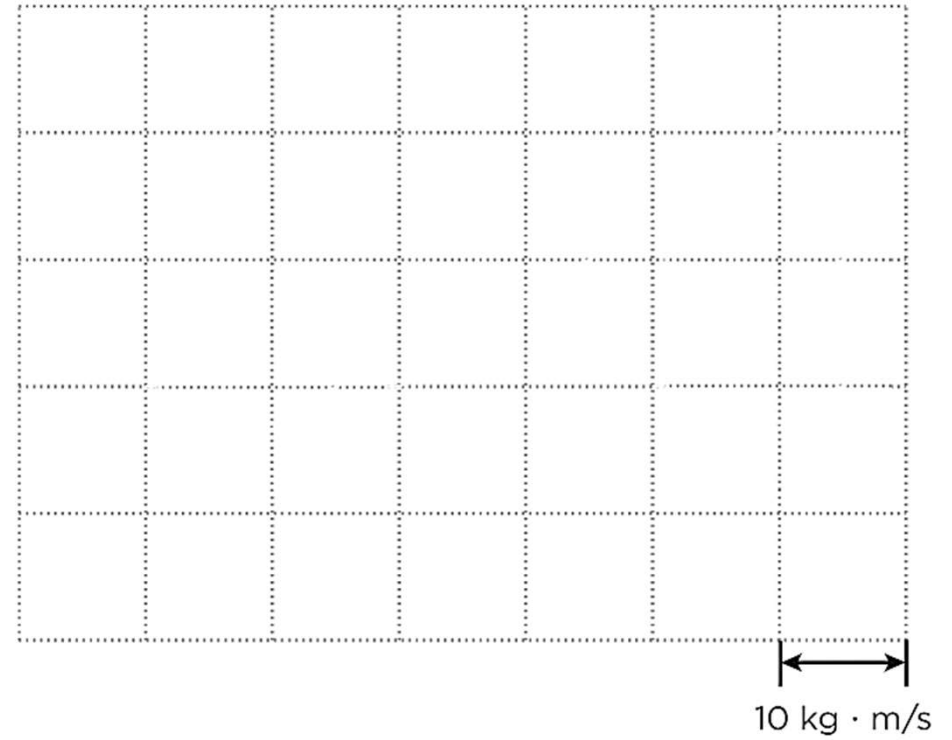
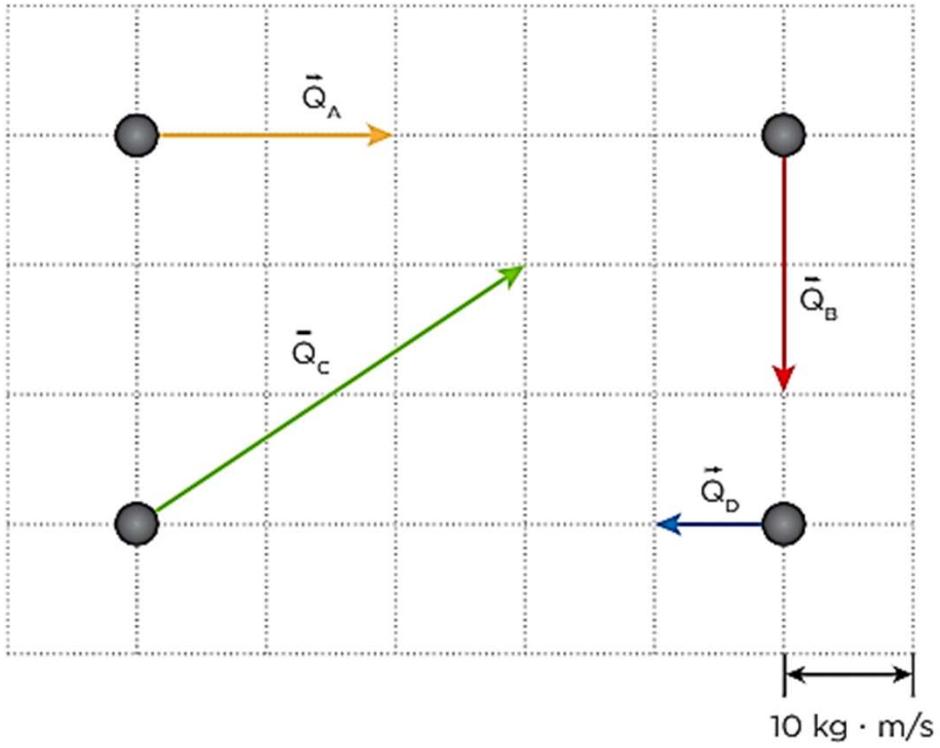
Se  $x > 0 \rightarrow \vec{V}_1$  e  $\vec{V}_2$  têm mesmo sentido

Se  $x < 0 \rightarrow \vec{V}_1$  e  $\vec{V}_2$  têm sentidos opostos



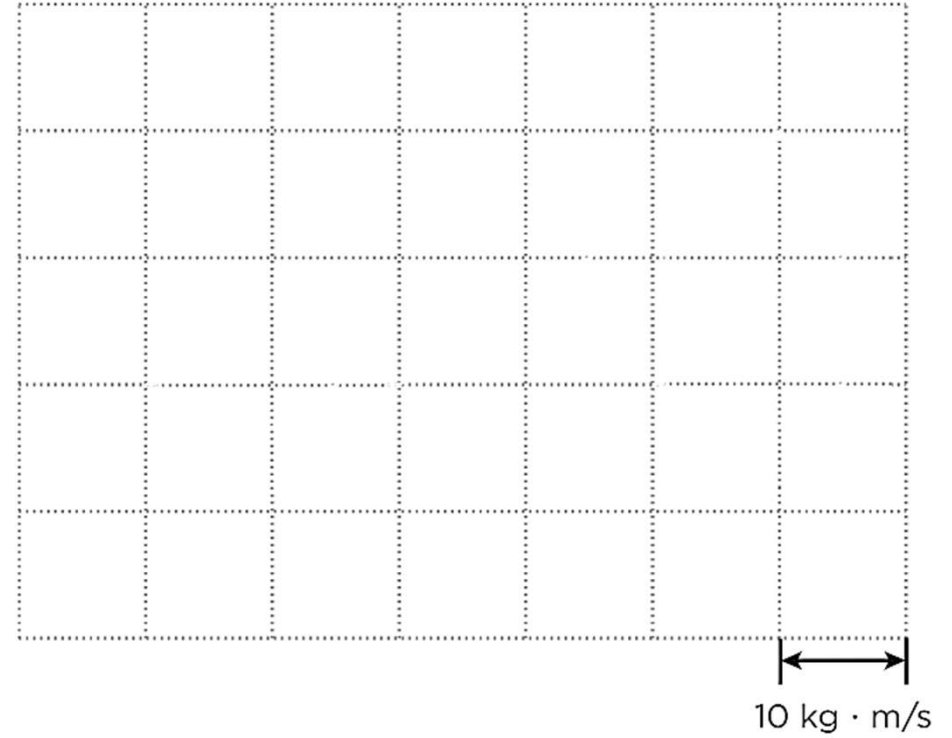
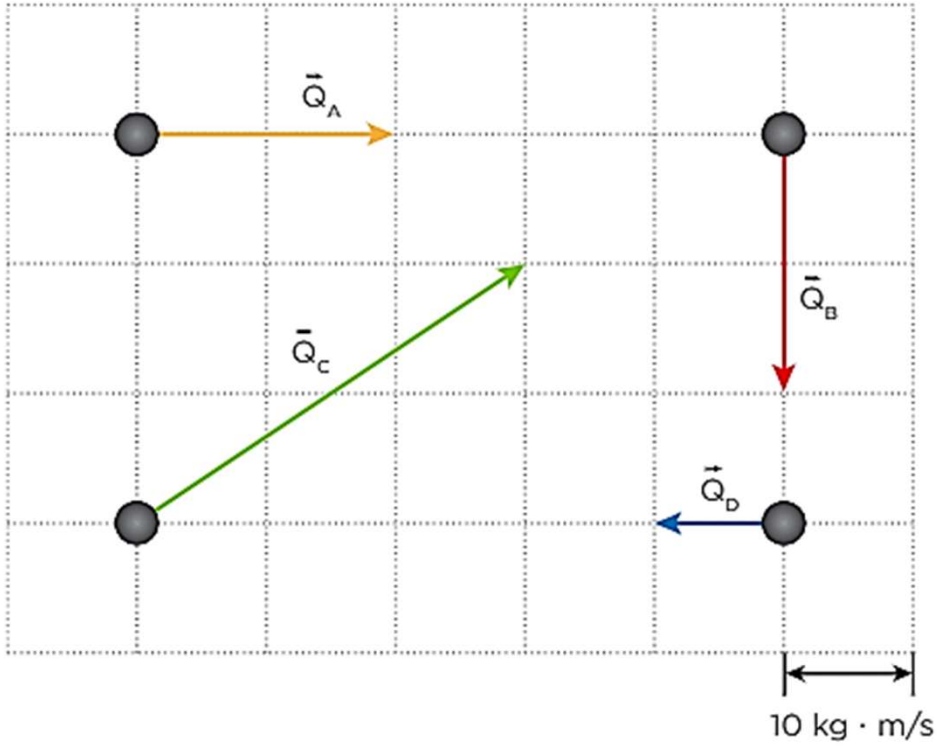
## Exercícios do Caio

1. Observe o sistema de quatro corpos a seguir e caracterize o vetor:  $\vec{Q}_{sistema} = \vec{Q}_A + \vec{Q}_B + \vec{Q}_C + \vec{Q}_D$

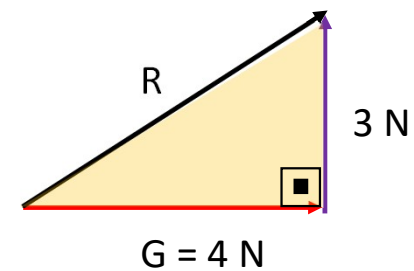
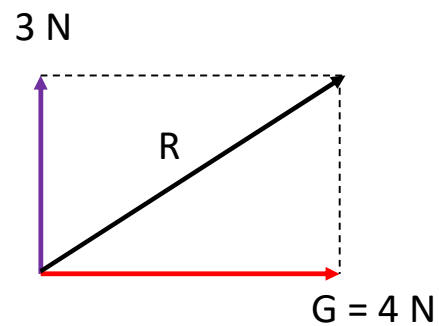
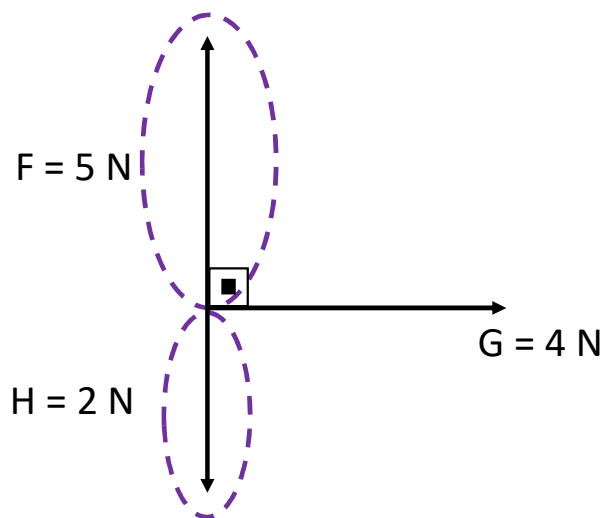


2. Observe o sistema de quatro corpos a seguir e caracterize o vetor

$$\vec{Q}_{sistema} = \vec{Q}_C + \vec{Q}_A + \vec{Q}_B + \vec{Q}_D$$



3. Determine a intensidade da resultante das forças.



$$R^2 = 4^2 + 3^2$$

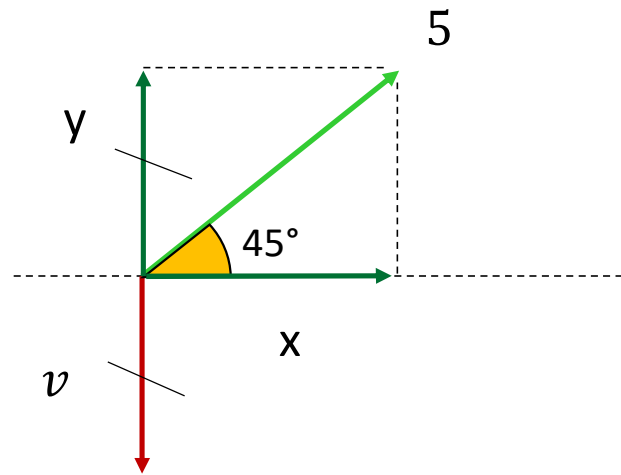
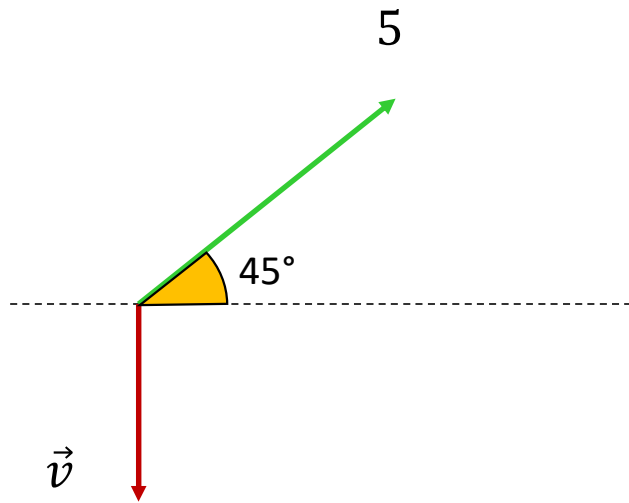
$$R^2 = 16 + 9$$

$$R^2 = 25$$

$$R = 5\text{ N}$$



4. Determine a intensidade do vetor  $\vec{v}$  sabendo que o vetor soma tem somente componente horizontal

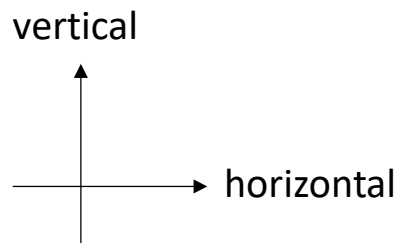


$$v = y$$

$$\text{sen } 45^\circ = \frac{y}{5}$$

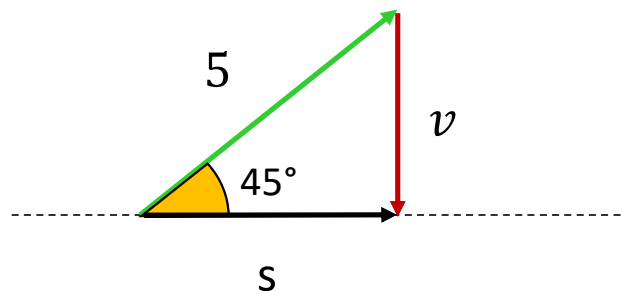
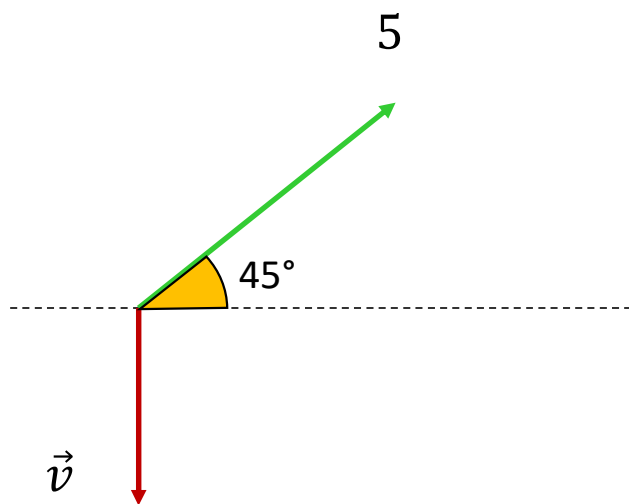
$$\frac{\sqrt{2}}{2} = \frac{y}{5}$$

$$y = \frac{5\sqrt{2}}{2}$$



$$\therefore v = y = \frac{5\sqrt{2}}{2}$$

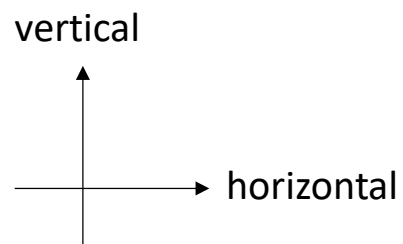
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$$\text{sen } 45^\circ = \frac{v}{5}$$

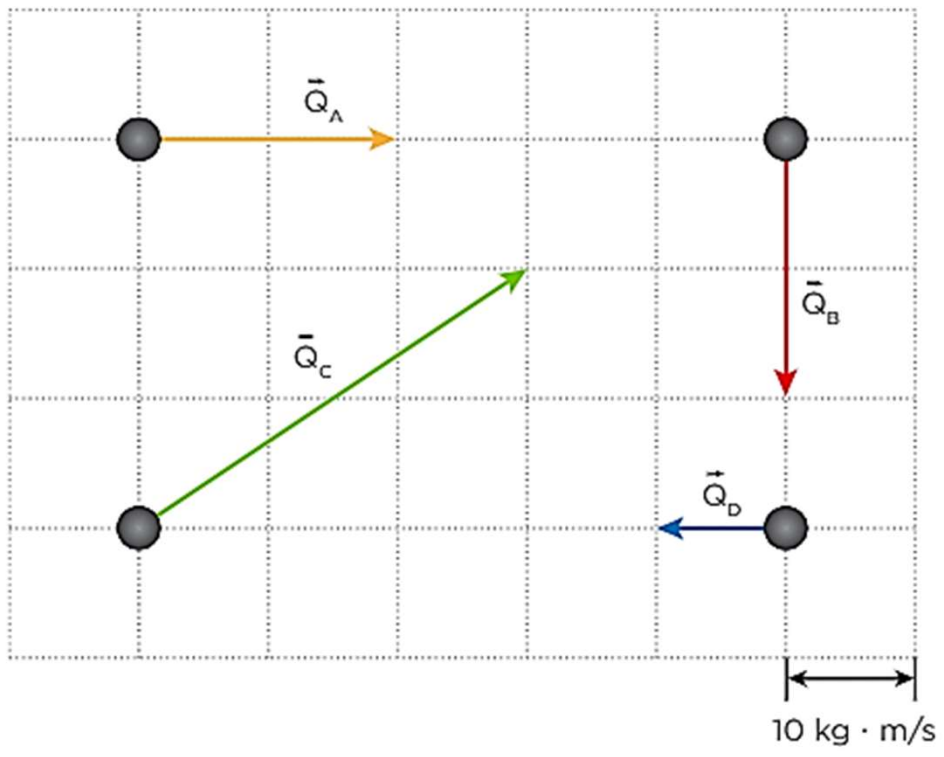
$$\frac{\sqrt{2}}{2} = \frac{v}{5}$$

$$v = \frac{5\sqrt{2}}{2}$$



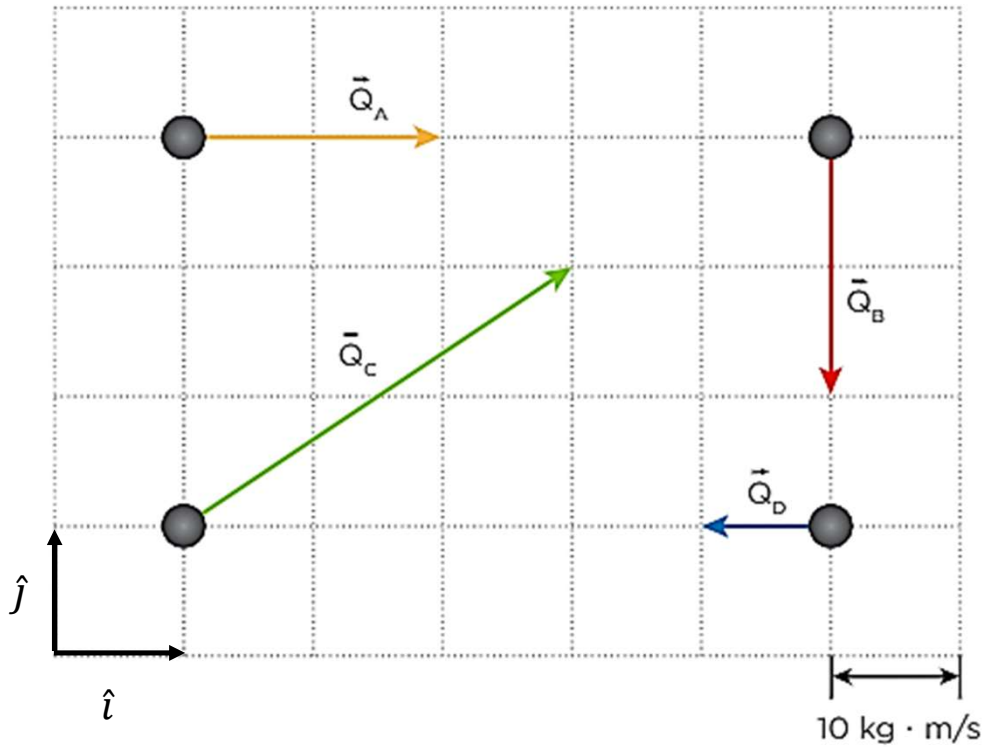
5. Observe o sistema de quatro corpos a seguir e caracterize o vetor  $\vec{Q}_{sistema}$ . Resolva utilizando versores.

$$\vec{Q}_{sistema} = \vec{Q}_A + \vec{Q}_B + \vec{Q}_C + \vec{Q}_D$$



5. Observe o sistema de quatro corpos a seguir e caracterize o vetor  $\vec{Q}_{sistema}$ . Resolva utilizando versores.

$$\vec{Q}_{sistema} = \vec{Q}_A + \vec{Q}_B + \vec{Q}_C + \vec{Q}_D$$



$$\vec{Q}_A = 2 \hat{i} \quad \vec{Q}_C = 3 \hat{i} + 2 \hat{j}$$

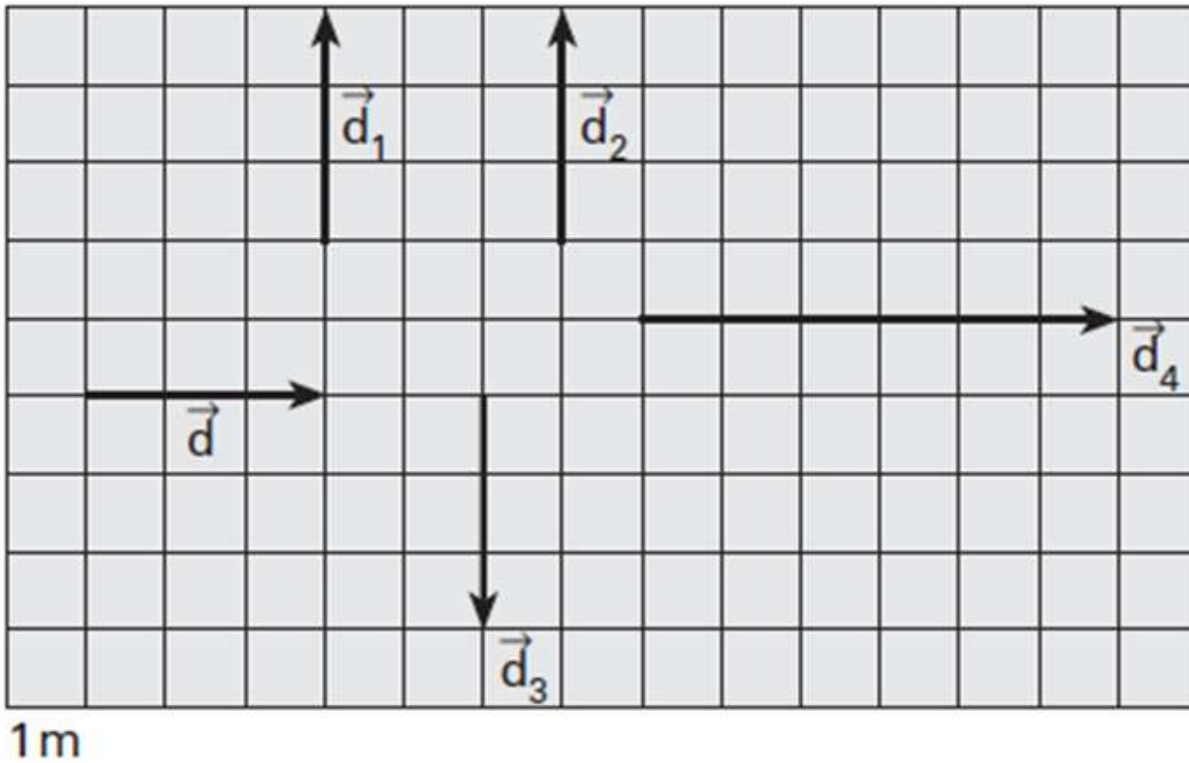
$$\vec{Q}_B = -2 \hat{j} \quad \vec{Q}_D = -1 \hat{i}$$

$$\vec{Q}_{sistema} = \vec{Q}_A + \vec{Q}_B + \vec{Q}_C + \vec{Q}_D$$

$$\vec{Q}_{sistema} = (2 \hat{i}) + (-2 \hat{j}) + (3 \hat{i} + 2 \hat{j}) + (-1 \hat{i})$$

$$\vec{Q}_{sistema} = 4 \hat{i}$$

6. Cada lado do quadriculado da figura representa 1m e uma certa escala, sendo que  $\vec{d}$ ,  $\vec{d}_1$ ,  $\vec{d}_2$ ,  $\vec{d}_3$  e  $\vec{d}_4$  são deslocamentos.



Marque verdadeiro ou falso para cada item:

a.  $\vec{d}_1 = \vec{d}_2$  (V)

b.  $\vec{d} = \vec{d}_1$  (F)

c.  $\vec{d}_4 = 2 \cdot \vec{d}$  (V)

d.  $\vec{d}_1 = -\vec{d}_3$  (V)

e.  $d_1 = 3 \text{ m}$  (V)

f.  $d_3 = -3 \text{ m}$  (F)

g.  $d_1 = -d_3$  (F)

h.  $d = d_1 = d_2 = d_3$  (V)