

بسم الله الرحمن الرحيم

King Saud University  
College of Science  
Physics & Astronomy Dept.

Phys 145 (General Physics)  
Chapter 2: Vectors (Components)  
Week n° 02

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## Chapter 2: Vectors (components)

- We will learn in this chapter:
- Magnitude of a vector
- Components of a vector
- Adding vectors

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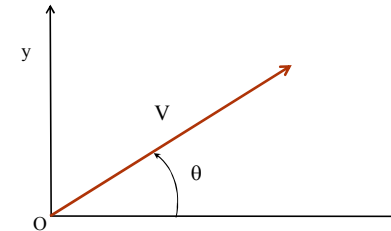
## Introduction: Scalar and vector quantities

- In Physics quantities can be:
- **Scalar** quantities (Magnitude): كمية قياسية  
Examples: mass, energy, time.
- **Vector** quantities (Magnitude and Direction): كمية متجهة  
Examples: velocity, acceleration, Force.

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## Magnitude and direction of a vector

A vector  $\mathbf{V}$  (or  $\vec{V}$ ) is defined by its direction  $\theta$  and magnitude  $V = |\mathbf{V}| = |\vec{V}|$ :



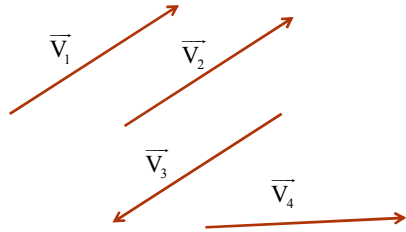
- The magnitude (length of the vector) is a positive number.
- The direction is the angle between the vector and the positive axis.  
It is between  $0^\circ$  and  $360^\circ$  (between 0 and  $2\pi$  radians).

**Remark:** The bold notation of a vector ( $\mathbf{V}$ ) is the printed notation.  
The arrow notation of a vector ( $\vec{V}$ ) is the handwritten notation.

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### Equality of vectors

Two vectors are equal if they have the same magnitude and the same direction.

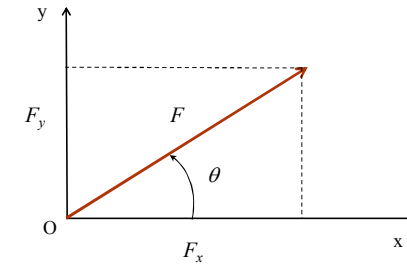


We have only:  $\vec{V}_1 = \vec{V}_2$   
All the other vectors are different.

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### Components of a vector



$$\cos(\theta) = \frac{F_x}{F}; \text{ so } F_x = F \cos(\theta)$$

$$\sin(\theta) = \frac{F_y}{F}; \text{ so } F_y = F \sin(\theta)$$

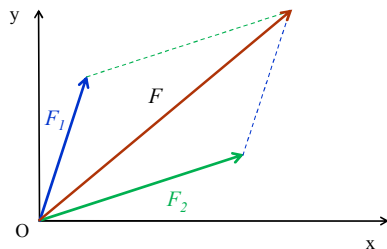
$F_x$  and  $F_y$  are the components of the vector  $F$ .

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### Addition of two vectors

Geometric method (Parallelogram construction)

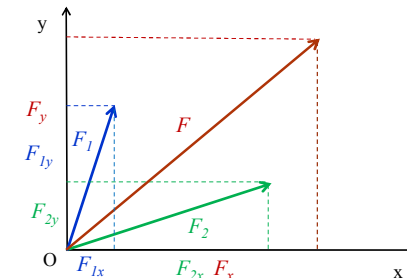


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### Addition of two vectors

Analytic method (Using the components of each vector)



$$\vec{F} = \vec{F}_1 + \vec{F}_2 \text{ or } \vec{F}_1 = F_{1x}\hat{x} + F_{1y}\hat{y} \text{ and } \vec{F}_2 = F_{2x}\hat{x} + F_{2y}\hat{y}$$

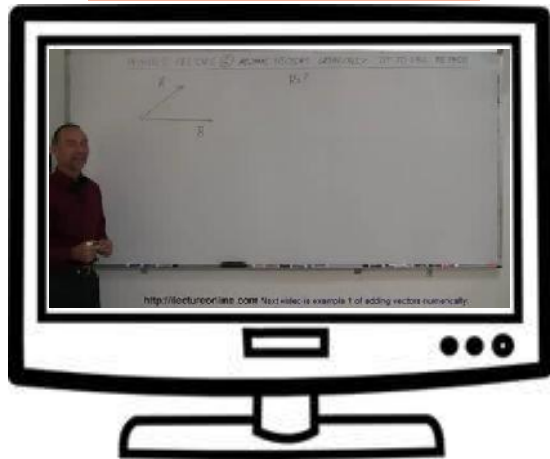
So:

$$\vec{F} = (F_{1x} + F_{2x})\hat{x} + (F_{1y} + F_{2y})\hat{y}$$

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### Video 01 of Chapter 02: Adding vectors



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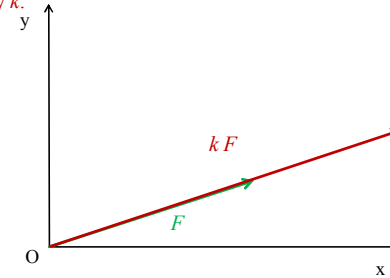
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### Multiplication of a vector by a scalar

A **unit vector** is a vector having 1 as magnitude.

The **negative of a vector** ( $-\vec{v}$ ) is defined as the vector that when added to the original vector ( $\vec{v}$ ) gives zero.

When multiplying a vector by a positive scalar  $k$ , we obtain a new vector having the same direction and the magnitude is multiplied by  $k$ .



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### Video 02 of Chapter 02: Scalars and vectors



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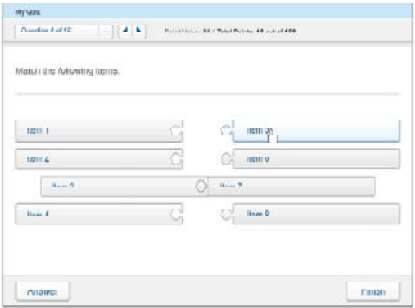
### Summary of week 02

- **Magnitude and direction of a vector** are defined.
- **Components of a vector** are defined.
- **How to add vectors** is explained.
- **How to multiply a vector by a scalar** is explained.

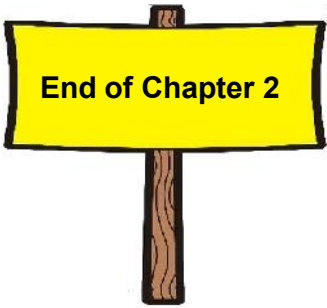
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Quiz for week 02



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