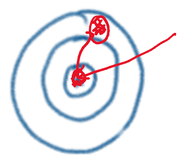
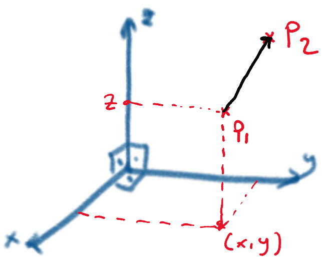
Lecture 2

26 Eylül 2019 Perşembe 09:36

- > Why we study physics
- > How we do physics
- > Units → Time
  - → Length
  - → Mass
- > Significant figures → precision & accuracy
- > Vectors & Vector algebra



Vectors & Vector Algebra



(x, y, z)

displacement from $P_1 \to P_2$

$\vec{A}$

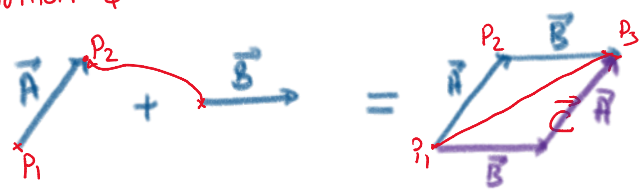
magnitude

direction

"Cartesian Coordinate System"

⇒ Vector Algebra

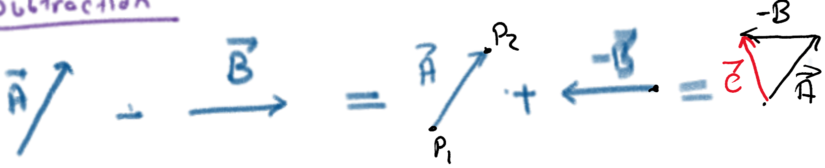
Addition & Subtraction



⇒ Commutative; $\vec{A}+\vec{B}=\vec{B}+\vec{A}$

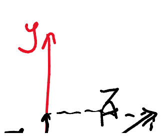
⇒ $\vec{A}+\vec{B}+\vec{C}+\vec{D}+\dots = \vec{R}$

Subtraction



⇒ $|\vec{A}| = |-\vec{A}|$ ⇒ $\vec{A}+\vec{A}=2\vec{A}$ $\quad c.\vec{A}$

magnitude

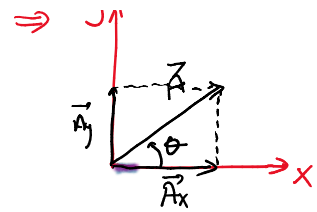
⇒ 

$A_x = |\vec{A}|.\cos\theta$

$A_y = |\vec{A}|.\sin\theta$

$\vec{A}_x = A_x\,\hat{i}$ → unit vector along

$\vec{A}_y = A_y\,\hat{j}$

⇒ 

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

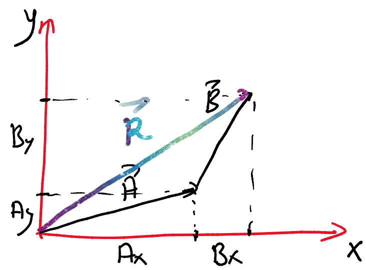
$A_y = |\vec{A}| \cdot \sin\theta$

$\vec{A}_x = A_x \hat{i}$ → unit vector along x-axis

$\vec{A}_y = A_y \hat{j}$ → unit vector along y-axis

$\hat{k} \to$ z-axis

$\hat{i}$	$\hat{j}$	$\hat{k}$
↓	↓	↓
x	y	z



$R_x = A_x + B_x$

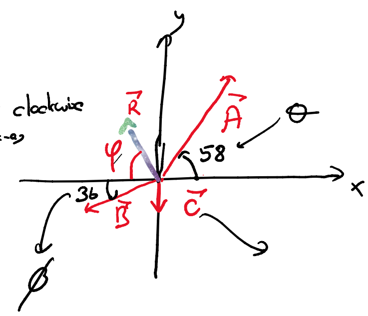
$R_y = A_y + B_y$

Ex)

$\vec{A}$: 72.4 , 58° counter clockwise from x-axis

$\vec{B}$: 57.3 , 216° ccw from x-axis

$\vec{C} = 17.8$, 270° ccw from x-axis



$A_x = |\vec{A}| \cos\theta$

$A_y = |\vec{A}| \sin\theta$

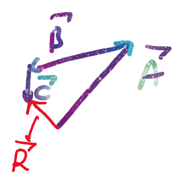
$B_x = -|\vec{B}| \cos\phi$

$B_y = -|\vec{B}| \sin\phi$

$C_x = 0$

$C_y = -|\vec{C}|$

$$\vec{R} = \hat{i}\,(\underbrace{A_x + B_x + C_x}_{-7.99}) + \hat{j}\,(\underbrace{A_y + B_y + C_y}_{9.92})$$



$$|R| = \sqrt{R_x^2 + R_y^2} = 12.7$$

$$\varphi = \arctan\left(\frac{R_y}{R_x}\right) = -51°$$

Vector Products

↳ There are two "multiplication" operations for vectors.

scalar product

vectors.

↳ scalar product (dot)

$$\vec{A}\cdot\vec{B} = \underbrace{AB}_{\text{magnitudes}}\ \underbrace{\cos\phi}_{\text{cosine of angle between the vectors}}$$

↳ vector product (cross)

$$\vec{A}\times\vec{B} = \vec{C}$$

$$\hat{i}\cdot\hat{i} = (1)(1)\underbrace{\cos 0}_{1} = 1$$

$$\hat{j}\cdot\hat{j} = 1$$

$$\hat{k}\cdot\hat{k} = 1$$

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

$$\hat{i}\cdot\hat{k} = 0$$

$$\hat{j}\cdot\hat{k} = 0$$

$$\vec{A}\cdot\vec{B} = (A_x\hat{i} + A_y\hat{j} + A_z\hat{k})\cdot(B_x\hat{i} + B_y\hat{j} + B_z\hat{k})$$

$$= A_xB_x + A_yB_y + A_zB_z$$

$$\boxed{\frac{A_xB_x + A_yB_y + A_zB_z}{AB} = \cos\phi}$$