FISIKA

1

Besaran Vektor

(Part 1)

Damar Wicaksono, S.T., M.Eng

Learning Objective

Mampu memahami dan menjelaskan konsep besaran vektor, menggambar vector, komponen-komponen vektor

Mampu memahami dan menjelaskan operasi penjumlahan dan pengurangan vektor

Mampu memahami dan menjelaskan operasi perkalian vektor

Course Material

SERI KULIAH FISIKA 1 - Besaran Vektor

Part 1

Konsep Vektor

Membahas konsep dasar besaran vektor

Damar Wicaksono, S.T., M.Eng

#Fisika1

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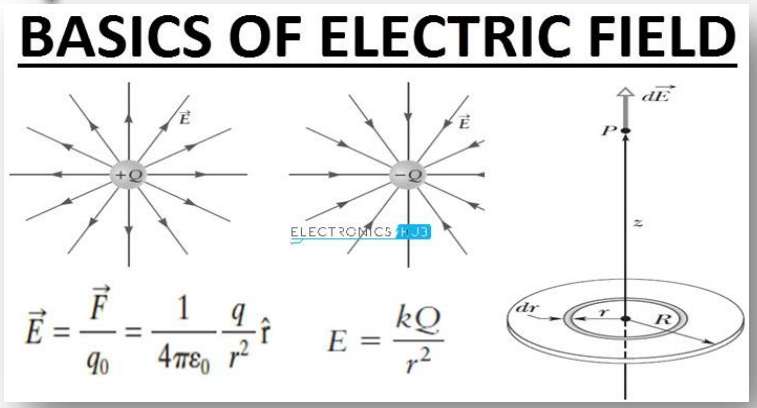
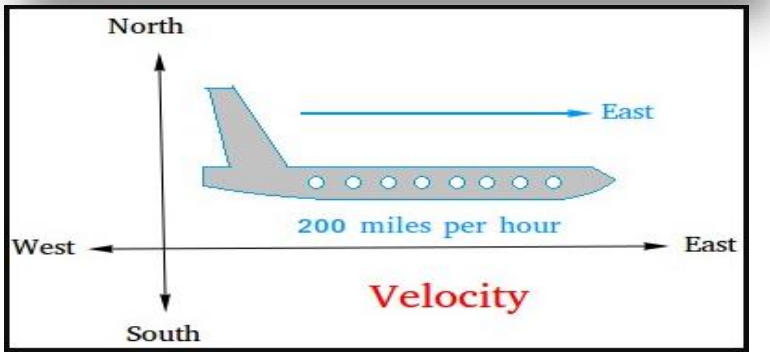
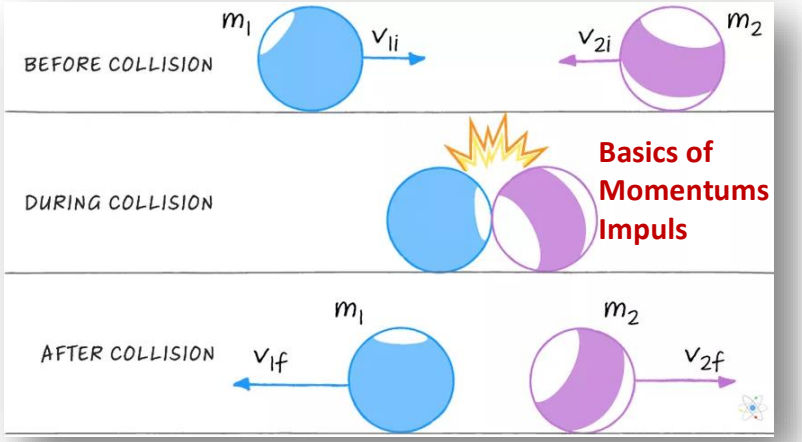
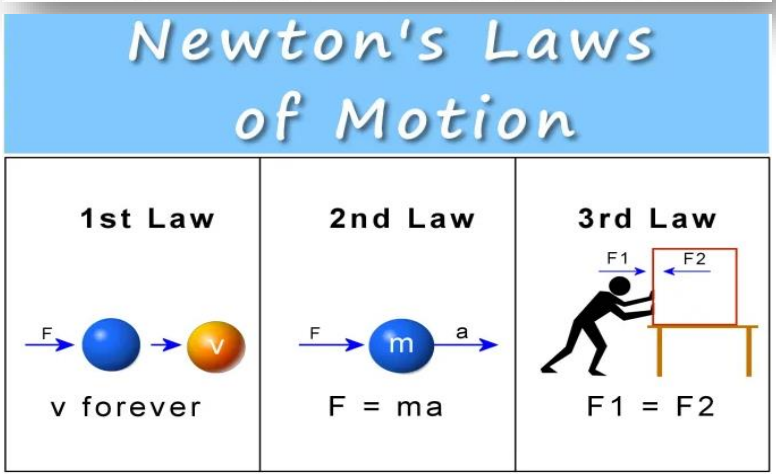
Penggunaan Vektor

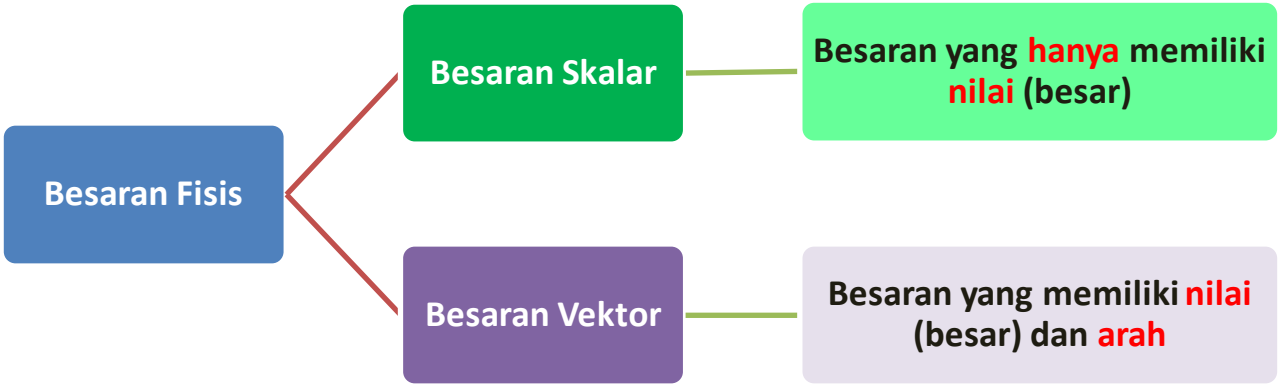








01 Besaran Fisis

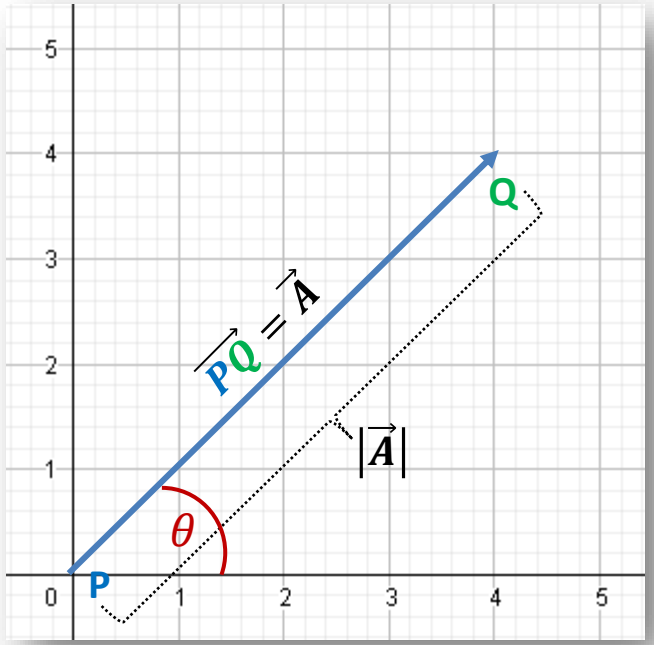


- Massa
- Volume
- Waktu
- Suhu
- Panjang
- Luas
- Kelajuan

- Perpindahan
- Kecepatan
- Percepatan
- Gaya
- Momentum
- Medan Magnet
- Medan Listrik
- Medan Gravitasi

"Vektor adalah besaran yang memiliki besar dan arah"

02 Representasi Vektor



Penulisan **besaran vektor** menggunakan suatu **notasi khusus**.

Notasi Vektor:

$\mathbf{A} \longrightarrow$ **Huruf Tebal**

$A \longrightarrow Huruf\ Miring$

$\vec{A} \longrightarrow Pakai\ Tanda\ Panah\ di\ Atas$

P = Pangkal Vektor

Q = Ujung Vektor

Tanda Panah dan θ = arah vektor terhadap sumbu datar (x)

$|\vec{A}|$ = **Besar** (**Magnitudo**) Vektor

Catatan Representasi Vektor

Dua Vektor dikatakan sama: jika "Arah" dan "Besar" sama.

$$\overrightarrow{PQ} = \overrightarrow{AB}$$

Dua Vektor dikatakan tidak sama: jika,

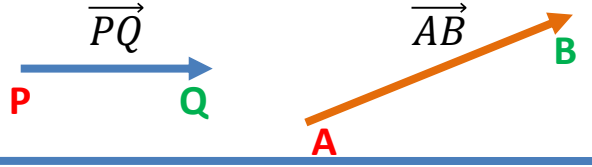
1. Besar Sama, Arah Beda

$$\overrightarrow{PQ} \neq \overrightarrow{AB}$$

2. Besar Tidak Sama, Arah Sama

$$\overrightarrow{PQ} \neq \overrightarrow{AB}$$

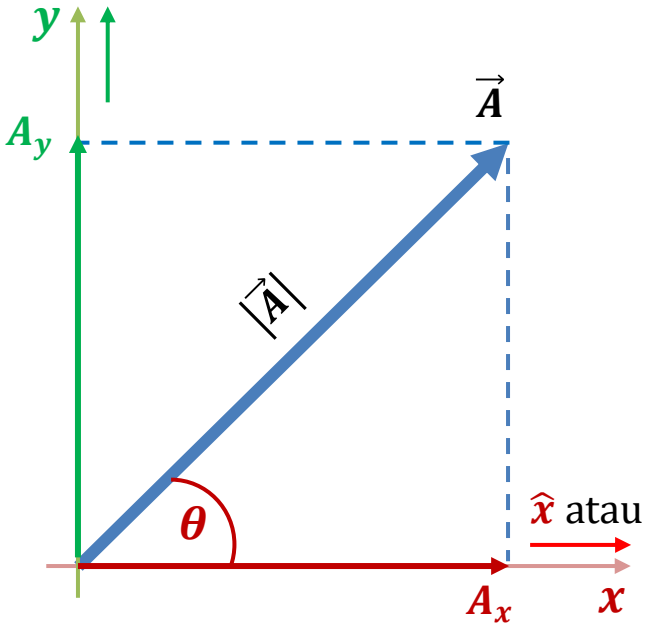
3. Besar dan Arah Berbeda



$$\overrightarrow{PQ} \neq \overrightarrow{AB}$$

03 Komponen Vektor dan Vektor Satuan (2D)

$\hat{y}$ atau $\hat{j}$ menyatakan arah sumbu y



Vektor dapat diuraikan menjadi komponen sumbu.

$$\vec{A} = A_x\hat{x} + A_y\hat{y} \quad \text{atau} \quad \vec{A} = A_x\hat{\imath} + A_y\hat{\jmath}$$

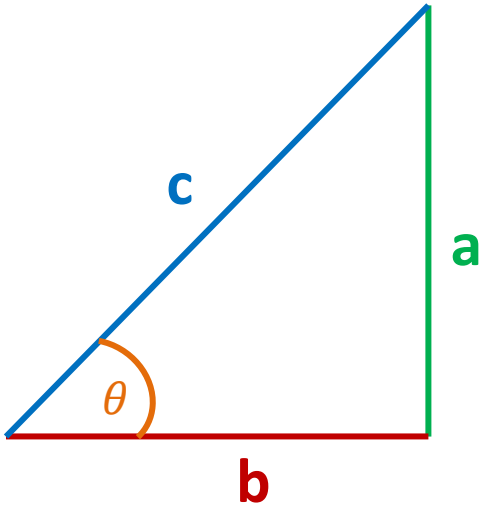
Vektor $\vec{A}$ adalah panjangnya A_x ke arah x $(\hat{x})$ ditambah panjangnya A_y ke arah y $(\hat{y})$.

$\hat{x}$ atau $\hat{\imath}$ dan $\hat{y}$ atau $\hat{\jmath}$ adalah vektor satuan yang besarnya 1

Berapa besar nilai A_x dan A_y ?

$\hat{x}$ atau $\hat{\imath}$ menyatakan arah sumbu x

04 Konsep Trigonometri



$$\sin\theta = \frac{\text{sisi depan}}{\text{sisi miring}} = \frac{a}{c}$$

$$\cos\theta = \frac{\text{sisi samping}}{\text{sisi miring}} = \frac{b}{c}$$

$$\tan\theta = \frac{\text{sisi depan}}{\text{sisi samping}} = \frac{a}{b}$$

$$c^2 = a^2 + b^2$$

$$c = \sqrt{a^2 + b^2}$$

Tabel Trigonometri

α	I					II				III				IV			
	0°	30°	45°	60°	90°	120°	135°	150°	180°	210°	225°	240°	270°	300°	315°	330°	360°
	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{5\pi}{4}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π
$\sin\alpha$	0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{3}$	1	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{2}\sqrt{2}$	$-\frac{1}{2}\sqrt{3}$	-1	$-\frac{1}{2}\sqrt{3}$	$-\frac{1}{2}\sqrt{2}$	$-\frac{1}{2}$	0
$\cos\alpha$	1	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{2}\sqrt{2}$	$-\frac{1}{2}\sqrt{3}$	-1	$-\frac{1}{2}\sqrt{3}$	$-\frac{1}{2}\sqrt{2}$	$-\frac{1}{2}$	0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{3}$	1
$\tan\alpha$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	td	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	td	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0
$\csc\alpha$	td	2	$\sqrt{2}$	$\frac{2}{3}\sqrt{3}$	1	$\frac{2}{3}\sqrt{3}$	$\sqrt{2}$	2	td	-2	$-\sqrt{2}$	$-\frac{2}{3}\sqrt{3}$	-1	$-\frac{2}{3}\sqrt{3}$	$-\sqrt{2}$	-2	td
$\sec\alpha$	1	$\frac{2}{3}\sqrt{3}$	$\sqrt{2}$	2	td	-2	$-\sqrt{2}$	$-\frac{2}{3}\sqrt{3}$	-1	$-\frac{2}{3}\sqrt{3}$	$-\sqrt{2}$	-2	td	2	$\sqrt{2}$	$\frac{2}{3}\sqrt{3}$	-1
$\cot\alpha$	td	$\sqrt{3}$	1	$\frac{\sqrt{3}}{3}$	0	$-\frac{1}{\sqrt{3}}$	-1	$-\sqrt{3}$	td	$\sqrt{3}$	1	$\frac{\sqrt{3}}{3}$	1	$-\frac{1}{\sqrt{3}}$	-1	$-\sqrt{3}$	td

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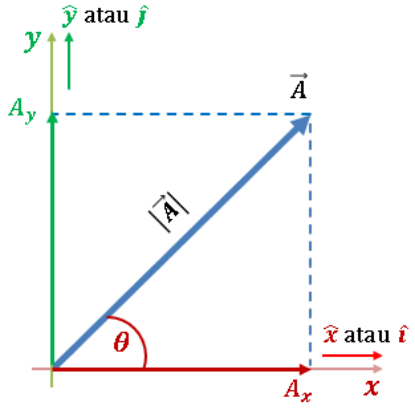
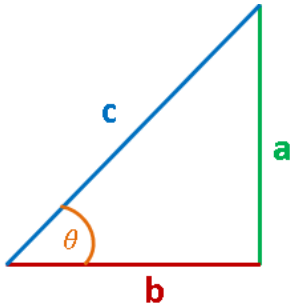
Besar Nilai Vektor (2D)

$\vec{A} = A_x\hat{x} + A_y\hat{y}$ atau $\vec{A} = A_x\hat{\imath} + A_y\hat{\jmath}$

Berapa besar nilai A_x dan A_y ?





$$\sin\theta = \frac{\text{sisi depan}}{\text{sisi miring}} = \frac{a}{c}$$

$$\cos\theta = \frac{\text{sisi samping}}{\text{sisi miring}} = \frac{b}{c}$$

$$\tan\theta = \frac{\text{sisi depan}}{\text{sisi samping}} = \frac{a}{b}$$

Komponen dalam sumbu y

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

Komponen dalam sumbu x

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

Arah Vektor $\vec{A}$ (terhadap sumbu x positif):

$$\tan\theta = \frac{A_y}{A_x} \qquad \theta = arctan = \frac{R_y}{R_x}$$

Maka besar nilai vektor $|\vec{A}|$

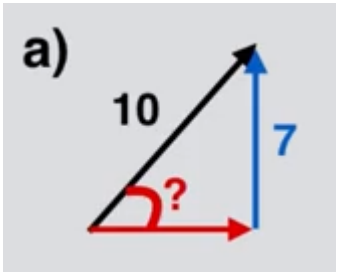
$$|\vec{A}|^2 = A_x{}^2 + A_y{}^2$$

$$|\vec{A}| = \sqrt{A_x{}^2 + A_y{}^2}$$

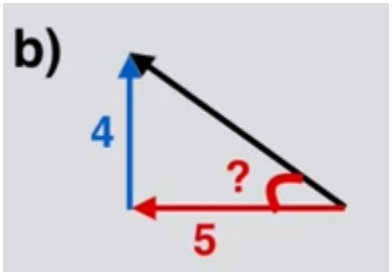
Latihan 1 – Sudut Vektor

Carilah besarnya sudut (θ) dari setiap vektor berikut:

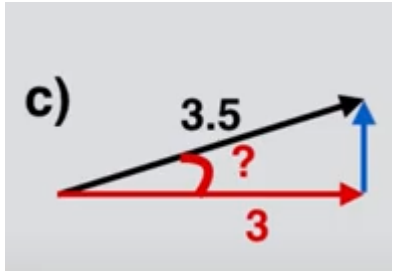
a)



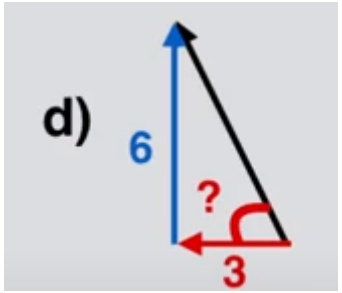
b)



c)

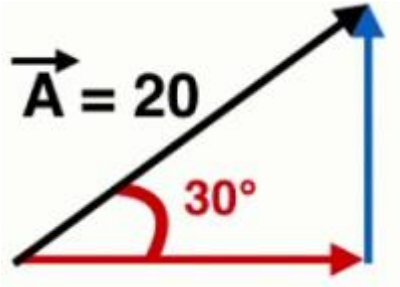


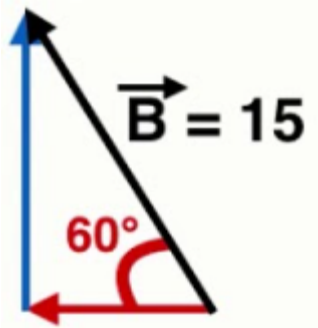
d)

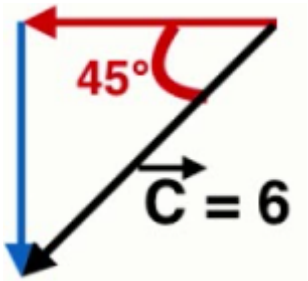


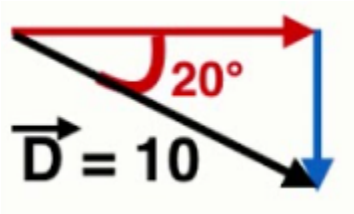
Latihan 2 – Komponen Vektor

Carilah nilai komponen-komponen vektor dari setiap vektor berikut:









Latihan 3 – Magnitudo & Arah Vektor

Gambarlah vektor dalam koordinat kartesian dan hitunglah magnitude dan arahnya!

a) Vektor $\vec{A} = (-3, \quad 1)$

b) Vektor $\vec{B} = (\quad 7, \quad 3)$

c) Vektor $\vec{C} = (\quad 1, \quad 4)$

d) Vektor $\vec{D} = (-3, -7)$

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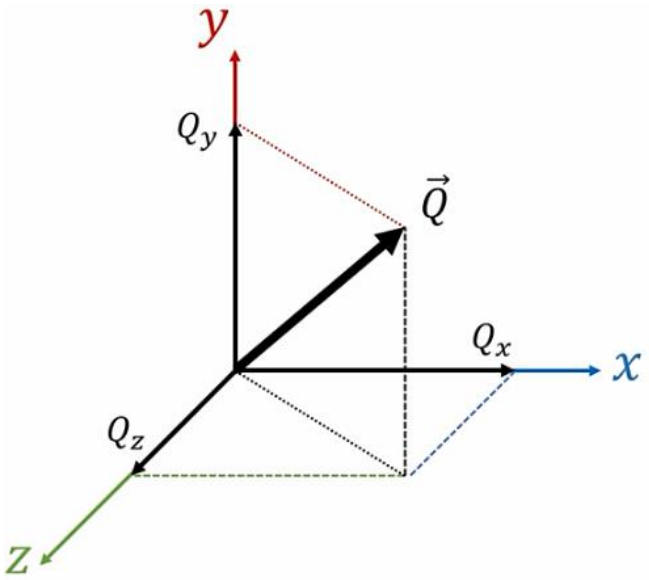
Komponen Vektor dan Vektor Satuan (3D)



Vektor dapat diuraikan menjadi komponen sumbu.

$$\vec{Q} = Q_x\hat{x} + Q_y\hat{y} + Q_y\hat{z}$$

atau

$$\vec{Q} = Q_x\hat{\imath} + Q_y\hat{\jmath} + Q_y\hat{k}$$

Maka besar nilai vektor $|\vec{Q}|$

$$|\vec{Q}|^2 = Q_x{}^2 + Q_y{}^2 + Q_z{}^2$$

$$|\vec{Q}| = \sqrt{Q_x{}^2 + Q_y{}^2 + Q_z{}^2}$$

Latihan 4 – Magnitudo Vektor Bidang 3D

Gambarlah vektor dalam koordinat kartesian dan hitunglah magnitude!

a) Vektor $\vec{A} = (-3, \quad 1, -5)$

b) Vektor $\vec{B} = (\quad 7, -2, \quad 3)$

c) Vektor $\vec{C} = (\quad 1, \quad 4, -5)$

d) Vektor $\vec{D} = (-3, -7, \quad 9)$

Part 1

Operasi Vektor

Penjumlahan

Mempelajari cara menjumlahkan dan mengurangi besaran vektor

Damar Wicaksono, S.T., M.Eng

#Fisika1

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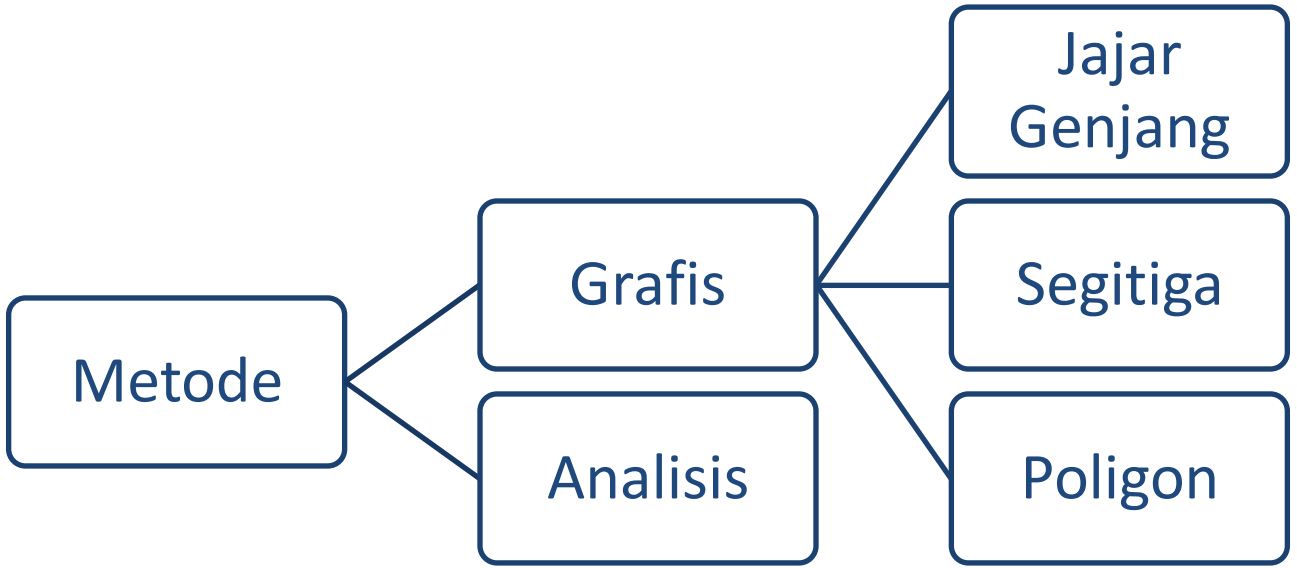
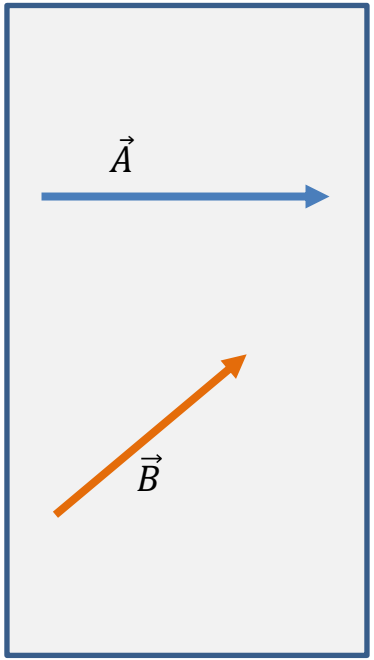
Metode Penjumlahan & Pengurangan Vektor

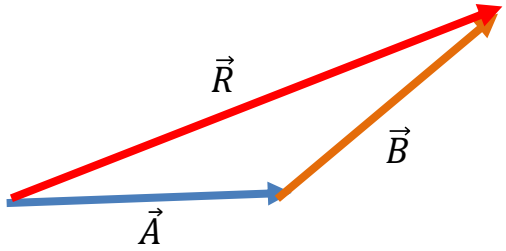


01 Metode Grafis: Segitiga

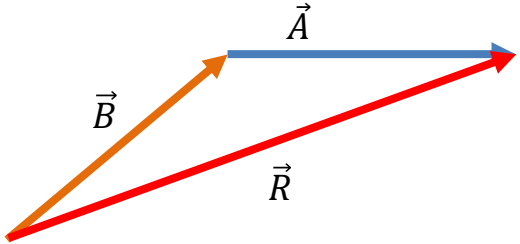
Penjumlahan



$$\vec{R} = \vec{A} + \vec{B}$$



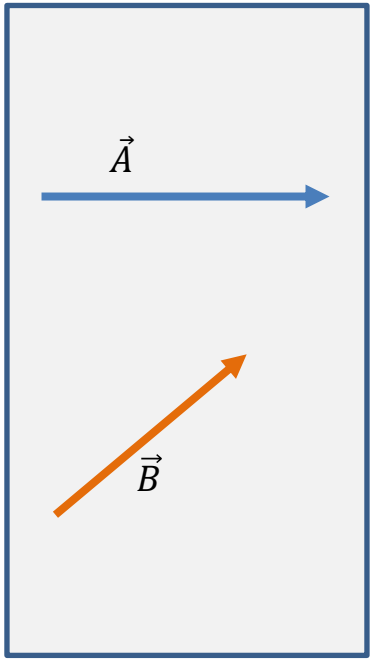
$$\vec{R} = \vec{B} + \vec{A}$$



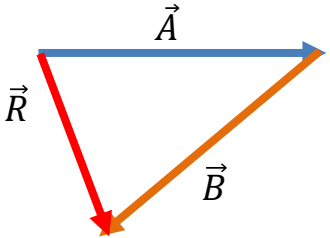
$$\vec{A} + \vec{B} = \vec{B} + \vec{A}$$

Metode Grafis: Segitiga

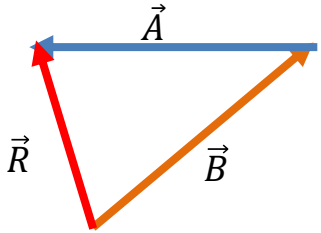
Pengurangan



$$\vec{R} = \vec{A} - \vec{B} = \vec{A} + (-\vec{B})$$



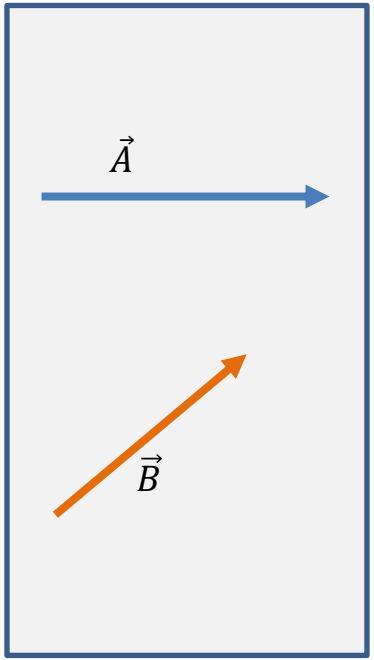
$$\vec{R} = \vec{B} - \vec{A} = \vec{B} + (-\vec{A})$$



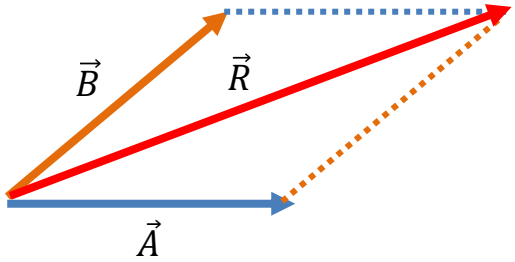
$$\vec{A} - \vec{B} = -(\vec{B} - \vec{A})$$

02 Metode Grafis: Jajar Genjang

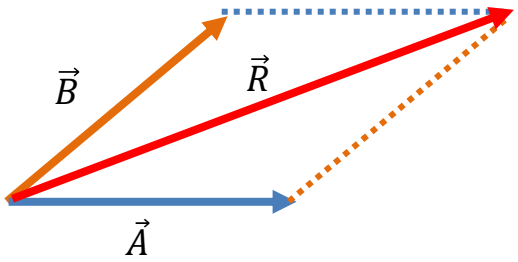
Penjumlahan



$$\vec{R} = \vec{A} + \vec{B}$$



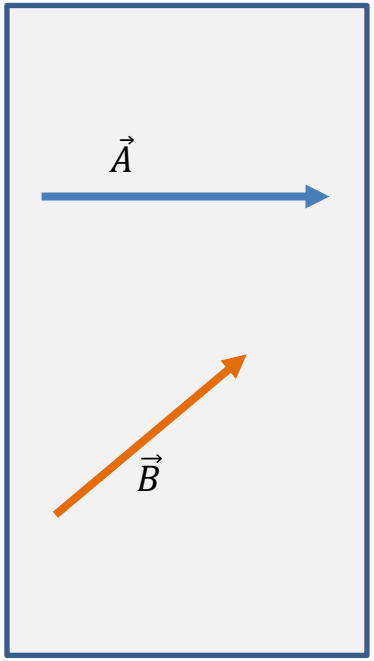
$$\vec{R} = \vec{B} + \vec{A}$$



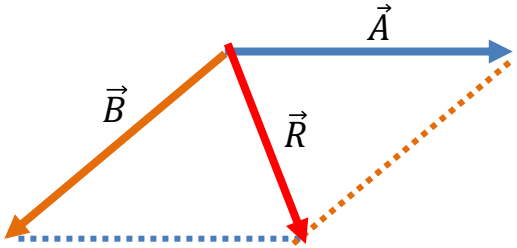
$$\vec{A} + \vec{B} = \vec{B} + \vec{A}$$

Metode Grafis: Jajar Genjang

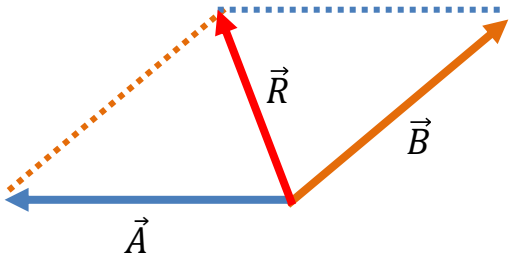
Pengurangan



$$\vec{R} = \vec{A} - \vec{B} = \vec{A} + (-\vec{B})$$

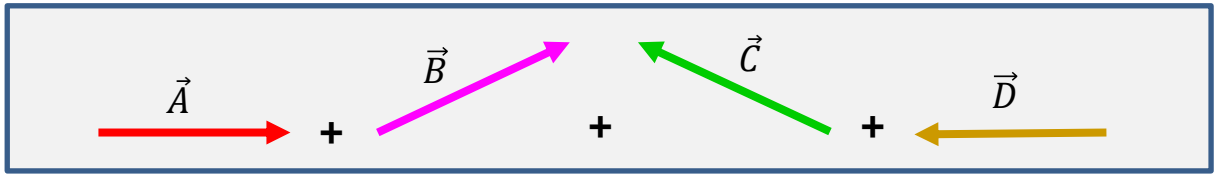


$$\vec{R} = \vec{B} - \vec{A} = \vec{B} + (-\vec{A})$$

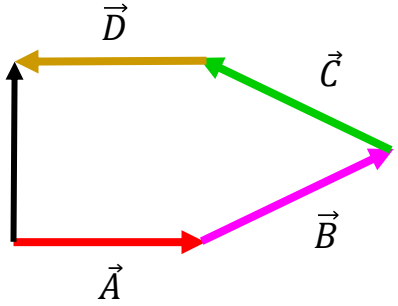


$$\vec{A} - \vec{B} = -(\vec{B} - \vec{A})$$

03 Metode Poligon

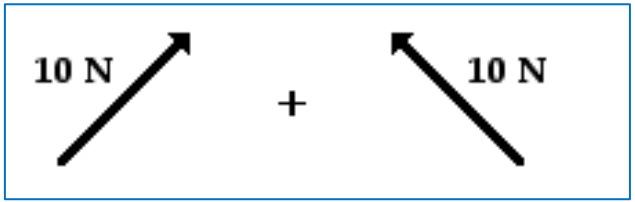


$$\vec{R} = \vec{A} + \vec{B} + \vec{C} + \vec{D}$$

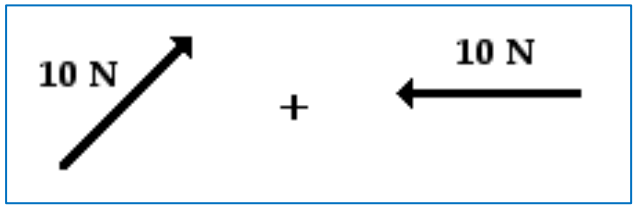


Latihan 5 – Penjumlahan Vektor

Lakukan operasi penjumlahan pada vektor-vektor di bawah ini menggunakan metode segitiga dan jajar genjang, kemudian lakukan operasi pengurangan menggunakan metode yang sama



(A)



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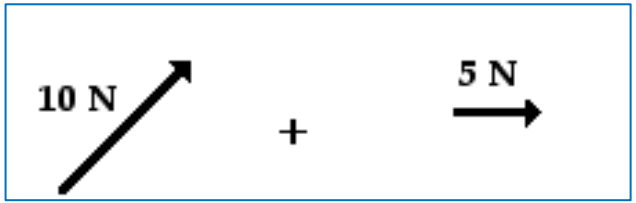

(C)

TERIMA KASIH

BesaranVektor

#FISIKA1

≫Besaran Vektor Part 2: Metode Analisis dan Perkalian Vektor