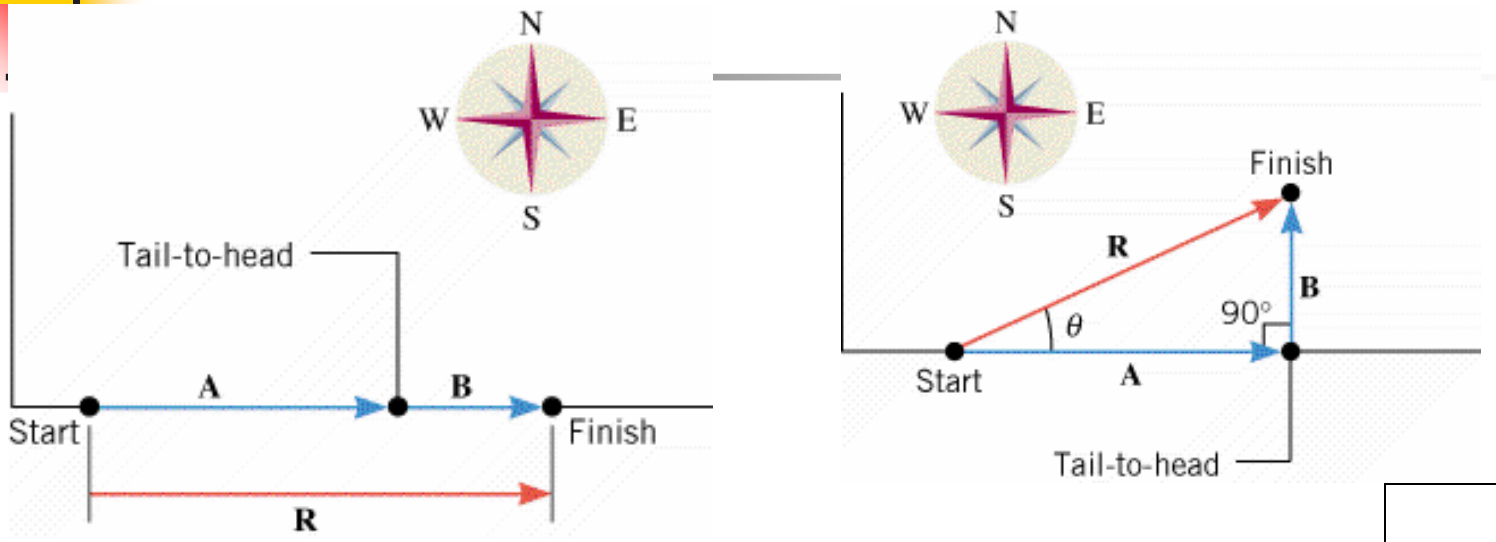
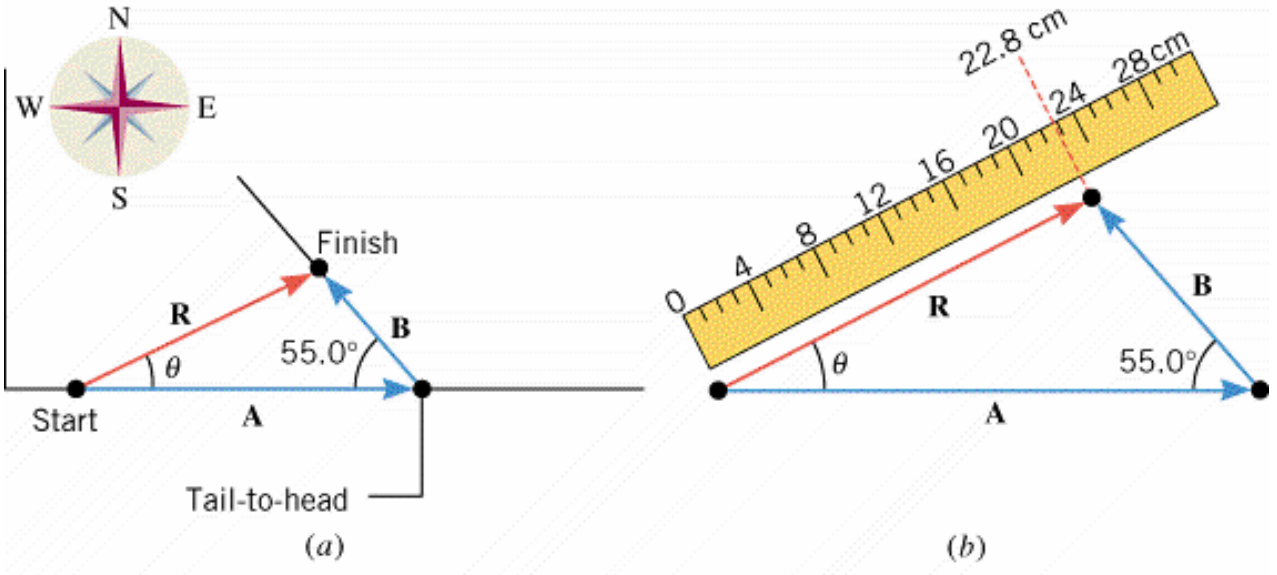
V E K T O R

VEKTOR dan SKALAR

- Skalar
  - simbol: *A*
  - Kuantitas yang hanya memiliki besaran saja.
  - memenuhi aljabar biasa
- Vektor
  - simbol: **A** atau $\vec{A}$
  - Kuantitas yang memiliki besaran dan arah
  - memenuhi aljabar vektor
  - Deskripsi vektor: geometri (grafis); analitik
    - Panjang panah: besarnya vektor
    - Arah panah: Arah vektor

PENJUMLAHAN VEKTOR (polygon)

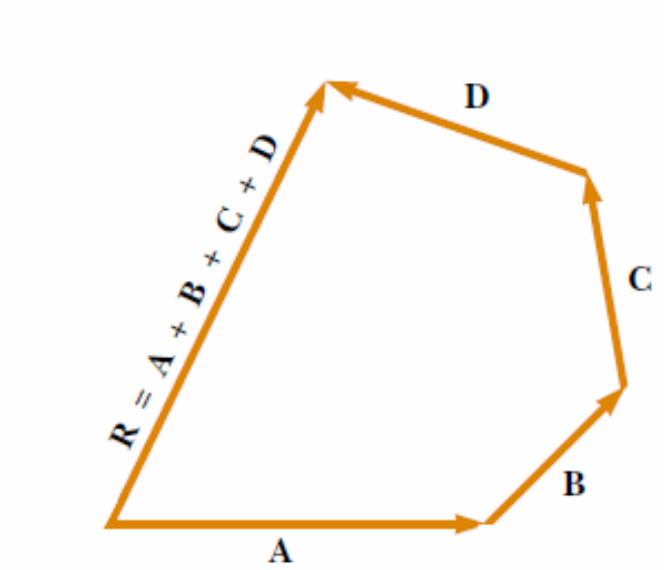




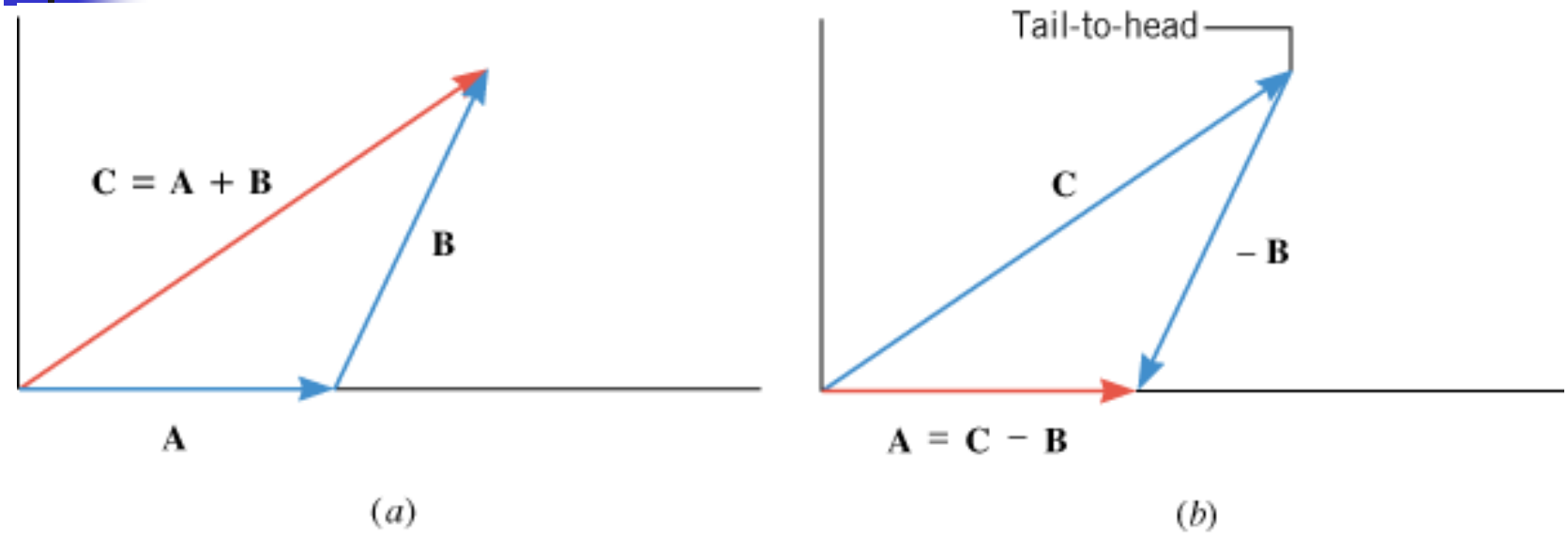
R=A+B

Besar dan arah vektor diukur langsung.

Penjumlahan Vektor (polygon)

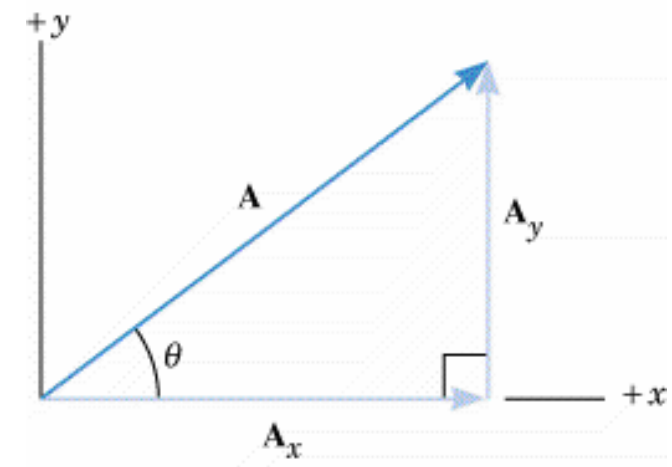


PENGURANGAN VEKTOR



$$A - B = A + (-B)$$

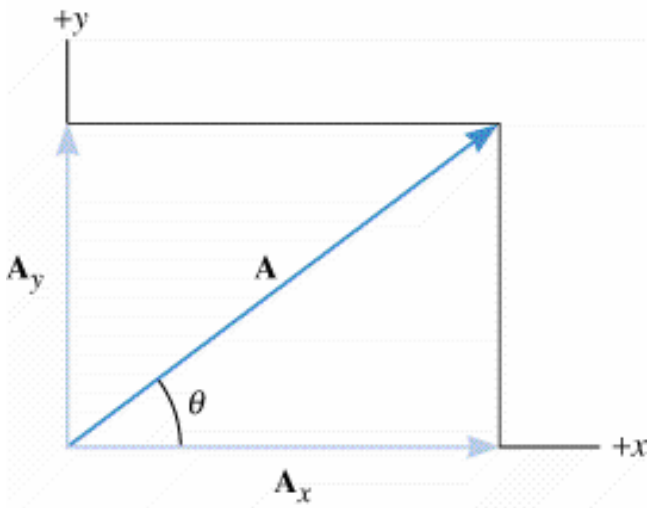
KOMPONEN SEBUAH VEKTOR



Vektor **A** dengan komponen vektor A_x dan A_y yang saling tegaklurus.
Komponen skalarnya:

$A_x = A \cos\theta$

$A_y = A \sin\theta$



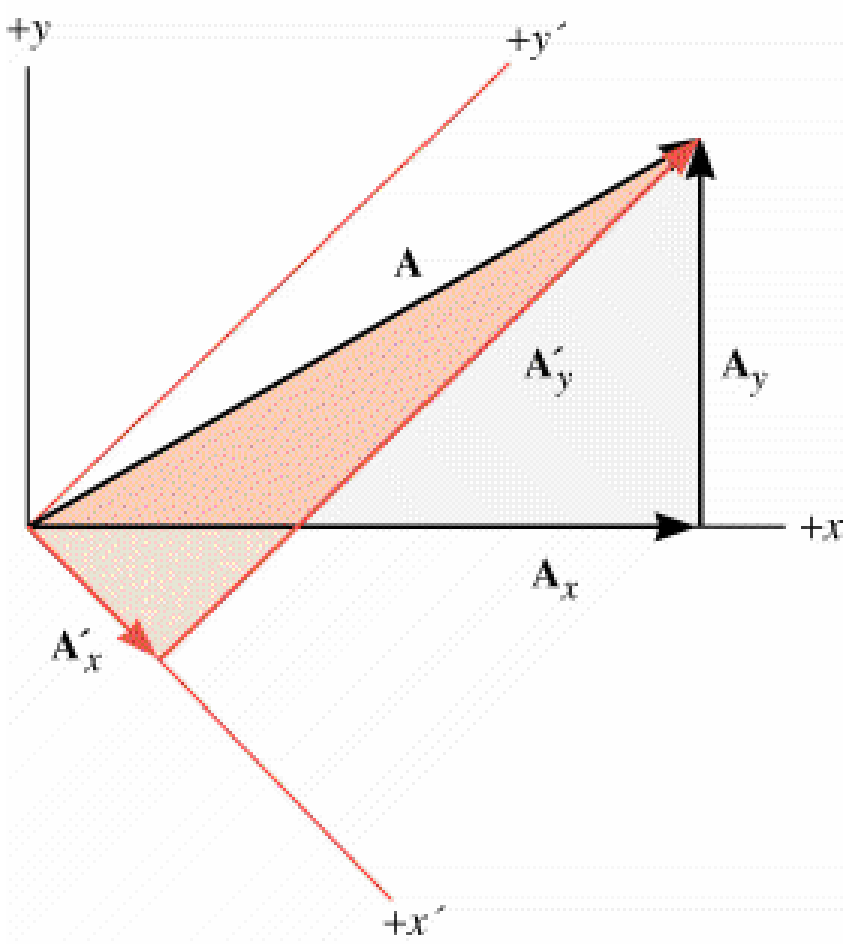
Ada 2 cara menyatakan vektor **A**

1. $\mathbf{A} = \mathbf{A_x} + \mathbf{A_y}$

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

$$\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$$

KOMPONEN SEBUAH VEKTOR (lanjutan)



Arah komponen vektor tergantung pada arah sumbu-sumbu yang digunakan sbg acuan.

$$\mathbf{A} = \mathbf{A}_x + \mathbf{A}_y$$

atau

$$\mathbf{A} = \mathbf{A'}_x + \mathbf{A'}_y$$

PENJUMLAHAN VEKTOR BERDASARKAN KOMPONENNYA

C = A + B

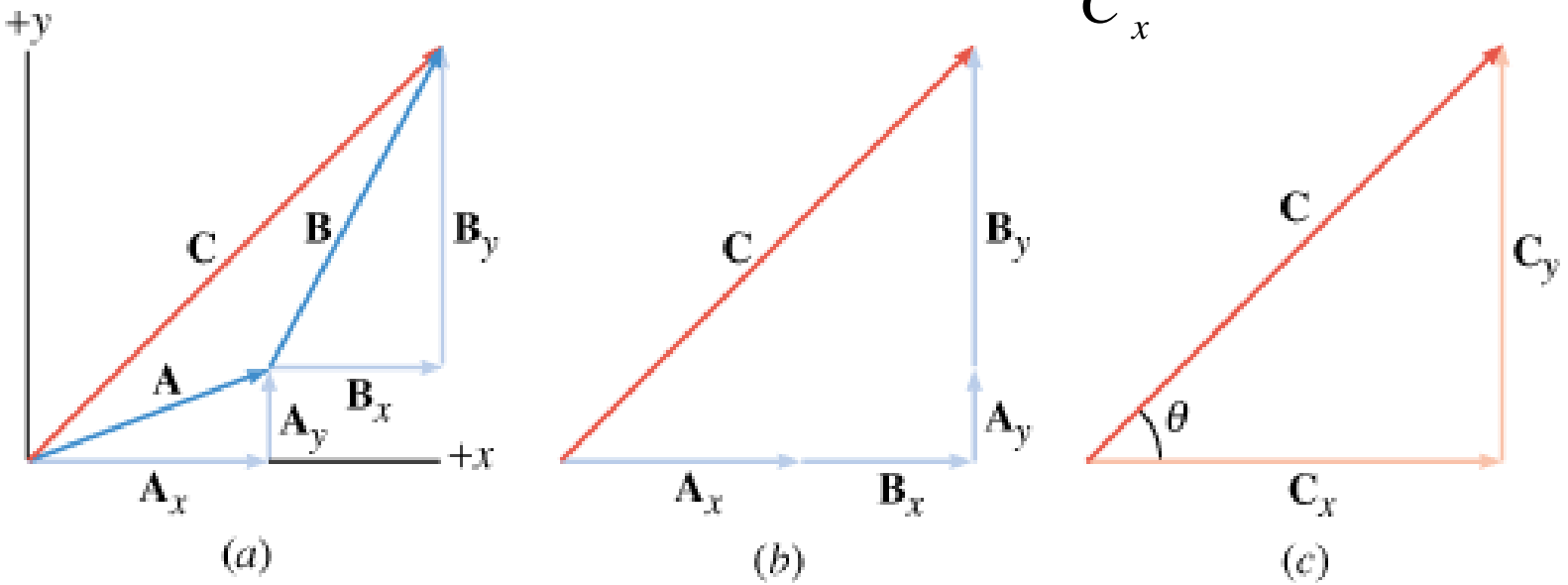
$C_x = A_x + B_x$

$C_y = A_y + B_y$

$$C = \sqrt{C_x^2 + C_y^2}$$

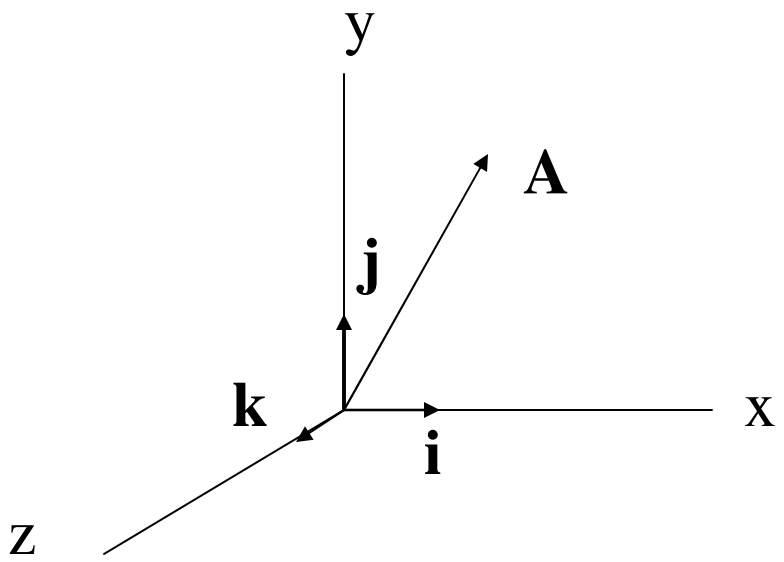
dan

$$\theta = \tan^{-1}\left(\frac{C_y}{C_x}\right)$$



VEKTOR SATUAN

Vektor dapat dituliskan dalam *vektor-vektor satuan*. Sebuah vektor satuan mempunyai magnitudo/ukuran yang besarnya sama dengan satu (1). Vektor satuan dalam sistem koordinat kartesis dinyatakan dengan **i, j** dan **k** yang saling tegaklurus.



Vektor **A** dapat ditulis:

$$\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$$

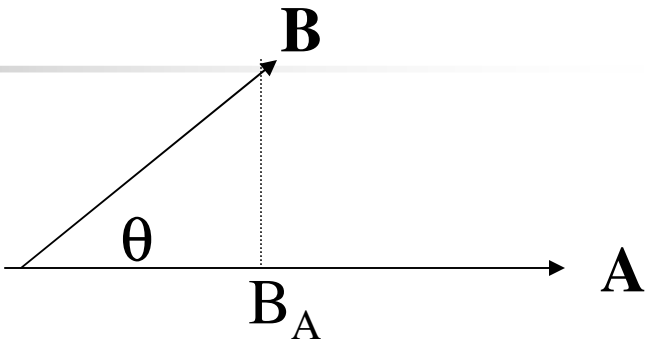
atau

$$\mathbf{A} = A_x\mathbf{i} + A_y\mathbf{j} + A_z\mathbf{k}$$

dan

$$\hat{A} = \frac{\vec{A}}{A}$$

PERKALIAN VEKTOR



- Perkalian *titik* (dot product)

  perkalian skalar

  $\mathbf{A.B} = A\,B\cos\theta\,; \quad 0 \le \theta \le \pi$

  $\mathbf{A.B} = A_xB_x + A_yB_y + A_zB_z$

  $\mathbf{A.A} = A^2 = A_x^2 + A_y^2 + A_z^2$

  $B_A = B\cos = \frac{\mathbf{B.A}}{A}$

- Sifat-sifat perkalian titik:

  $\mathbf{A.B} = \mathbf{B.A}$

  $\mathbf{i.i} = \mathbf{j.j} = \mathbf{k.k} = 1$

  $\mathbf{i.j} = \mathbf{j.k} = \mathbf{k.i} = 0$

PERKALIAN VEKTOR

Perkalian *Silang* (cross product)

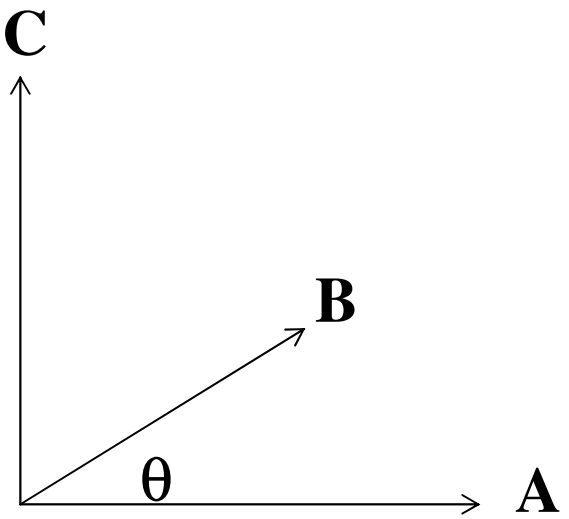
C = A x B

$C = AB \sin\theta;\ 0 \le \theta \le \pi$

$C_x = A_yB_z - A_zB_y$

$C_y = A_zB_x - A_xB_z$

$C_z = A_xB_y - A_yB_z$



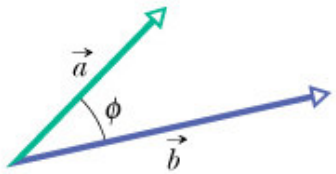
Sifat-sifat perkalian silang:

A x B = - B x A

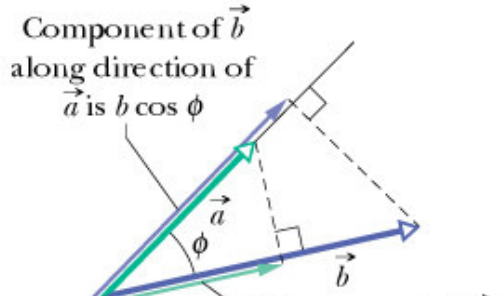
ixj = k ; jxk = i ; kxi = j

ixi = jxj = kxk = 0

Dot product

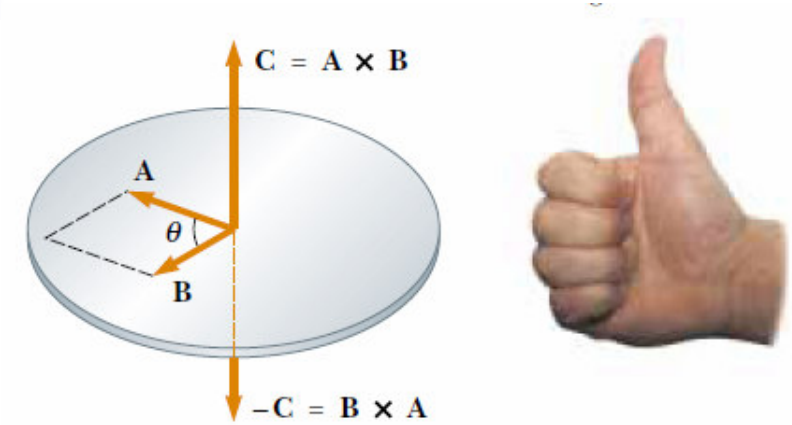


(a)



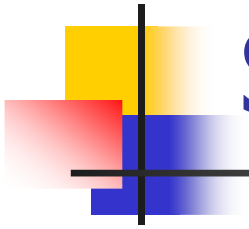
(b)

Cross product (perkalian silang)



$$\mathbf{A} \times \mathbf{B} = \begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix} = \begin{vmatrix} A_y & A_z \\ B_y & B_z \end{vmatrix} \hat{\mathbf{i}} - \begin{vmatrix} A_x & A_z \\ B_x & B_z \end{vmatrix} \hat{\mathbf{j}} + \begin{vmatrix} A_x & A_y \\ B_x & B_y \end{vmatrix} \hat{\mathbf{k}}$$

Dapat juga menggunakan aljabar vektor, perhatikan sifat-sifat cross product vektor-vektor satuan



Sistem koordinat

- Adalah cara pandang terhadap suatu keadaan
- Sistem koordinat kartesian
- Sistem koordinat polar (silinder)
- Sistem koordinat bola

Sistem koordinat polar (silinder 2D)

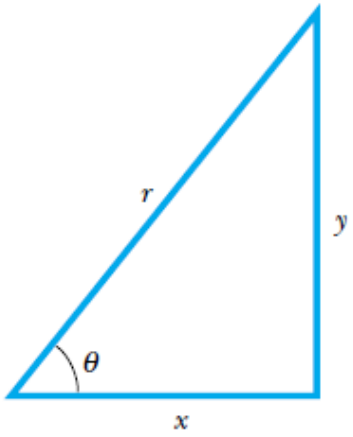
- Posisi suatu titik dalam koordinat polar

$$\mathbf{r} = r\hat{\mathbf{r}}$$

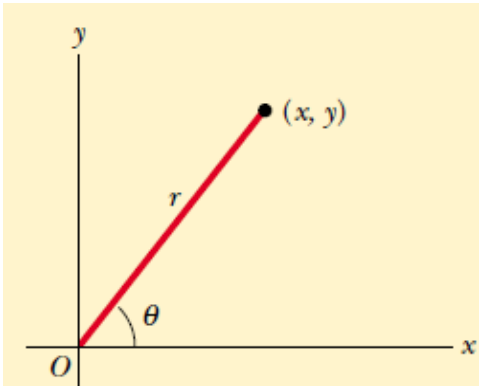
$$\sin\theta = \frac{y}{r}$$

$$\cos\theta = \frac{x}{r}$$

$$\tan\theta = \frac{y}{x}$$



- $$\mathbf{r} = r\cos\theta\,\hat{\mathbf{i}} + r\sin\theta\,\hat{\mathbf{j}}$$
$$= r(\cos\theta\,\hat{\mathbf{i}} + \sin\theta\,\hat{\mathbf{j}})$$



$$\hat{\mathbf{r}} = \frac{\mathbf{r}}{r} = (\cos\theta\,\hat{\mathbf{i}} + \sin\theta\,\hat{\mathbf{j}})$$