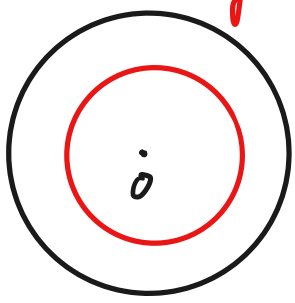
differential e.g. $\vec{v}_{avg} = \frac{\Delta \vec{r}}{\Delta T}$ $\lim_{\Delta T \to 0} \frac{\Delta \vec{r}}{\Delta T} = \frac{d\vec{r}}{dt}$

integral e.g.



R $A = \pi R^2$

Circumference $= 2\pi r$

width dr $A = 2\pi r\, dr$

$r: 0 \rightsquigarrow R$

$$\int_{r=0}^{r=R} 2\pi r\, dr = 2\pi \int_0^R r\, dr = \pi R^2$$

base quantity	SI unit	fundamental dimension
1. length	meter (m)	[L]
prefix	nm 10^{-9}, μm 10^{-6}, mm 10^{-3}, cm 10^{-2}, m, km 10^{3}	
2. time	second (s)	[T]
3. mass	kilogram (kg)	[M]
4. temperature	kelvin (K)	
5. electric current	Ampere (A)	
6. amount of substance	mole (mol)	

7. luminous intensity candela (cd)

derived quantity — derived dimension

$$\text{velocity} = \frac{\text{displacement}}{\text{time}} = \frac{[L]}{[T]}$$

$$\text{acceleration} = \frac{\Delta V}{\Delta T} = [L][T]^{-1}[T]^{-1} = [L][T]^{-2}$$

$$\text{force} = ma = [M][L][T]^{-2}$$

$$E_K = \frac{1}{2}mv^2 = [M][L]^2[T]^{-2}$$

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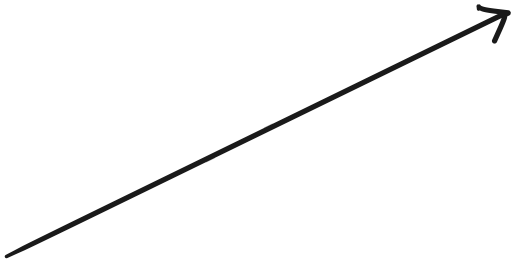
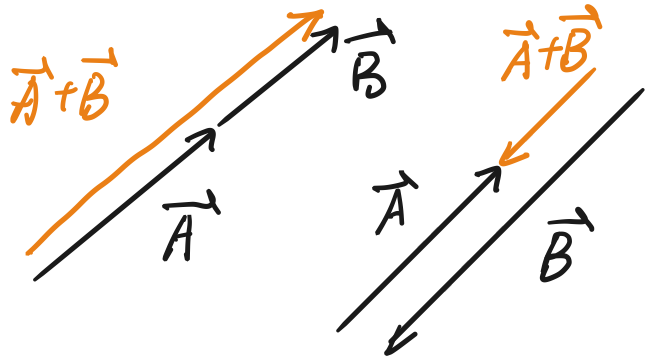
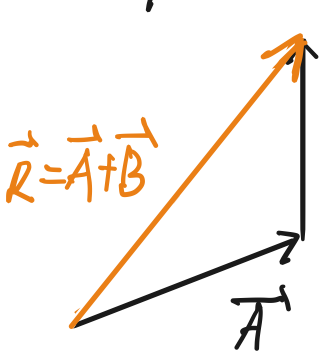
graphical method



① colinear vectors



② head-to-tail method (parallelogram method)



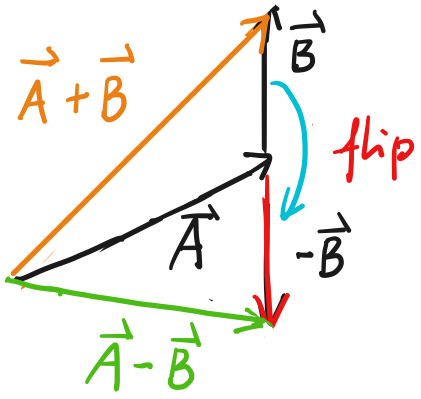
$\vec{A}+\vec{B} = \vec{B}+\vec{A}$ commutative law

associative law

$$\vec{A}+(\vec{B}+\vec{C}) = (\vec{A}+\vec{B})+\vec{C}$$

subtraction = − ″

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



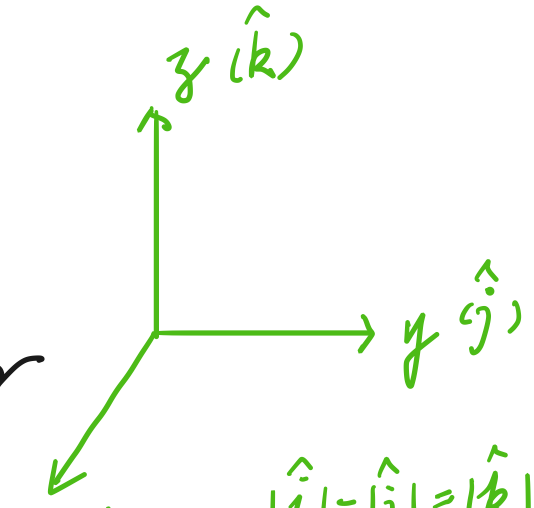
distributive law

$$a(\vec{A}+\vec{B}) = a\vec{A} + a\vec{B}$$

mathmatic presentation of a Vector

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

3D-vector



$$|\hat{i}| = |\hat{j}| = |\hat{k}| = 1$$

$\hat{i}$, $\hat{j}$, $\hat{k}$

dimensionless