$F_g \propto \frac{1}{r^2}$.

$F_{EB} \propto \frac{1}{r^2}$.

F_W (弱交)

F_S (强交).

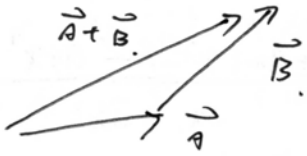
} 力.

1. 2. 3 维运动.

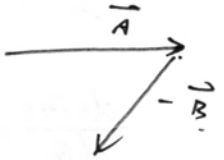
$\vec{F} = m\vec{a} = m\frac{d\vec{v}}{dt} = \frac{d(m\vec{v})}{dt} = \frac{d\vec{p}}{dt}$.

math.

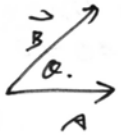
$\vec{A}+\vec{B} = \vec{B}+\vec{A}$.



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



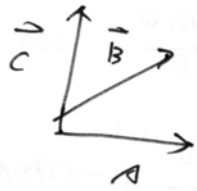
$\vec{A}\cdot\vec{B} = |\vec{A}||\vec{B}|\cos\theta$



(内积). Inner product.

$|\vec{A}\times\vec{B}| = |\vec{A}||\vec{B}|\sin\theta = |\vec{C}|$ $\quad \vec{C} = \vec{A}\times\vec{B}$.

(外积) cross product.



微分

$y = f(x) \Rightarrow x \to x+\Delta x$

$f(x) \to f(x+\Delta x)$

$f' = \frac{df}{dx} = \lim_{\Delta x \to 0} \frac{f(x+\Delta x)-f(x)}{\Delta x}$.

$f(x) = a_n x^n$.

$f(x+\Delta x) = a_n (x+\Delta x)^n$

$= a_n (x^n + n x^{n-1} \Delta x + \cdots) \to$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \left(\frac{a_n x^n + a_n n x^{n-1} \Delta x + \cdots - a_n x^n}{\Delta x} \right)$$

$f(\theta) = \sin\theta$.

$g(\theta) = \cos\theta$.

$$\frac{d\sin\theta}{d\theta} = \lim_{\Delta\theta \to 0} \frac{\sin(\theta+\Delta\theta) - \sin\theta}{\Delta\theta}$$

(将 $\sin(\theta+\Delta\theta)$ 展开)

$\Rightarrow \sin\Delta\theta \Rightarrow \Delta\theta$.

$\cos\Delta\theta \Rightarrow 1$.

$$\frac{d\sin\theta}{d\theta} = \cos\theta.$$

$$\frac{d\cos\theta}{d\theta} = -\sin\theta.$$ (同理可证)

$$\frac{d\sin a\theta}{d\theta} = \frac{d\sin a\theta}{da\theta} \frac{da\theta}{d\theta} = a\cos\theta$$

$$\frac{de^{ax}}{dx} = a e^{ax}. \qquad i = \sqrt{-1}$$

$$\frac{de^{i\theta}}{d\theta} = i e^{i\theta}.$$

歷史

Trans Lippershey (1587–1619)

Galileo Galilei (1564 ~ 1642) 望遠鏡

Kepler (1571 – 1630) 克普勒

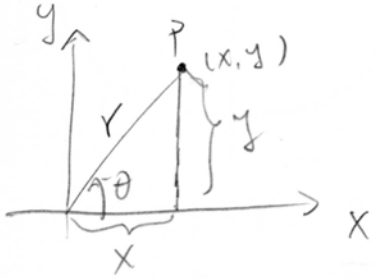
Snell (1591 – 1626) (1621 折射定律)

Fermat (1601 – 1665) (笛卡兒 ↗)

Hurke (1635 – 1705)

Newton (1668 ~ 1704)

Cartesian coordinates (xy) 卡氏坐標



$X = r\cos\theta$

$y = r\sin\theta$

$r = \sqrt{x^2 + y^2}$