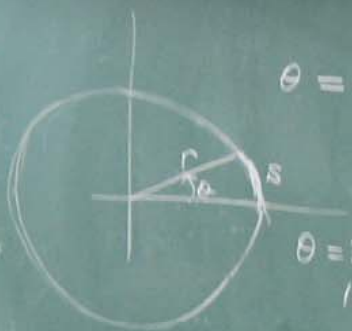


4. 極限

5. 微分

6. 積分

$$\sqrt{-1} \heartsuit \cup$$



$$\theta = \frac{s}{r} \text{ radian}$$

$$\begin{aligned} \theta = 360^\circ &\rightarrow \frac{2\pi r}{r} = 2\pi \\ 180^\circ &\rightarrow \pi \\ 90^\circ &\rightarrow \frac{\pi}{2} \text{ (rad)} \end{aligned}$$

$$\sin x = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

$$n! = n(n-1)(n-2)\dots 2 \cdot 1$$

$$180^\circ \rightarrow \pi$$

$$90^\circ \times \frac{\pi}{180^\circ}$$

$$z_1 = a + bi$$

$$z_2 = c + di$$

$$z_1 + z_2 = (a+c) + (b+d)i$$

$$z_1 - z_2 = (a-c) + (b-d)i$$

$$z_1 z_2 = z_2 z_1 = ac + (ad+bc)i + bd(i^2) = (ac-bd) + (ad+bc)i$$

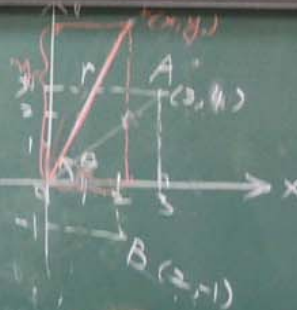
$$x \rightarrow \sqrt{-1} = i \leftarrow \text{虛數}$$

$$i^2 = -1$$

a^x

$$y = f(x)$$

$$g(x)$$



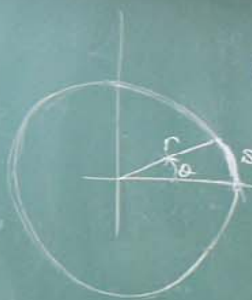
(x, y)
 \uparrow
 Cartesian Coordinates
 卡氏座標

4. 極限

5. 微分

6. 積分

$\sqrt{-1} \heartsuit U$



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$$n! = n(n-1)(n-2)\dots 2 \cdot 1$$

$$180^\circ \rightarrow \pi$$

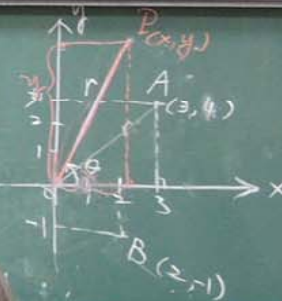
$$\theta \times \frac{\pi}{180^\circ}$$

$$a^{x_1} a^{x_2} = a^{x_1+x_2}$$

$$y = f(x) : x \rightarrow f(x)$$

$$\sin(x) : x \rightarrow \sin(x)$$

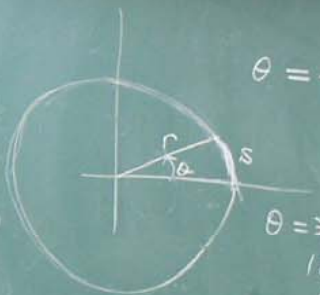
$$f(x) = ax + b$$



(x, y)
↑
Cartesian
Coordinates
卡氏座標

- 4. 極限
- 5. 微分
- 6. 積分

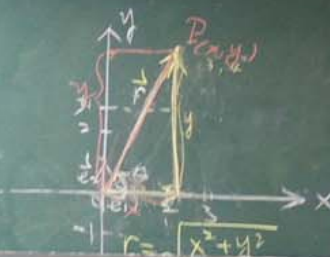
$$\sqrt{-1} \heartsuit U$$



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$$\begin{aligned} \theta = 360^\circ &\rightarrow \frac{2\pi r}{r} = 2\pi \\ 180^\circ &\rightarrow \pi \\ 90^\circ &\rightarrow \frac{\pi}{2} \text{ (rad)} \end{aligned}$$

$$\begin{aligned} \sin \theta &= \frac{y}{r} = \frac{a}{c} \\ \cos \theta &= \frac{x}{r} = \frac{b}{c} \\ \tan \theta &= \frac{y}{x} = \frac{a}{b} \end{aligned}$$



$$x = r \cos \theta$$

$$y = r \sin \theta$$

$$x^2 + y^2 = r^2$$

$$\vec{r} = x\vec{e}_1 + y\vec{e}_2$$

$$x \rightarrow \sqrt{-1} \equiv i \leftarrow \text{虛數}$$

$$i^2 = -1$$

$$f(x) = e^x, \quad f'(x) = \frac{df}{dx} = e^x \quad \text{arc}$$

$$\begin{aligned} \sin x &= \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots \\ \cos x &= 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots \\ e^x &= 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots \end{aligned}$$

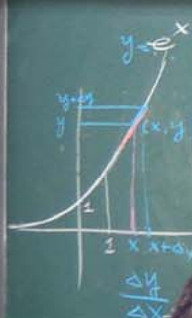
$$e \approx 2.718$$

$$e^{-1} \approx (2.718)^{-1}$$

Euler's formula

$$e^{ix} = \cos x + i \sin x$$

$$e^{i\theta} = \cos \theta + i \sin \theta$$



$f(x) = e^x \quad f'(x) = \frac{df}{dx} = e^x$ arc
 $\sin x = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$
 $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$
 $e^{ix} = \cos x + i \sin x$ Euler's formula

$\vec{e}_1 = \hat{i}, \vec{e}_2 = \hat{j}$
 $\vec{r} = x\vec{e}_1 + y\vec{e}_2 = x\hat{i} + y\hat{j}$
 $\vec{r} \rightarrow (x, y)$
 $e^x \rightarrow \exp(x)$
 exponent
 $x = r \cos \theta$
 $y = r \sin \theta$
 $z = x + iy = r \cos \theta + i r \sin \theta = r(\cos \theta + i \sin \theta)$
 $x + iy = z$
 $r = \sqrt{x^2 + y^2}$
 $z = r e^{i\theta}$
 Complex number

$\phi = \frac{\sqrt{27+3\sqrt{69}}}{\sqrt{27+3\sqrt{69}}} + \frac{1}{3} \sqrt[3]{\frac{27+169}{2}}$
 $\phi \approx 1.618033988749895$
 $50431659 \dots 781253.0000 \dots$
 $\theta = \frac{\pi}{r}$ radian
 $\frac{2\pi}{r} = \dots$
 $\frac{\pi}{r} = \dots$

$x^3 - x - 1 = 0$ Plastic number
 $x^4 - x^3 - 1 = 0$ Pisot number
 $\delta^* = \frac{1}{\delta} = x - iy$
 $\bar{\delta} \delta = x^2 + y^2$
 $|\delta| = \sqrt{\bar{\delta} \delta}$
 $x = r \cos \theta$
 $y = r \sin \theta$
 $x\vec{e}_1 + y\vec{e}_2 = r(\cos \theta \vec{e}_1 + \sin \theta \vec{e}_2)$
 $\theta = \tan^{-1} \left(\frac{y}{x} \right)$

