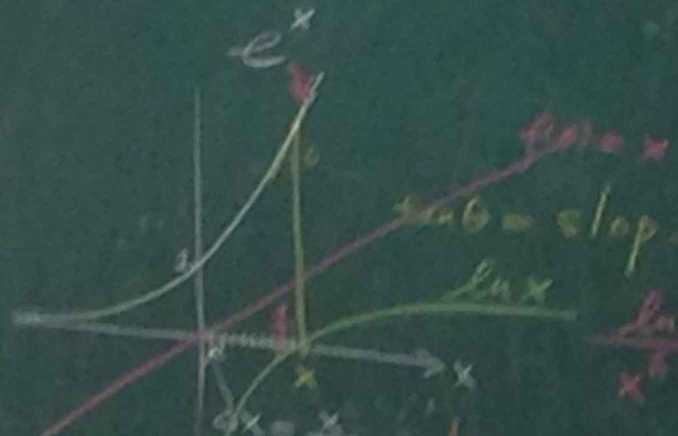


$\frac{dx}{dx} = 0$

$$\frac{dx^0}{dx} = 0x^{-1} = 0$$

$$a^x \leftarrow a = e \cong 2.7182818\ldots$$

$$\frac{\ln x}{x^{\theta>0}} \xrightarrow[x\to\infty]{} 0$$

$$\begin{cases} \frac{d}{dx} f(x) = f(x) & \forall x \\ f(0) = 1 \end{cases}$$

$$f(x) = e^x$$

$$\frac{d}{dx} \ln x = \frac{1}{x}$$

$$y = \ln x = \log_e x$$

$$x = e^y$$

$$dx = \frac{x}{n}$$

$$e^x = \lim_{n\to\infty} \left(1 + \frac{x}{n}\right)^n$$

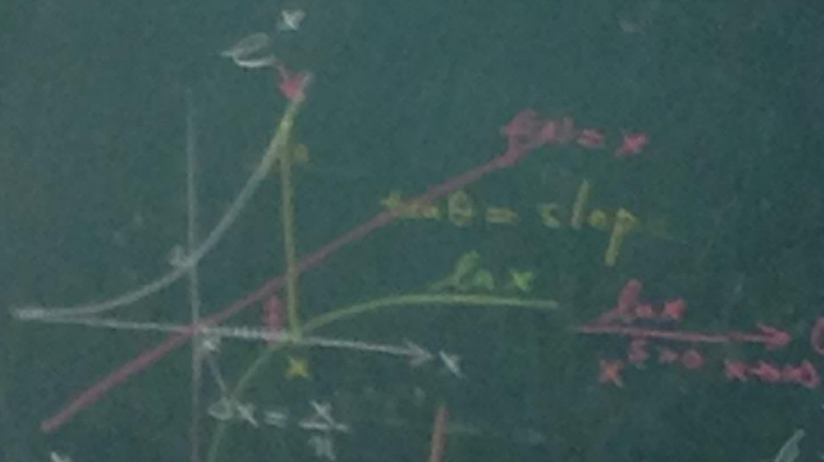
$$\frac{d}{dx} x^x = x\, x^{x-1} \ ? \ \times$$

$$\frac{d}{dx} a^x \neq a^x$$

$$\frac{dU(x)}{dx} = \frac{\frac{1}{2}(-2x)}{\sqrt{a^2 - x^2}} = -\frac{x}{y}$$

$$x^2 + y^2 = a^2$$

$2x + 2y\,y'$ [illegible] implicit [illegible]



$$e^x = \lim_{n\to\infty}\left(1+\frac{x}{n}\right)^n$$

$$\frac{dx^0}{dx} = 0\,x^{-1} = 0$$

$$a^x \leftarrow a = e \cong 2.7182818\ldots$$

$$\begin{cases} \frac{d}{dx}f(x) = f(x) & \forall x \\ f(0) = 1 \end{cases}$$

$$f(x) = e^x$$

$$\frac{d}{dx}\ln x = \frac{1}{x}$$

$$y = \ln x \equiv \log_e x$$

$$x = e^y$$

$$\frac{d}{dx}x^x = x\,x^{x-1} \;?\; \times$$

$$\frac{d}{dx}a^x \neq a^x$$

$$y = a^x = e^{\ln a^x} = e^{x\ln a}$$

$$\frac{dy}{dx} = \frac{d\,e^{x\ln a}}{d(x\ln a)}\,\frac{d(x\ln a)}{dx} = \left(e^{x\ln a}\right)\ln a$$

$$\frac{dU(x)}{dx} = \frac{\frac{1}{2}(-2x)}{\sqrt{a^2-x^2}} = -\frac{x}{y}$$

$$x^2+y^2=a^2$$

implicit function

$$2x+2yy'=0$$

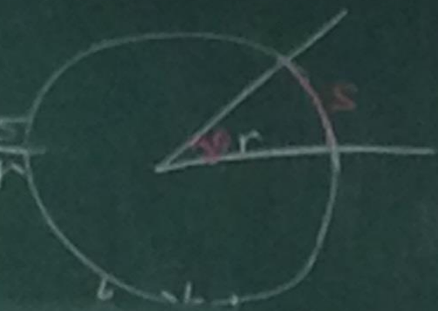
$$y' = -\frac{x}{y}$$

$y = x^x = e^{\ln x^x}$

$e^{y^2} + xy^2 + e^{3x\ln x} = 0$

$\therefore \frac{dy}{dx} = \frac{d e^{x\ln x}}{d(x\ln x)} \frac{d x\ln x}{dx}$

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



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

$i = \sqrt{-1}$

$x^2 + y^2 = a^2$

U(a)

$$\lim_{x\to a}\frac{f(x)}{g(x)} = \lim_{x\to a}\frac{[f(x)-f(a)]/(x-a)}{[g(x)-g(a)]/(x-a)} \overset{?}{=} \frac{\lim_{x\to a}\frac{f(x)-f(a)}{x-a}}{\lim_{x\to a}\frac{g(x)-g(a)}{x-a}} =$$

$f(a) = g(a) = 0$

$= \lim f'$

$$\lim_{x \to a} \frac{f(x)}{g(x)} = \lim_{x \to a} \frac{[f(x) - f(a)] / (x-a)}{[g(x) - g(a)] / (x-a)} \overset{?}{=} \frac{\lim\limits_{x \to a} \frac{f(x) - f(a)}{x-a}}{\lim\limits_{x \to a} \frac{g(x) - g(a)}{x-a}} =$$

$$f(a) = g(a) = 0$$

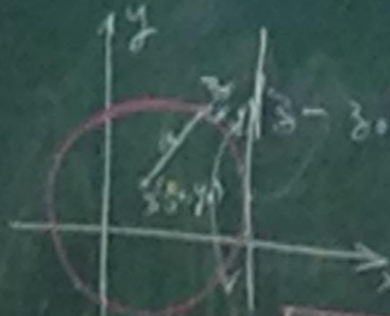
$$= \lim_{x \to a} \frac{f'(\xi)}{g'(\xi)} = \lim_{x \to a} \frac{f'(x)}{g'(x)}$$

L'Hospital rule

$$\boxed{\frac{f(x) - f(a)}{x-a} = f'(\xi)}$$

$$\lim_{x \to 0} \frac{1 - \cos x}{x^2} = \lim_{x \to 0} \frac{\sin x}{2x} = \frac{1}{2} \qquad \lim_{x \to 0} \frac{\cos x}{2} = \frac{1}{2}$$

$$\lim_{x \to 0} \frac{[\text{illegible}]}{x^2} = \frac{1}{2}$$



$|z - z_0| = a > 0$

$z = x + yi$

$z_0 = x_0 + y_0 i$

$|z - z_0| = \sqrt{(x-x_0)^2 + (y-y_0)^2} = a \Rightarrow$

$(x-x_0)^2 + (y-y_0)^2 = a^2$

a Circle with radius $= a$

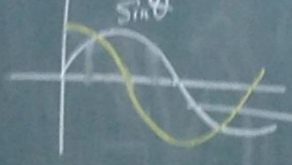
L'Hospital rule

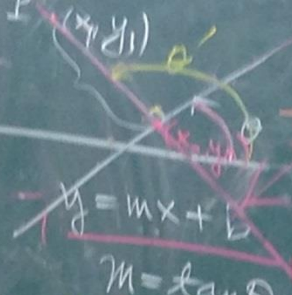
Complex number

$z = x + iy$

$|z| + |z-2| = 4$

$\sqrt{x^2+y^2} + \sqrt{(x-2)^2+y^2} = \ldots$





$m = \tan\theta$

$y = mx + b$

$m = \tan\theta$

$m' = -\frac{1}{m}$

$$m' = \tan\left(\theta + \frac{\pi}{2}\right) = \frac{\sin\left(\theta + \frac{\pi}{2}\right)}{\cos\left(\theta + \frac{\pi}{2}\right)} = \frac{\cos\theta}{-\sin\theta} = -\cot\theta$$

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$mm' = -1$$

$$\frac{y - y_1}{x - x_1} = -\frac{1}{m}$$

$$y = mx + b$$

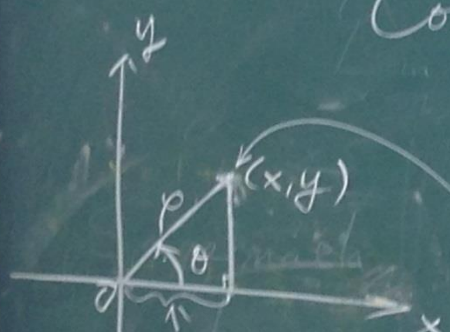
$$(x_0, y_0)$$

$$m(x - x_1) + y_1$$

$$b = y_1 - m x_1$$

$$d_\perp = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2}$$

Complex number



$x = \rho\cos\theta$

$y = \rho\sin\theta$

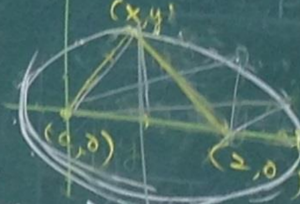
$z = x + iy$

$i = \sqrt{-1}$

$$\underset{\text{real part}}{x} + \underset{\text{imaginary part}}{y\,i} = \rho e^{i\theta}$$

$$|z| + |z - 2| = 4$$

$$\sqrt{x^2 + y^2} + \sqrt{(x-2)^2 + y^2} = 4$$



$$\frac{(x-1)^2}{4} + \frac{y^2}{3} = 1.$$

Argand diagram.

$$\lim_{x\to a}\frac{f(x)}{g(x)} = \lim_{x\to a}\frac{[f(x)-f(a)]/(x-a)}{[g(x)-g(a)]/(x-a)} \overset{?}{=} \frac{\lim_{x\to a}\frac{f(x)-f(a)}{x-a}}{\lim_{x\to a}\frac{g(x)-g(a)}{x-a}} =$$

$f(a)=g(a)=0$

$$= \lim_{x\to a}\frac{f'(\xi)}{g'(\xi)} = \lim_{x\to a}\frac{f'(x)}{g'(x)}$$

L'Hospital rule

$$\boxed{\frac{f(x)-f(a)}{x-a} = f'(\xi)}$$

$$\lim_{x\to 0}\frac{1-\cos x}{x^2} = \lim_{x\to 0}\frac{\sin x}{2x} = \frac{1}{2} \quad a<\xi<x$$

$$\lim_{x\to 0}\frac{\cos x}{2} = \frac{1}{2}$$

$$\lim_{x\to 0}\frac{\left[1-\left(1-\frac{x^2}{2}+\frac{x^4}{4!}\ \ \right)\right]}{x^2} = \frac{1}{2}$$

$z = x+yi$

$|z| = \sqrt{x^2+y^2} = \rho$

$z_1 = \rho_1(\cos\theta_1 + i\sin\theta_1)$

$z_2 = \rho_2(\cos\theta_2 + i\sin\theta_2)$

conjuga

$n! \simeq n^{n+\frac{1}{2}}e^{-n}\left(1+\frac{1}{12n}\right)$

$z_1 z_2 = \rho_1 e^{i\theta_1}\,\rho_2 e^{i\theta_2}$

$i(\theta_1+\theta_2)$

$f(a) = g(a) = 0$

L'Hospital rule

$$\boxed{\frac{f(x)-f(a)}{x-a} = f'(\xi)}$$

$$= \lim_{x\to a}\frac{f'(\xi)}{g'(\xi)} = \lim_{x\to a}\frac{f(x)}{g(x)}$$

$$\lim_{x\to 0}\frac{1-\cos x}{x^2} = \lim_{x\to 0}\frac{\sin x}{2x} = \frac{1}{2} \qquad a<\xi<x$$

$$\lim_{x\to 0}\frac{\cos x}{2} = \frac{1}{2}$$

$$\lim_{x\to 0}\frac{\left[1-\left(1-\frac{x^2}{2}+\frac{x^4}{4!}\cdots\right)\right]}{x^2} = \frac{1}{2}$$

$z = x + yi$

$|z| = \sqrt{x^2+y^2} = \rho$

$z_1 = \rho_1(\cos\theta_1 + i\sin\theta_1)$

$z_2 = \rho_2(\cos\theta_2 + i\sin\theta_2)$

conjugate

$$z_1 z_2 = \rho_1\rho_2\left\{\cos\theta_1\cos\theta_2 - \sin\theta_1\sin\theta_2 + i\left(\sin\theta_1\cos\theta_2 + \cos\theta_1\sin\theta_2\right)\right\}$$

$$= \rho_1\rho_2\left\{\cos(\theta_1+\theta_2) + i\sin(\theta_1+\theta_2)\right\}$$

$$n! \approx n^{n+\frac{1}{2}}e^{-n}\left(1+\frac{1}{12n}\right)$$

$$n\cdot(n-1)\cdots 2\cdot 1$$

$$n^n$$

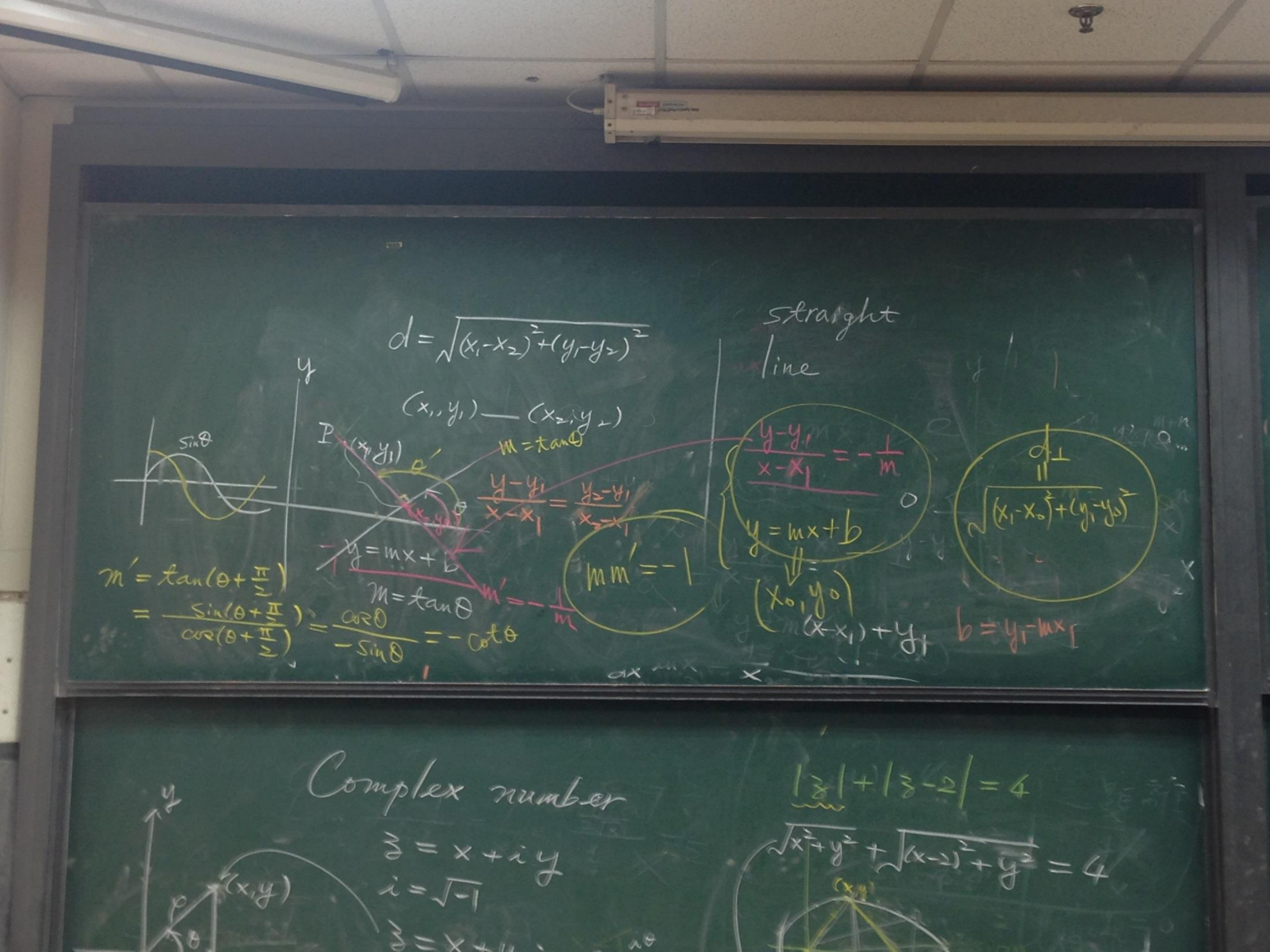
$$\left(\frac{n+1}{2}\right)^n$$

$+i(ad+bc)$

$$z_1 z_2 = \rho_1 e^{i\theta_1}\,\rho_2 e^{i\theta_2} = \rho_1\rho_2 e^{i(\theta_1+\theta_2)}$$

$$(1+2i)^8 = \Big\{\underbrace{\sqrt{5}}_{\rho}\Big(\underbrace{\tfrac{1}{\sqrt{5}}}_{\cos\theta} + \underbrace{\tfrac{2}{\sqrt{5}}}_{\sin\theta}\,i\Big)\Big\}^8$$

$$= (\sqrt{5})^8 e^{8i\theta} \quad \cos 8\theta + i\sin 8\theta$$


d = √((x₁-x₂)² + (y₁-y₂)²)
(x₁, y₁) — (x₂, y₂)
straight
line
y
sinθ
P (x₁, y₁)
θ'
θ
(x₂, y₂)
m = tanθ
(y - y₁)/(x - x₁) = (y₂ - y₁)/(x₂ - x₁)
y = mx + b
m = tanθ
m' = -1/m
mm' = -1
m' = tan(θ + π/2)
= sin(θ + π/2)/cos(θ + π/2) = cosθ/(-sinθ) = -cotθ
(y - y₁)/(x - x₁) = -1/m
y = mx + b
(x₀, y₀)
m(x - x₁) + y₁
b = y₁ - mx₁
d⊥
√((x₁-x₀)² + (y₁-y₀)²)
Complex number
z = x + iy
i = √-1
(x, y)
ρ
θ
|z| + |z - 2| = 4
√(x² + y²) + √((x-2)² + y²) = 4
(x, y)