$$(e^x)' = \lim_{\Delta x \to 0} \frac{e^{x+\Delta x} - e^x}{\Delta x} = e^x \lim_{\Delta x \to 0} \frac{e^{\Delta x} - 1}{\Delta x} = \text{"} z = \frac{1}{\Delta x} \text{"} = e^x \lim_{z \to \infty} \left(\frac{e^{1/z} - 1}{1/z} \right) =$$

$$= e^x \cdot \lim_{z \to \infty} \left[z \cdot \left\{ \left(\lim_{z \to \infty} \left(1 + \frac{1}{z}\right)^z \right)^{1/z} - 1 \right\} \right] = e^x \lim_{z \to \infty} \left[\frac{z}{z} \right] = e^x \cdot \lim_{z \to \infty} 1$$

$$\left(f(g(x))\right)'_x = \lim_{x \to 0} \frac{f(g(x+\Delta x)) - f(g(x))}{\Delta x}$$

$$\Delta f = f'_x(g(x)) \cdot \Delta g = f'(g(x)) \cdot g'(x) \cdot \Delta x$$

$$\Delta g = g'_x(x) \Delta x$$

$$\left(f(g(x))\right)'_x = f'(g(x)) \cdot g'(x)$$

$$\frac{df}{dx} = \frac{df}{dg} \cdot \frac{dg}{dx}$$ денuос диффер.

$$y = R \sin(t)$$

$$x = R \cos(t)$$

$$\frac{dy}{dx} = \frac{d(R\sin(t))}{d(R\cos(t))} = \frac{\cos(t)}{-\sin(t)} = -\operatorname{ctg}(t)$$ $t \neq \pi n, \; n \in \mathbb{Z}$

$$\frac{d\sin(t)}{dt} = \cos(t)$$

$$\frac{d\cos(t)}{dt} = -\sin(t)$$

Функция задана неявно

$$F(x, y) = 0$$

$$\frac{dx}{dy} = \frac{\frac{\partial F}{\partial y}}{\frac{\partial F}{\partial x}}$$

1. По x:

$$\frac{\partial F}{\partial x} \cdot \frac{dx}{dx} + \frac{\partial F}{\partial y} \cdot \frac{dy}{dx} = 0 \qquad // \; dF = \frac{\partial F}{\partial x} \cdot dx + \frac{\partial F}{\partial y} \cdot dy = 0 \;\Big|\cdot \frac{1}{dx}$$

$$\frac{\partial F}{\partial x} + \frac{dy}{dx} \cdot \frac{\partial F}{\partial y} = 0$$

$$\frac{dy}{dx} = -\frac{\frac{\partial F}{\partial x}}{\frac{\partial F}{\partial y}}$$

Ex. $x^2 + y^2 - 25 = 0$

$$2x\,dx + 2y\,dy = 0$$

$$\frac{dy}{dx} = -\frac{x}{y}$$

$$f(x) = y$$

$$f^{-}(y) = x$$

$$x = f^{-1}(f(x))$$