Fundamental Theorem

w/ Substitution

$$\int_{x=a}^{b} f(x)\,dx = F(b) - F(a)$$

or

$$F(x)\Big|_a^b$$

$$\int_{u(a)}^{u(b)} f(u)\,du = F(u(b)) - F(u(a))$$

Ex $\displaystyle\int_{-10}^{10} \frac{x}{(x^2+9)^2}\,dx$

$u = x^2+9$

$du = 2x\,dx$

$\frac{du}{2} = x\,dx$

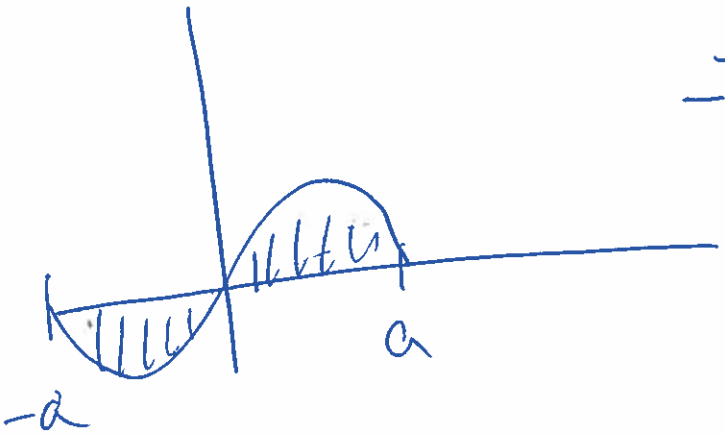
$u(10) = 109$

$u(-10) = 109$

$$\int_{109}^{109} \frac{1}{u^2}\cdot\frac{du}{2} = 0$$

what if

$$\int_{-a}^{a} \sin(x)\,dx = 0$$



Not

$$\int_{-a}^{a} |\sin(x)|\,dx = \#$$

$$\int_{b}^{a} f(x)\,dx = F(a) - F(b)$$

$$= -\left(F(b) - F(a)\right)$$

$$= -\int_{a}^{b} f(x)\,dx$$

$$\int_{a}^{a} f(x)\,dx = 0$$

$$y = \int_0^x \underbrace{x^2 - 16x + 16}_{f(x)} = F(x) - F(0)$$

$$\#$$

$$y' = x^2 - 16x + 16 + 0$$