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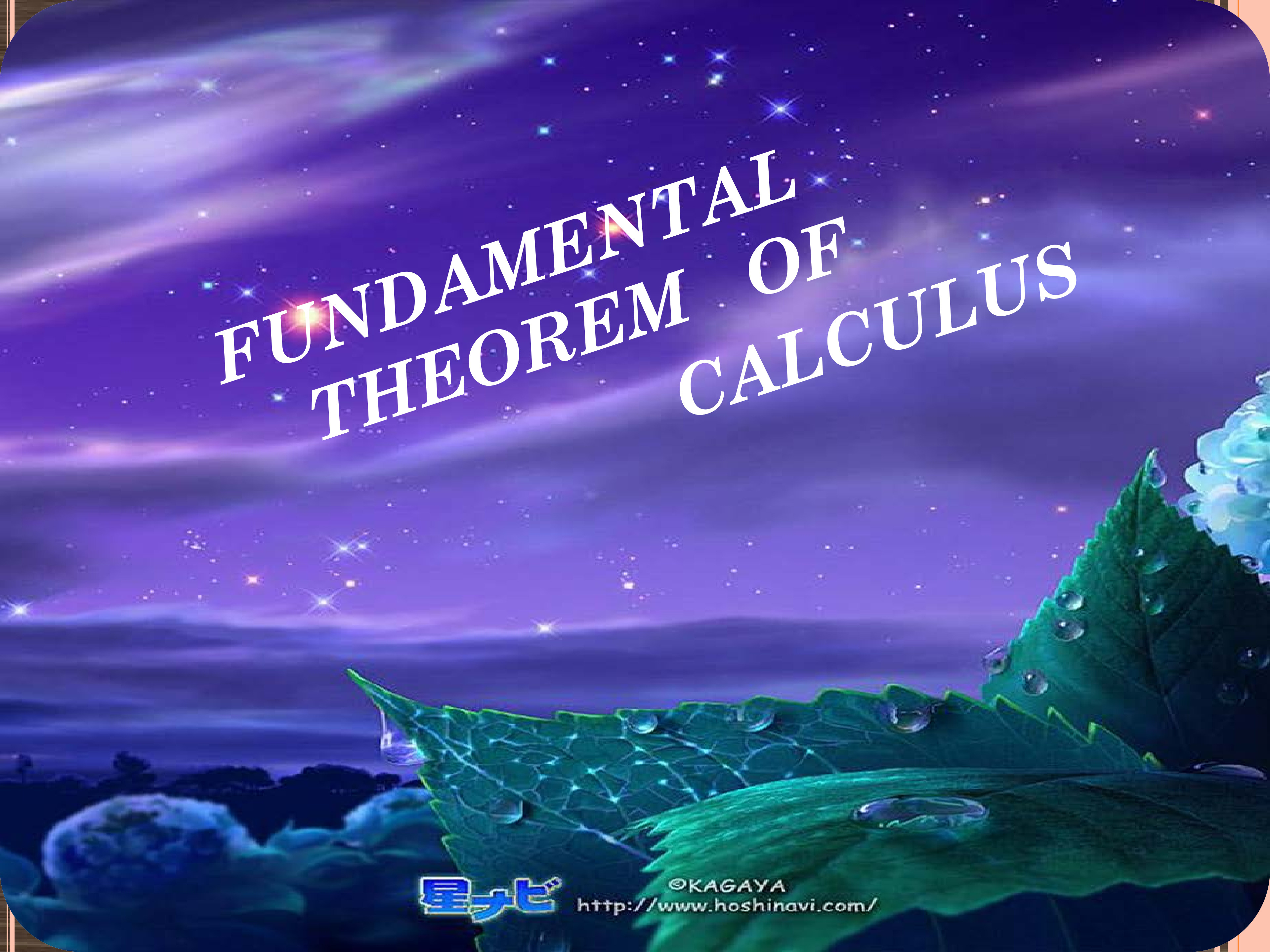
ANTIDERIVATIVE

DEFINITION:

A function F is an antiderivative (or primitive or indefinite integral) of f on an integral I if $F'(x)=f(x)$ for all $x \in I$.

FUNDAMENTAL THEOREM OF CALCULUS



FUNDAMENTAL THEOREM OF CALCULUS

If f is continuous on the interval I=[a , b] then

F has an anti derivative on I

PROOF:

Define a function F_0 on I by

$$F_0(x)=\int_0^x f(t)dt \qquad a\leq x\leq b$$

If x and x+h both lie in I1

Then $F_0(x+h)-F_0(x)=\int_a^{x+h} f - \int_a^{x} f$

$$=\int_a^{x+h} f+\int_x^{a} f$$

$$=\int_x^{x+h} f=f(\bar{x})h$$

where $\bar{x} \in (x,x+h)$

(by mean value thm)

$F_0(x+h)-F_0(x)/h=f(\bar{x})$

As $h\to 0, \bar{x}\to x$. Since f is continuous on I.

$F(x)=f(x)$ as $h \to \infty$.

Therefore $F`(x)=f(x)$ for all $x \in I$

F_0 is an anti derivative of f.

Hence the theorem proved.