# Cal1 Definite Substitution

Wednesday, 12 June 2024 9:28 pm

**Fundamental Theorem of Calculus, Part I**

If $f(x)$ is continuous on $[a,b]$ then,

$$g(x) = \int_a^x f(t)\ dt$$

is continuous on $[a,b]$ and it is differentiable on $(a,b)$ and,

$$g'(x) = f(x)$$

An alternate notation for the derivative portion of this is,

$$\frac{d}{dx}\int_a^x f(t)\ dt = f(x)$$

**(a)** $g(x) = \displaystyle\int_{-4}^{x} \mathrm{e}^{2t}\cos^2(1-5t)\ dt$ Hide Solution ▾

This one is nothing more than a quick application of the Fundamental Theorem of Calculus.

$$g'(x) =$$

## Section 5.7 : Computing Definite Integrals

In this section we are going to concentrate on how we actually evaluate definite integrals in practice. To do this we will need the Fundamental Theorem of Calculus, Part II.

**Fundamental Theorem of Calculus, Part II**

Suppose $f(x)$ is a continuous function on $[a,b]$ and also suppose that $F(x)$ is any anti-derivative for $f(x)$. Then,

$$\int_a^b f(x)\,dx = F(x)\big|_a^b = F(b) - F(a)$$

$$\int_0^2 x^2 + 1\,dx$$

***Example 4*** Given,

$$f(x) = \begin{cases} 6 & \text{if } x > 1 \\ 3x^2 & \text{if } x \le 1 \end{cases}$$

Evaluate each of the following integrals.

**(a)** $\displaystyle\int_{10}^{22} f(x)\, dx$

**(b)** $\displaystyle\int_{-2}^{3} f(x)\, dx$

## Substitution Rule For Definite Integrals

Screen clipping taken: 13/06/2024 10:50 am

***Example 1*** Evaluate the following definite integral.

$$\int_{-2}^{0} 2t^2 \sqrt{1 - 4t^3}\, dt$$

**(a)** $\displaystyle\int_{-1}^{5} (1 + w)\left(2w + w^2\right)^5 dw$