Sections 5.5: The Substitution Rule

Knowing $f(x) = (x^4 + 3)^4$ and $f'(x) = 4(x^4 + 3)^3 * 4x^3 = 16x^3(x^4 + 3)^3$

Compute $\int 16x^3(x^4 + 3)^3 dx =$

Example: Compute.

$\int 2x(x^2 + 5)^8 \; dx =$

The substitution Rule If $u = g(x)$ is a differentiable function whose range is an interval I and f is continuous on I, then

$\int f(g(x))g'(x) \; dx = \int f(u) \; du$

Example: Compute the following.

A) $\int \cos(kx) \; dx =$

B) $\displaystyle\int \frac{12x^3 + 9}{(x^4 + 3x)^5} \; dx$

C) $\displaystyle\int x(x-8)^8 \; dx$

D) $\int \dfrac{1 + 4x}{1 + x^2} \, dx$

The substitution Rule for Definite Integrals If $g'(x)$ is differentiable on $[a, b]$ and f is continuous on the range of g, then continuous on I, then

$$\int_a^b f(g(x))g'(x)\ dx = \int_{g(a)}^{g(b)} f(u)\ du$$

Example: Compute

$$\int_0^2 x\cos(4x^2 - 1)dx =$$

Example: Compute

$$\int\limits_{0}^{3} 2x^3(1-x^2)^5 \ dx$$