

Section 5.5

The Substitution Rule: If $u = g(x)$ is a differentiable function and f is continuous, then

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

Exercises: Evaluate the following

(1) $\int 4x^3 \cos(x^4 + 2) dx$

(4) $\int \frac{x}{\sqrt{1-4x^2}} dx$

(7) $\int x^5 \sqrt{1+x^2} dx$

(2) $\int \frac{\ln x}{x} dx$

(5) $\int \sin(5x) dx$

(8) $\int \frac{2x+3}{3x^2+9x+7} dx$

(3) $\int \sqrt{2x+1} dx$

(6) $\int x\sqrt{4-x} dx$

(9) $\int \cos x \sin^2 x dx$

Definite Integrals: When doing substitution with definite integrals, there are two methods that you can do:

- Method 1: Change the bounds to be in terms of u instead of x
- Method 2: Convert back to x before plugging in the bounds

Exercises: Evaluate the following

$$(1) \int_0^4 \sqrt{2x+1} \, dx$$

$$(3) \int_1^3 \frac{\sqrt{\ln x}}{x} \, dx$$

$$(5) \int_1^2 \frac{x}{(x^2+3)^3} \, dx$$

$$(2) \int_0^{\sqrt{\pi}} x \cos(x^2) \, dx$$

$$(4) \int_0^1 \frac{e^{2x}}{\sqrt{1+e^{2x}}} \, dx$$

$$(6) \int_1^2 \left(e^{4x} - \frac{1}{(x+1)^2} \right) \, dx$$