ART OF INTEGRATION

EXAMPLE

EXAMPLE

Since $\frac{d}{dx}\sin(x^2) = 2x\cos(x^2)$ we have that

$$\int 2x\cos(x^2)dx = \sin(x^2) + C.$$

REVERSING THE CHAIN RULE

CHAIN RULE

LEMMA

$H(x) = F(g(x))$ is an anti-derivative for $f(g(x))g'(x)$ where $F' = f$

EXAMPLE

EXAMPLE

Let $f(u) = \cos(u)$ and $g(x) = x^2$

SUBSTITUTION

THEOREM

If $F' = f$

$$\int f(g(x)g'(x)dx = F(g(x)) + C$$

EXAMPLE

EXAMPLE

Calculate

$$\int (x-4)^2 dx$$

EXAMPLE

EXAMPLE

Calculate

$$\int x\sqrt{x^2-5}dx$$

SUBSTITUTION

SUBSTITUTION

THEOREM

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

where $u = g(x)$

EXAMPLE

EXAMPLE

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

EXAMPLE

EXAMPLE

$$\int (x-4)^2 dx$$

EXAMPLE

EXAMPLE

$$\int x^2 e^{x^3} dx$$

EXAMPLE

EXAMPLE

$$\int \frac{1}{3-x}\,dx$$