

ART OF INTEGRATION

EXAMPLE

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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 $F' = f$

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

SUBSTITUTION

THEOREM

$$\text{If } F' = f$$

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

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

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

EXAMPLE

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