

§5.5 Substitution Rule (u -substitution)

Recall the Chain Rule for derivative of the composition $F(u(x))$:

$$(F(u(x)))' = F'(u(x))u'(x).$$

Take indefinite integral for both sides of the chain rule formula.

$$\int (F(u(x)))' dx = \int F'(u(x))u'(x) dx.$$

Suppose $F'(u) = f(u)$. Simplify both sides,

$$F(u(x)) + C = \int F'(u(x))u'(x) dx.$$

u -substitution

Then, we have the **Substitution Rule** for indefinite integral:

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

where $F'(u) = f(u)$.