

§7.1 Integration by Parts

Recall in §5.5,

We have the **u -Substitution Rule** for indefinite integral:

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

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

Trick: find the right u function.

Recall that we can look at u -Substitution Rule as the “backwards” of the chain rule, or the “anti-chain rule”.

Now, in this chapter, we will learn the backwards of the product rule, or consider it as “anti-product rule”.¹

¹This chapter is another difficult and technical chapter.

The **product rule** for derivative is

$$(u(x)v(x))' = u'(x)v(x) + u(x)v'(x)$$

Or write it short by omitting the variable, $u = u(x)$, $v = v(x)$,

$$(uv)' = u'v + uv'$$

So, we can write it as

$$uv' = (uv)' - u'v$$

Integrating both sides, we have the formula for Integration by Parts.

Integration by Parts

$$\int uv' dx = uv - \int u'v dx$$

or

$$\int u dv = uv - \int v du$$

Trick: Find the right u and v functions.