

2021.01.13

(1)

EX:  $\int (\cos t) \sin^6(t) dt = \int u^6 du = \frac{u^7}{7} + C$

$\int \cos t dt = \sin(t) + C$

$\int \sin t dt = -\cos(t) + C$

~~u = sin(t)~~

$u = \sin(t)$

$u^6 = \sin^6(t)$

$= \frac{\sin^7(t)}{7} + C$

$\frac{du}{dt} = \cos(t)$

$du = \cos(t) dt$

You have to decide what u is

What if we picked a different change of variable?

$w = \cos t$

$\frac{dw}{dt} = -\sin t$

$dw = -\sin t dt$

Can't take powers here

$dt = \frac{dw}{-\sin t}$

$\int \cos(t) \sin^6(t) dt$

$= \int w$  how to write  $\sin^6(t)$  in terms of  $w$ ? how to handle  $dt$ ?

$= \int w$   $\sin^6(t)$ ?  $\frac{dw}{\sin(t)}$

can't take powers here

can't take powers here

Ex:  $\int \frac{e^t + 8}{e^t + 8t} dt$

$u = e^t + 8t$

$w = e^t + 8$

$v = e^t$

$\int \frac{e^t + 8}{e^t + 8} dt$   $\left(\frac{d}{dt} t^2 = 2t\right)$   
 $\int \frac{du}{u}$

Do u

$u = e^t + 8t$

$du = e^t + 8 dt$

$\int \frac{e^t + 8}{e^t + 8t} dt = \int \frac{1}{u} du = \ln(u) + C$   
 $= \ln(e^t + 8t) + C$   
*parts of integral*  
*the answer to the integral*

Do w

$w = e^t + 8$

$dw = e^t dt$

$\downarrow$   
 $dt = \frac{dw}{e^t} = \frac{dw}{w-8}$

$e^t = w - 8$

$\int \frac{e^t + 8}{e^t + 8t} dt = \int \frac{w}{w-8} \frac{1}{w-8} dw$

how to express  $e^t + 8t$  in terms of  $w$ ? CANT!

Do  $\checkmark$

$$\ln(v) = t$$

$$v = e^t$$

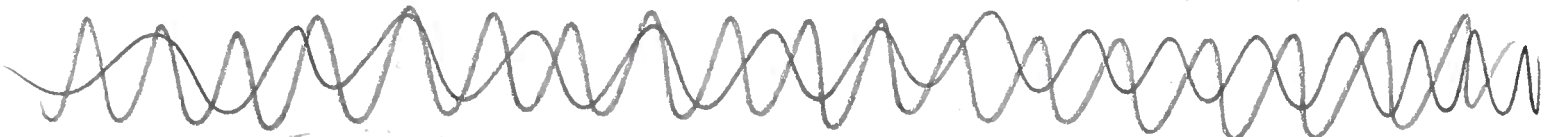
$$dv = e^t dt$$

$$dt = \frac{dv}{e^t} = \frac{1}{v} dv$$

how to solve?

This is a more difficult problem.

$$\int \frac{e^{t+8}}{e^t + 8t} dt = \int \frac{v+8}{v+8\ln(v)} \frac{1}{v} dv$$



Ex:

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

Recall

$$\sqrt{x} = x^{1/2}$$

$$u = 1+x^3 \Rightarrow \int 2 \frac{1}{3} \sqrt{u} du$$

$$du = 3x^2 dx \Rightarrow \frac{2}{3} \int u^{1/2} du$$

$$\frac{du}{3} = x^2 dx \Rightarrow \frac{2}{3} \frac{u^{3/2}}{3/2} + C$$

$$= \frac{4}{9} u^{3/2} + C$$

$$= \frac{4}{9} (1+x^3)^{3/2} + C$$

$$\int \sqrt{x} dx = \int x^{1/2} dx = \frac{x^{1/2+1}}{1/2+1} + C$$

$$= \frac{x^{3/2}}{3/2} + C$$

$$= \frac{2x^{3/2}}{3} + C$$

Ex:  $\int \tan(x) dx = \int \frac{\sin x}{\cos x} dx$

$\sec(x) = \frac{1}{\cos x}$

$u = \cos x$

$= -\int \frac{1}{u} du$

$du = -\sin(x) dx$

$= -\ln(u) + C$

$-du = \sin(x) dx$

$= -\ln(\cos(x)) + C$

↑  
careful to never  
plug in x where  
 $\cos(x) < 0$