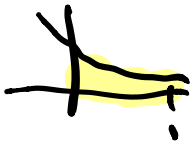
Unit 19
Anti derivatives

1

A $\int_0^1 e^x\,dx = e^x\Big|_0^1 = \boxed{e-1}$ ~ 1.6

B $\int_{-1}^{0} e^{-x}\,dx = -e^{-x}\Big|_{-1}^{0} = \boxed{-1+e}$

C $\int_0^1 e^{-x}\,dx = -e^{-x}\Big|_0^1 = \boxed{1-e^{-1}}$



D $\int_1^2 \frac{1}{x^2}\,dx = -x^{-1}\Big|_1^2 = \boxed{\frac{1}{2}}$

E $\int_0^{\pi/2} \cos x\,dx = 1$

F $\int_{-2}^{2} 3x^4\,dx = \frac{3}{5}\cdot x^5\Big|_{-2}^{2}$

$= \frac{3\cdot 64}{5} = \frac{192}{5}$

2

A $\int \frac{1}{x^2}\,dx = \boxed{-\frac{1}{x} + C}$

B $\int \frac{1}{\cos^2 x}\,dx = \boxed{\tan(x) + C}$

C $\int x^{-2/3}\,dx = \boxed{x^{1/3} \cdot 3 + C}$

D $\int \cos x\,dx = \boxed{+\sin(x) + C}$

F $\int 4 - \frac{3}{1+x^2}\,dx$

$F(0) = 3$

$F(x) = 4x - 3\arctan x + C$

what is C ?

$\boxed{C = 3}$

MIT Contest Problem (JAM)

Group 2 (6)

Group 6 (4)

Congratulations!

MIT contest problem

(3) $\int \frac{1}{1+e^x}\,dx =$ ↑ trick

$= \int \frac{1+e^x}{1+e^x} - \frac{e^x}{1+e^x}\,dx$

$= \int 1 - \int \frac{e^x}{1+e^x}\,dx$

(Try: $\log(1+e^x)$)

$$\frac{d}{dx}\log(1+e^x) = \frac{1}{1+e^x}\cdot e^x$$

$$= \boxed{x - \log(1+e^x) + C}$$

MIT contest prob

(4) $$\int \frac{\log x \;\; \log\log x}{x}\, dx$$

Try: $\frac{d}{dx}\log(\log(x))$

$$= \frac{1}{\log x}\cdot\frac{1}{x}$$

$$\frac{d}{dx}\log(\log(\log x)) = \frac{1}{x\log x\log\log x}$$

we are lost....

$\frac{1}{\log x \cdot x}$

5 Integration is hard!
Sometimes impossible!

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

Stats

does not have an anti-derivative that is elementary

we just call it

$\text{erf}(x)$

$$\int \frac{1}{\log x}\, dx$$

numbers they

we call this $li(x)$

because there is no elementary expression.