Anti Derivatives

19

f	F
x^n	$\dfrac{x^{n+1}}{n+1}$
$\sin(ax)$	$-\cos(ax)/a$
$\exp(ax)$	$\exp(ax)/a$
$1/x$	$\log(x)$

PLAN

1. Poll

2. Review

3. Anti derivatives vs. indefinite integrals

4. Examples

5. Integration Bee

Yesterday

Why was yesterday a special day?

POLL

1 =indefinite integral

2 =definite integral

3 =Anti Derivative

A $\int x^2 dx = x^3/3 + C$

B $\int x^2 \, dx = \dfrac{x^3}{3}$

C $\int_0^1 x^2 \, dx = 1/3$

THREE NOTIONS

$$\int_a^b f(x)\ dx$$

Definite integral

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

Indefinite integral

$F(x) + c$ is the general anti-derivative

THE FTC

$$\frac{d}{dx} \int_a^x f(t)\ dt = f(x)$$

$$\int_a^x f'(t)\ dt = f(x) - f(a)$$

DEFINITE INTEGRALS

A $\displaystyle\int_0^1 e^x \, dx$

B $\displaystyle\int_{-1}^0 e^{-x} \, dx$

C $\displaystyle\int_0^1 e^{-x} \, dx$

D $\displaystyle\int_1^2 \frac{1}{x^2} \, dx$

E $\displaystyle\int_0^{\pi/2} \cos(x) \, dt$

F $\displaystyle\int_{-2}^2 3x^4 \, dx$

INDEFINITE INTEGRALS

A $\displaystyle\int \frac{1}{x^2}\, dx$

B $\displaystyle\int 1/\cos^2(x)\, dx$

C $\displaystyle\int x^{-2/3}\, dx$

D $\displaystyle\int \cos(x)\, dx$

E Find the anti-derivative

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

with F(0)=3

MIT INTEGRATION BEE

SPECIAL CASES

You have $\int_a^a f(x)\,dx$ friends

CALCULUS

can be funny if you understand it

$$\int_a^b 1\,dx = b - a$$

$$\int_a^a f(x)\,dx = 0$$

WHAT IS THIS?

$$\int \text{devil} = \text{evil} + C$$

1 $\displaystyle\int \frac{\log(2x)}{x\log x}\, dx$

2 $\displaystyle\int_0^\infty \frac{1}{e^x + 1}\, dx$

3 $\displaystyle\int_e^{e^e} \frac{\log x \cdot \log\left(\log x\right)}{x}\, dx$

4 $\displaystyle\int_0^1 \log\left(\frac{1+x}{1-x}\right)\, dx$

5 $\displaystyle\int \frac{1}{x^2 + (x-1)^2}\, dx$

MIT
INTEGRATION
BEE

Can you do one?

2 MORE CHALLENGES

From a MIT integration bee contest

A $\displaystyle\int_0^{2\pi} \sin(\sin(x) - x)\, dx$

B $\displaystyle\int \frac{x^4}{x^2 + 1}\, dx$

NON-ELEMENTARY

These integrals can not be expressed using elementary functions

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

$$\int \frac{1}{\log(x)} dx$$

WELLNESS DAY!

UNPLUG FOR WELLNESS DAY!

The End