Indefinite Integrals - U-sub

Friday, November 15, 2019 9:35 AM

Definite Integral: net area between the curve and the x-axis

Indefinite Integral: the family of all antiderivatives

of a function f(x) is the

indefinite integral of f wl

respect to X.

 $\int f(x) dx = F(x) + C$ where C is arbitroury constant $\int f'(x) dx = f(x) + C$ must have

Evaluate ξ_{x} : $\int (x^{2} - \sin x) dx = \frac{x^{3}}{3} - (-\cos x) + C$ $= \frac{x^{3}}{3} + \cos x + C$

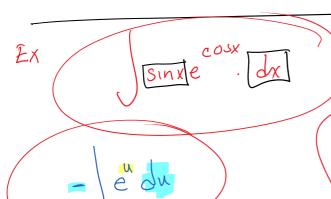
substitution

 $\int \sin(3x) dx$ $\int \sin(u) \left(\frac{1}{3} du\right)$

Let 3x = u $\frac{du}{dx} = 3$ du = 3 dx1du = dx

$$\frac{1}{3}du = dx$$

$$-\frac{1}{3}\cos u + C = -\frac{1}{3}\cos (3x) + C$$



2. Find the derivative of
u we respect to X

and write as dy

$$dy = -\sin X$$

Pick the "inside" function

U = (08)

and call it "u"

$$-e^{u} + C = -e^{\cos x} + C$$

3. Adjust the substitution so that the right hand side looks like port of the integrand.

5. substitute the original function in for u.

du = -sinxdx -du= sinxdx

4. Substitute à integrate we respect to u.

When can I substitute?

QΧ(

a. | 2x sin(x2) dx 11

 $u=x^2$ du=2x dx

a.
$$\int \frac{\partial x}{\partial x} \sin(x^2) \frac{dx}{dx} \frac{dx}{dx}$$

b.
$$\int \sin(x^2) dx \int u = x^2 dx$$

C.
$$\int x \sin(x^2) dx$$

$$u = x^2$$

$$du = 2x dx$$

$$du = 2x dx$$

$$du = 2x dx$$

$$du = x dx$$

$$= -\frac{1}{2} \cos(x^2) + C$$

$$= -\frac{1}{2} \cos(x^2) + C$$

Ex:
$$\int u' du = \int u du = |n|u| + C$$

Evaluate.

$$\int \frac{5x}{\sqrt{x^2+1}} dx = \int \frac{1}{\sqrt{x^2+1}} \frac{5x \cdot dx}{dx}$$

$$= 5 \int \frac{1}{\sqrt{x^2+1}} x dx$$

$$= 4x dx$$

$$= 5 \cdot 1 \int \frac{1}{\sqrt{x^2+1}} dx$$

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$$= 5 \cdot \frac{1}{2} \int_{10}^{10} \frac{1}{10} du$$

$$= \frac{5}{2} \int_{10}^{1/2} \frac{1}{2} du = \frac{5}{2} \cdot 2 u^{1/2} + C$$

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you try

$$\frac{e^{\frac{1}{x}}}{x^{2}}dx = u = \frac{1}{x^{2}}dx$$

$$\int e^{\frac{1}{x}} \sqrt{\frac{1}{x^{2}}}dx$$

$$-du = \frac{1}{x^{2}}dx$$

$$-\int e^{u} du = -e^{u} + C = -e^{\frac{1}{x}} + C$$

$$(6x)(x+5)^{4}$$

$$u = x^{3} + 5$$

$$u(1) = x^{3} + 5 = 6$$

$$u(0) = x^{3} + 5 = 6$$

$$u(0) = x^{3} + 5 = 5$$

$$du = 3x^2 dx$$

$$\frac{1}{3}du = x^2 dx$$

 $\frac{1}{3} \cdot 6 \int_{5}^{6} \frac{4}{3} du$ $2 \int_{5}^{4} \frac{1}{5} \int_{5}^{6} = 2 \int_{5}^{5} - 2 \int_{5}^{5}$

$$\int_{0}^{1/2} \sin x \, e^{\cos x} \, dx \qquad -du = \sin x \, dx \qquad u(0) = 1$$

$$-\int_{1}^{1/2} e^{u} \, du = -e^{u} \Big|_{1}^{1/2} = -e^{u/2} - (-e^{u})$$