

Topic(s) :

Previous Years Questions Part 3

Chapter 2: Integration by Substitution (प्रतिस्थापन द्वारा समाकलन)

(1) $\int f(x) dx = F(x) + c$

$\int f(ax+b) dx = \frac{F(ax+b)}{a} + c$

(2) More problems.....

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Q. $I = \int \sin(7x+5) dx$

$$= -\frac{\cos(7x+5)}{7} + C$$

Ans

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

$$\int f(ax+b) dx = \frac{F(ax+b)}{a} + C$$



$$\int \sin x dx = -\cos x + C$$

$$\int \sin(ax+b) dx = -\frac{\cos(ax+b)}{a} + C$$

$$\int \sin(7x+5) dx = -\frac{\cos(7x+5)}{7} + C$$

Q.

$$I = \int \frac{x+3}{x-2} dx$$

$$I = \int \frac{x-2+2+3}{x-2} dx$$

$$= \int \frac{x-2+5}{x-2} dx$$

$$= \int \left[\frac{x-2}{x-2} + \frac{5}{x-2} \right] dx$$

$$= \int \left[1 + \frac{5}{x-2} \right] dx$$

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

$$= x + 5 \log|x-2| + C$$

$$\int \frac{1}{x} dx = \log|x| + C$$

$$\int \frac{1}{ax+b} dx = \frac{\log|ax+b|}{a} + C$$

$$\int \frac{1}{x-2} dx = \frac{\log|x-2|}{1} + C$$

$$\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$$

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

$$\int f(ax+b) dx = \frac{F(ax+b)}{a} + C$$

Q.

$$I = \int \frac{7}{1+x} dx$$

$$I = 7 \int \frac{1}{1+x} dx$$

$$= 7 \log |1+x| + C$$

Ans

$$\int \frac{1}{ax+b} dx = \frac{\log |ax+b|}{a} + C$$

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

$$\int f(ax+b) dx = \frac{F(ax+b)}{a} + C$$

Q.

$$I = \int e^{3x+4} dx$$

$$= \frac{e^{3x+4}}{3} + c$$

Ans

$$\int e^x dx = e^x$$

$$\int e^{ax+b} dx = \frac{e^{ax+b}}{a}$$

$$\int e^{3x+4} dx = \frac{e^{3x+4}}{3}$$

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

$$\int f(ax+b) dx = \frac{F(ax+b)}{a} + c$$



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Q.

$$I = \int \sin x \cos x \, dx$$

Solution

$$I = \int \frac{2 \sin x \cos x}{2} \, dx$$

$$= \frac{1}{2} \int \sin 2x \, dx$$

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

$$= \frac{-\cos 2x}{4} + C \text{ Ans.}$$

$$\int \sin x \, dx = -\cos x + c$$

$$\int \sin ax \, dx = -\frac{\cos ax}{a} + c$$

$$\int \sin 2x \, dx = -\frac{\cos 2x}{2} + c$$

Q.

$$I = \int \frac{\sin x}{\sin(x-\alpha)} dx$$

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\text{let } x - \alpha = t \Rightarrow x = t + \alpha$$

$$\frac{d}{dx}(x - \alpha) = \frac{dt}{dx}$$

$$(1 - 0) = \frac{dt}{dx}$$

$$dx = dt$$

$$I = \int \frac{\sin(t + \alpha)}{\sin t} dt$$

$$= \int \frac{\sin t \cos \alpha + \cos t \sin \alpha}{\sin t} dt$$

$$= \int \left[\frac{\sin t \cos \alpha}{\sin t} + \frac{\cos t \sin \alpha}{\sin t} \right] dt = \cos \alpha \int dt + \sin \alpha \int \cot t dt$$

$$I = \cos \alpha \int dt + \sin \alpha \int \cot t \, dt$$

$$= \cos \alpha \, t + \sin \alpha \log |\sin t| + C$$

$$= \cos \alpha (x - \alpha) + \sin \alpha \log |\sin(x - \alpha)| + C$$

$$= \cos \alpha \, x - \cos \alpha \alpha + \sin \alpha \log |\sin(x - \alpha)| + C$$

$$= x \cos \alpha + \sin \alpha \log |\sin(x - \alpha)| + C_1 \quad \underline{\text{Ans}}$$

$$C_1 = C - \alpha \cos \alpha$$



Q.

$$I = \int x \sqrt{4x+3} dx$$

$$\text{let } 4x+3 = t \Rightarrow 4x = t-3 \Rightarrow x = \frac{t-3}{4}$$

$$\frac{d}{dx}(4x+3) = \frac{dt}{dx}$$

$$4 + 0 = \frac{dt}{dx}$$

$$4 dx = dt$$

$$dx = \frac{dt}{4}$$

$$I = \int \frac{(t-3)}{4} \sqrt{t} \frac{dt}{4}$$

$$I = \frac{1}{16} \int (t-3) t^{1/2} dt$$

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$$I = \frac{1}{16} \int (t-3) t^{1/2} dt$$

$$\int t^n dt = \frac{t^{n+1}}{n+1} + c$$

$$= \frac{1}{16} \int (t^{3/2} - 3t^{1/2}) dt$$

$$4x+3 = t$$

$$= \frac{1}{16} \left[\frac{t^{3/2+1}}{\frac{3}{2}+1} - 3 \frac{t^{1/2+1}}{\frac{1}{2}+1} \right] + c$$

$$= \frac{1}{16} \left[\frac{2t^{5/2}}{5} - \frac{3 \times 2t^{3/2}}{3} \right] + c$$

$$= \frac{2}{16} t^{3/2} \left[\frac{t}{5} - 1 \right] + c$$

$$= \frac{1}{8} t^{3/2} \left[\frac{t-5}{5} \right] + c = \frac{1}{40} (4x+3)^{3/2} (4x+3-5) + c$$

$$= \frac{1}{40} (4x+3)^{3/2} (4x-2) + c = \frac{2}{40} (4x+3)^{3/2} (2x-1) + c$$

$$I = \frac{2}{40} (4x+3)^{3/2} (2x-1) + c$$

$$I = \frac{1}{20} (4x+3)^{3/2} (2x-1) + c$$

Ans.



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Solution to previous HW Question:

$$\int \tan x \, dx = -\log |\cos x| + C = \log |\sec x| + C$$

HW Question:

$$\int \sin(7x+5) \, dx = ?$$

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Next Video:

Previous Years Questions and practice problems Part 4

Chapter 2: Integration by Substitution (प्रतिस्थापन द्वारा समाकलन)

UPBTE 2018

Q. $I = \int \sin^2 2x \, dx$

Q. $I = \int \cos^2 x \, dx$

Q. $I = \int \sin^2 x \, dx$

UPBTE 2023

Q. $I = \int \sin^3 x \, dx$

Q. $I = \int \cos^3 x \, dx$

UPBTE 2005

Q. $I = \int \cos^4 x \, dx$

Q. $I = \int \sin^4 x \, dx$



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