NDA 1 2025

LIVE

MATHS

INTEGRATION

CLASS 2

NAVJYOTI SIR

18 Dec 2024 Live Classes Schedule

8:00AM	18 DEC 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	18 DEC 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:30AM	COMPLETE PSYCH TESTS	ANURADHA MA'AM

NDA 1 2025 LIVE CLASSES

1:00PM	PHYSICS - WORK ENERGY POWER - CLASS 2	NAVJYOTI SIR
4:30PM	ENGLISH - CORRELATING SENTENCES - CLASS 1	ANURADHA MA'AM
5:30PM	MATHS - INTEGRATION - CLASS 2	NAVJYOTI SIR

CDS 1 2025 LIVE CLASSES

1:00PM	PHYSICS - WORK ENERGY POWER - CLASS 2	NAVJYOTI SIR
4:30PM	ENGLISH - CORRELATING SENTENCES - CLASS 1	ANURADHA MA'AM
7:00PM	MATHS - LOGARITHMS	NAVJYOTI SIR

IMPORTANT INTEGRAL FORMULAS

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + C$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right) + C \text{ or } -\cos^{-1}\left(\frac{x}{a}\right) + C$$

IMPORTANT INTEGRAL FORMULAS

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

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

SSBCrack EXAMS

IMPORTANT INTEGRAL FORMULAS

$$\int \frac{dx}{\sqrt{x^2 - a^2}} = \log| x + \sqrt{x^2 - a^2} | + C$$

$$\int \frac{dx}{\sqrt{x^2 + a^2}} = \log| x + \sqrt{x^2 + a^2} | + C$$

SSBCrack EXAMS

IMPORTANT INTEGRAL FORMULAS

$$\int \sqrt{a^2 - x^2}\, dx = \frac{x\sqrt{a^2 - x^2}}{2} + \frac{a^2}{2}\sin^{-1}\left(\frac{x}{a}\right) + C$$

$$\int \sqrt{a^2 + x^2}\, dx = \frac{1}{2} x \sqrt{a^2 + x^2} + \frac{1}{2} a^2 \log\left|x + \sqrt{a^2 + x^2}\right| + C$$

$$\int \sqrt{x^2 - a^2}\, dx = \frac{1}{2} x\sqrt{x^2 - a^2} - \frac{1}{2} a^2 \log\left|x + \sqrt{x^2 - a^2}\right| + C$$

IMPORTANT INTEGRAL FORMULAS

$$\int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a}\sec^{-1}\left(\frac{x}{a}\right) + C \text{ or } -\frac{1}{a}\operatorname{cosec}^{-1}\left(\frac{x}{a}\right) + C$$

QUESTION

Find $\int \sqrt{10 - 4x + 4x^2}\, dx$

$$\int \sqrt{a^2 + x^2} \quad \text{or} \quad \int \sqrt{a^2 - x^2} \quad \text{or} \quad \int \sqrt{x^2 - a^2}$$

$$4x^2 - 4x + 10 = \left[(2x)^2 - 2(2x)(1) + 1^2\right] + 9$$

$$= (2x-1)^2 + (3)^2$$

$$I = \int \sqrt{(2x-1)^2 + (3)^2}\, dx = \int \sqrt{t^2 + 3^2}\, \frac{dt}{2}$$

$2x - 1 = t$

$2\,dx = dt$

$$= \frac{1}{2} \int \sqrt{t^2 + 3^2}\, dt = \frac{1}{2}\left[\frac{t}{2}\sqrt{t^2+3^2} + \frac{3^2}{2} \log\left|t + \sqrt{t^2+3^2}\right|\right] + C$$

$$\frac{1}{2}\left[\frac{t}{2}\sqrt{t^2+3^2}+\frac{3^2}{2}\log\left|t+\sqrt{t^2+3^2}\right|\right]+c$$

$$=\frac{t}{4}\sqrt{(2x-1)^2+9}+\frac{9}{4}\log\left|(2x-1)+\sqrt{(2x-1)^2+3^2}\right|+c$$

$$=\frac{(2x-1)}{4}\sqrt{4x^2-4x+10}+\frac{9}{4}\log\left|(2x-1)+\sqrt{4x^2-4x+10}\right|+c$$

=

QUESTION

Find $\int \frac{dx}{2\sin^2 x + 5\cos^2 x}$

Divide by $\cos^2 x$

$$\int \frac{\frac{1}{\cos^2 x}}{\frac{2\sin^2 x}{\cos^2 x} + 5}\, dx$$

$$= \int \frac{\sec^2 x}{2\tan^2 x + 5}\, dx$$

$\tan x = t \Rightarrow \sec^2 x\, dx = dt$

$$I = \int \frac{dt}{2t^2 + 5}$$

$$= \int \frac{dt}{2\left(t^2 + \frac{5}{2}\right)} = \frac{1}{2}\int \frac{dt}{t^2 + \left(\sqrt{\frac{5}{2}}\right)^2}$$

$$\int \frac{dx}{x^2 + a^2} = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + C$$

$$I = \int \frac{dt}{2t^2+5} = \frac{1}{2}\int \frac{dt}{t^2+\left(\frac{\sqrt{5}}{\sqrt{2}}\right)^2}$$

$$= \frac{1}{2}\left[\frac{1}{\left(\frac{\sqrt{5}}{\sqrt{2}}\right)} \tan^{-1}\left(\frac{t}{\sqrt{5}/\sqrt{2}}\right)\right] + c$$

$$= \frac{1}{\sqrt{10}} \tan^{-1}\left(\frac{\sqrt{2}}{\sqrt{5}} \tan x\right) + C$$

QUESTION

Evaluate $\int \frac{x+1}{\sqrt{9-4x^2}}dx.$

a. $\frac{1}{4}\sqrt{9-4x^2}+\frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right)+C$

b. $\frac{1}{4}\sqrt{9-4x^2}-\frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right)+C$

c. $-\frac{1}{4}\sqrt{9-4x^2}+\frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right)+C$ ✓

d. $-\frac{1}{4}\sqrt{9-4x^2}-\frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right)+C$

$$I = \int \frac{x+1}{\sqrt{9-4x^2}}\,dx$$

$$= \underbrace{\int \frac{x}{\sqrt{9-4x^2}}\,dx}_{(I_1)} + \underbrace{\int \frac{1}{\sqrt{9-4x^2}}\,dx}_{(I_2)}$$

$I_1 \Rightarrow \quad 9-4x^2 = t^2$

$-8x\,dx = 2t\,dt$

$x\,dx = -\frac{1}{4}t\,dt$

$$I_1 = \int \frac{-\frac{1}{4}t\,dt}{\sqrt{t^2}} = -\frac{1}{4}\int dt = \underbrace{-\frac{1}{4}t}_{} = -\frac{1}{4}(9-4x^2)$$

$$I_2 = \int \frac{1}{\sqrt{9-4x^2}}dx = \int \frac{1}{\sqrt{3^2-(2x)^2}}dx$$

$$\int \frac{1}{\sqrt{a^2-x^2}}dx = \sin^{-1}\left(\frac{x}{a}\right) + C$$

$$= \frac{1}{2}\sin^{-1}\left(\frac{2x}{3}\right) + c$$

$$I = I_1 + I_2 = -\frac{1}{4}(9-4x^2) + \underbrace{\frac{1}{2}\sin^{-1}\left(\frac{2x}{3}\right)}_{} + c$$

Ans. (c)

INTEGRATION BY PARTS

$$\int u \cdot v \, dx = u \cdot \int v \, dx - \int \left[\frac{du}{dx} \cdot \int v \, dx \right] dx$$

I — Inverse trignometric $(\sin^{-1}x, \ \cos^{-1}x)$

u — L — Logarithmic — $(\log x)$

A — Algebraic — $(1, x, x^2)$

v — T — Trignometric — $(\sin x, \ \tan x, \ \cos x)$

E — exponential — (e^x)

QUESTION

$$I = \int \log x \, dx = \int 1 \cdot \log x \, dx$$

I L A T E

u v

(I) (II)

$$I = \log x \int \underline{1 \cdot dx} - \int \left[\frac{d}{dx}(\log x) \cdot \int \underline{1 \cdot dx} \right] dx$$

$$= \log x \cdot x - \int \frac{1}{x} \cdot x \, dx$$

$$= x \log x - x = x(\log x - 1) + C$$

SSBCrack EXAMS

QUESTION

$$I = \int \tan^{-1}x \, dx = \int 1 \cdot \tan^{-1}x \, dx$$

A I

I L A T E

u v

$$= \tan^{-1}x \int 1 \cdot dx - \int \left[\frac{d}{dx}\left(\tan^{-1}x\right) \cdot \int 1 \cdot dx \right] dx$$

$$= x\tan^{-1}x - \int \frac{1}{1+x^2} \cdot x \, dx$$

$1 + x^2 = t$

$2x\,dx = dt \Rightarrow x\,dx = \frac{1}{2}dt$

$$= x\tan^{-1}x - \frac{1}{2}\int \frac{dt}{t} = x\tan^{-1}x - \frac{1}{2}\log\left|1+x^2\right| + C$$

INTEGRATION OF SPECIAL FUNCTIONS

$$\int e^{x}\{f(x)+f'(x)\}\,dx=e^{x}f(x)+C$$

$$\int \frac{f'(x)}{f(x)}\,dx=\log|f(x)|+C$$

INTEGRATION OF SPECIAL FUNCTIONS

$$\int e^{ax}\sin bx\,dx = \frac{e^{ax}}{a^2+b^2}(a\sin bx - b\cos bx) + C$$

$$\int e^{ax}\cos bx\,dx = \frac{e^{ax}}{a^2+b^2}(a\cos bx + b\sin bx) + C$$

QUESTION

$\int e^{x}(1+\tan x+\tan^{2} x)\, dx$ equals

a. $e^{x}\sin x+C$

b. $e^{x}\cos x+C$

c. $e^{x}\tan x+C$

d. $e^{x}\sec x+C$

$$I = \int e^{x}\left(\tan x + 1 + \tan^{2} x\right) dx$$

$$\int e^{x}\left(f(x) + f'(x)\right) dx = e^{x} f(x) + c$$

$$= \int e^{x}\left(\tan x + \sec^{2} x\right) dx = e^{x}\tan x + c$$

Ans. (c)


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