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A LEVEL MATHS

(60) Integrating Standard Functions (Logs and Trig)

WORKING AT D/E

(1) **Use the formula book** to find the following integrals:

(a) $\int \sec^2 x \ dx$ (b) $\int \sec x \tan x \ dx$
(c) $\int \operatorname{cosec}^2 x \ dx$ (d) $\int -\operatorname{cosec} x \cot x \ dx$

(2) Considering the derivatives of $\sin x$, $\cos x$, $\ln x$ and e^x find the following integrals:

(a) $\int \cos x \, dx$ (b) $\int \sin x \ dx$
(c) $\int \frac{2}{x} dx$ (d) $\int e^{3x} \, dx$

(3) **Using the formula book** and the results above, find each integral below:

(a) $\int \tan x - \frac{1}{x} + e^x \, dx$

(b) $\int -2 \operatorname{cosec}^2 x - \sin x \ dx$

(c) $\int 4\sec^2 x - e^x - x \ dx$

(d) $\int \cot 2x - x^{-2} - \cos x \, dx$

WORKING AT B/C

(1) (a) Show that $\frac{4-x^2}{x} \equiv \frac{A}{x} + Bx$

(b) Hence, find $\int \frac{4-x^2}{x} \ dx$

(c) Simplify $\sin x \, (1 + \cot x)$

(d) Hence, find $\int \sin x \, (1 + \cot x) \mathrm{dx}$

(2) (a) Find $\int \frac{5}{x} - \frac{1}{\sin^2 x} \ dx$

(b) (i) Show that $\frac{\sin x}{\cos^2 x} \equiv \sec x \tan x$

(ii) Hence, find $\int \frac{\sin x}{\cos^2 x} \ dx$

(3) Find the value of each giving your answers in exact form where appropriate. You must show full workings :

(a) $\int_0^{\frac{\pi}{4}} x - \sec^2 x \ dx$

(b) $\int_1^3 \frac{4}{x} - e^x + x \ dx$

(c) $\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \sin x - \operatorname{cosec}^2 x \ dx$

(d) $\int_1^6 \frac{8-3x}{x} \ dx$

WORKING AT A*/A

(1) Evaluate $\int_0^{\frac{\pi}{4}} \sec\theta \, (\sec\theta - \sin\theta) \, d\theta$ giving your answer in the form $\ln Ae$ where A is a simplified surd.

(2) Show that $\int_1^2 \frac{(1-x)^2}{2x} dx = A\ln B + \frac{C}{D}$ where A, B, C and D are rational constants to be found.

(3) Show that

$$\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \operatorname{cosec} x \, (\cos x + \sin x)^2 \, dx = 2 - \sqrt{3} + \ln\sqrt{3}$$