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A LEVEL MATHS

(61) Integrating Functions of the form $f(ax+b)$

WORKING AT D/E

(1) Find each of the following by **using the formula book**:

(a) $\int 2\sec 2x \tan 2x\, dx$ (b) $\int \tan 3x\ dx$

(c) $\int -4\,\text{cosec}^2 2x\ dx$ (c) $\int 8\,\text{cosec}\, 4x \cot 4x\ dx$

(2) Show each of the following results. **You must show your full method:**

(a) $\int_0^1 e^{2x} dx = \frac{1}{2}(e^2 - 1)$

(b) $\int_0^{\frac{\pi}{2}} \cos\left(2x - \frac{\pi}{6}\right) dx = \frac{1}{2}$

(c) $\int_0^2 \frac{2x}{x^2+3} dx = \ln\frac{5}{3}$

(3) Show each of the following results:

(a) $\int_0^1 (3x+1)^2 dx = 7$

(b) $\int_{\frac{\pi}{12}}^{\frac{\pi}{6}} -2\,\text{cosec}\, 2x \cot 2x\, dx\ = \frac{2\sqrt{3}}{3} - 2$

WORKING AT B/C

(1) Find $\int_0^{\frac{\pi}{8}} \sec^2 2x\ dx$ showing full workings.

(2) Find each of the following integrals:

(a) $\int \frac{4x+2}{2x^2+2x} dx$

(b) $\int e^{3x} + \text{cosec}^2\, 4x\, dx$

(c) $\int e^{2x+3} - \frac{3}{x}\, dx$

(d) $\int 4x + \sin(2-x)\, dx$

(3) Evaluate each of the following. You must show full workings and give answers in exact form:

(a) $\int_1^2 \frac{2x+3}{x^2+3x}\ dx$

(b) $\int_0^{\frac{\pi}{8}} -2\sin 4x\ dx$

(c) $\int_0^2 \frac{1}{3} e^{4x+1}\ dx$

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WORKING AT A*/A

(1) (a) Show that

$(\text{cosec}\, x + \tan x)^2 \equiv \text{cosec}^2 x + 2\sec x + \sec^2 x - 1$

(b) Hence find $\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} (\text{cosec}\, x + \tan x)^2 dx$ giving your answer in exact form.

(2) Evaluate $\int_1^3 \frac{2x+7}{2x^2+14x} dx$ giving your answer in the form $\ln\frac{\sqrt{a}}{b}$ where $\sqrt{a}$ and b are in their simplest form.

(3) Given that $\int_1^{e^4} \frac{p}{x} dx = \frac{16}{3}$, where p is a positive constant, find the value of p.